IEC 61097-3

Edition 2.0 2017-10

INTERNATIONAL STANDARD

Global maritime distress and safety system (GMDSS) –
Part 3: Digital selective calling (DSC) equipment – Operational and performance requirements, methods of testing and required testing results

IEC 61097-3:2017-10(en)

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

ICS 33.060.20; 47.020.70

ISBN 978-2-8322-4901-7

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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GLOBAL MARITIME DISTRESS AND SAFETY SYSTEM (GMDSS) –

Part 3: Digital selective calling (DSC) equipment – Operational and performance requirements, methods of testing and required testing results

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International Standard IEC 61097-3 has been prepared by IEC technical committee 80: Maritime navigation and radiocommunication equipment and systems.

This second edition cancels and replaces the first edition published in 1994. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) changes in the operation of DSC which have been developed by IMO and ITU since the first edition was published;
b) compliance with bridge alert management (BAM);

c) optional addition of remote operation of the DSC functionality. This facility can also used for type approval testing of the performance of the DSC equipment;

d) incorporation of the radio frequency test methods for MF, MF/HF and VHF transceivers and watch receivers for convenience of testing.

The text of this International Standard is based on the following documents:

FDIS	Report on voting
80/861/FDIS	80/866/RVD

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

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts in the IEC 61097 series, published under the general title *Global maritime distress and safety system (GMDSS)*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

A bilingual version of this publication may be issued at a later date.

GLOBAL MARITIME DISTRESS AND SAFETY SYSTEM (GMDSS) –

Part 3: Digital selective calling (DSC) equipment – Operational and performance requirements, methods of testing and required testing results

1 Scope

This part of IEC 61097 specifies the performance requirements, technical characteristics, operational requirements and methods of testing of shipborne DSC equipment for use with MF, MF/HF and VHF installations in the GMDSS, including those required by Chapter IV of the 1974 International Convention for Safety of Life at Sea (SOLAS) as amended, and is associated with IEC 60945 (Shipborne radio equipment forming part of the global maritime distress and safety system and marine navigational equipment).

This document incorporates applicable parts of the performance standards of IMO Resolutions A.803(19), A.804(19) and A.806(19) (DSC facilities for VHF, MF and MF/HF radio installations), IMO MSC/Circ.862 (describing the operation of the distress button), the provisions of the ITU Radio Regulations, the technical characteristics of DSC equipment and the operational procedures for its use contained in Recommendations ITU-R M.493, M.541, M.689, M.821 and M.1082, and takes into account the general requirements contained in IMO Resolution A.694(17).

Recommendation ITU-R M.493-14 describes classes A, B, D, E, H and M of DSC equipment. This document specifies test procedures for DSC equipment of Class A and B which are applicable to the SOLAS requirements:

Class A, which includes all of the facilities defined in Annex 1, 3 and 4 of Recommendation ITU-R M.493-14 and which will comply with the IMO GMDSS carriage requirements for MF/HF installations and/or VHF installations;

Class B, which provides minimum facilities for equipment on ships not required to use Class A equipment and which will comply with the minimum IMO GMDSS carriage requirements for MF and/or VHF installations.

This document also includes requirements and methods of testing for the RF part of the MF, MF/HF and VHF installations, specified in the annexes of this document for reference.

NOTE All text whose meaning is identical to that in IMO Resolution A.803(19), A.804(19), A.806(19), MSC.68(68), and to that in IMO Circular MSC/Circ.862, and to that in Recommendations ITU-R M.493, M.541, M 689, M.821, and M.1082 is printed in italics and the references indicated in brackets. Text referencing IMO Resolution A.803(19) includes references to A.804(19) and A.806(19) unless otherwise stated.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60945, *Maritime navigation and radiocommunication equipment and systems - General requirements - Methods of testing and required test results*

IEC 61162-1, *Maritime navigation and radiocommunication equipment and systems - Digital interfaces - Part 1: Single talker and multiple listeners*

IEC 61162-2, *Maritime navigation and radiocommunication equipment and systems - Digital interfaces - Part 2: Single talker and multiple listeners, high-speed transmission*

IEC 61162-450, *Maritime navigation and radiocommunication equipment and systems - Digital interfaces - Part 450: Multiple talkers and multiple listeners - Ethernet interconnection*

IEC 61162-460:2015, *Maritime navigation and radiocommunication equipment and systems - Digital interfaces - Part 460: Multiple talkers and multiple listeners - Ethernet interconnection - Safety and security*

IEC 62288, *Maritime navigation and radiocommunication equipment and systems - Presentation of navigation-related information on shipborne navigational displays - General requirements, methods of testing and required test results*

IEC 61924-2:2012, *Maritime navigation and radiocommunication equipment and systems - Integrated navigation systems - Part 2: Modular structure for INS - Operational and performance requirements, methods of testing and required test results*

Recommendation ITU-R M.493-14:2015, *Digital selective-calling system for use in the maritime mobile service*

Recommendation ITU-R M.541-10:2015, *Operational procedures for use of digital selective-calling equipment in the maritime mobile service*

Recommendation ITU-R M.689-3:2012, *International maritime VHF radiotelephone system with automatic facilities based on DSC signalling format*

Recommendation ITU-R M.821-1:1997, *Optional expansion of the digital selective-calling system for use in the maritime mobile service*

Recommendation ITU-R M.1084-5:2012, *Interim solutions for improved efficiency in the use of the band 156-174 MHz by stations in the maritime mobile service*

Recommendation ITU-R M.1082-1:1997, *International maritime MF/HF radiotelephone system with automatic facilities based on digital selective calling signalling format*

ITU *Radio Regulations*:2016

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

IMO Resolution A.803(19), *Performance standards for shipborne VHF radio installations capable of voice communication and digital selective calling, as amended by Resolution MSC.68(68):1997, Annex 1*

IMO Resolution A.804(19), *Performance standards for shipborne MF radio installations capable of voice communication and digital selective calling, as amended by Resolution MSC.68(68):1997, Annex 2*

IMO Resolution A.806(19), *Performance standards for shipborne MF/HF radio installations capable of voice communication, narrow-band direct-printing and digital selective calling, as amended by Resolution MSC.68(68):1997, Annex 3*

IMO MSC.1/Circ.1389, *Guidance on procedures for updating shipborne navigation and communication equipment*

IMO MSC.68(68):1997, *Adoption of amendments to performance standards for shipborne radiocommunication equipment*

IMO MSC.191(79), *Performance standards for the presentation of navigation-related information on shipborne navigational displays*

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

3.1.1
acknowledged
indication that the objective of the initial DSC message has been achieved when used to describe an automated procedure

3.1.2
active
automated procedure which has control of the general receiver and transmitter and is thus able to engage in subsequent communications and receive DSC messages on both the watch receiver and general receiver

3.1.3
automated procedure
set of actions necessary to complete the objective of an initiating DSC message or non-DSC communication event

3.1.4
BAM alert
alert that falls into the concept of bridge alert management (BAM)

3.1.5
critical errors
set of information characters obtained from one or more received DSC messages if the automated procedure needs information characters from that set in order to proceed or perform any task, but the required information characters are in error

EXAMPLE An acknowledgement cannot be composed to an individual DSC message that has errors in the sender's MMSI.

3.1.6
default
value selected or action taken by the equipment software in the absence of any operator input

3.1.7
distress alert
single distress DSC message with the format symbol 112

3.1.8
distress alert attempt
set of distress alerts sent by a vessel when in distress

3.1.9
distress DSC message
DSC message or acknowledgement containing the distress information

3.1.10
distress event
unique distress situation identified by two (VHF) or three (MF/HF) parameters of the distress information

Note 1 to entry. The parameters are the MMSI of the vessel in distress and the nature of distress, and on MF/HF the mode of subsequent communication.

3.1.11
distress information
symbols within a DSC message describing a distress situation consisting of the MMSI of the vessel in distress, the nature of distress, the position of the vessel in distress, the UTC time of that position, and the mode of subsequent communication

3.1.12
DX/RX
notation used to describe the time diversity structure of DSC messages

Note 1 to entry: See Recommendation ITU-R M.493-14:2015, Figure 1.

3.1.13
engaged
indication that the equipment is busy handling an automated procedure

3.1.14
factory default
default value that is set by the manufacturer such that the field or behaviour is defined prior to any operator intervention

3.1.15
general receiver
receiver used for the reception of all subsequent communications and on HF the reception of DSC acknowledgements on the duplex DSC channels

3.1.16
GMDSS alarm
visual indication and audible annunciation of an alarm generated by, and shown on the equipment covered by this document.

Note 1 to entry: This includes the two-tone distress alarm and the urgency alarm.

Note 2 to entry: "Alarm", "audible alarm" or "aural alarm" in this document in general refers to the audible annunciation of the GMDSS alarm.

3.1.17
identical
set of information characters where all pairs of corresponding information characters are equal or, if a pair of corresponding information characters is not equal, one of the pair is in error

3.1.18
information characters
set of symbols in a DSC message that contains the items of interest for the recipient and is used to compute the ECC symbol that terminates the message

Note 1 to entry: These symbols are repeated in the DX/RX time diversity pattern.

3.1.19
initial DSC message
DSC message that starts an automated procedure

3.1.20
non-distress DSC message
DSC messages or acknowledgments that do not contain the distress information

3.1.21
objective
goal or intent of the item when in reference to a DSC message or automated procedure

Note 1 to entry: Usually, this goal or intent is to establish subsequent communications or request information.

3.1.22
on hold
automated procedure which does not have access to the transmitter and general receiver and therefore cannot engage in subsequent communications and is only able to receive DSC messages on the watch receiver

3.1.23
operator options
any choices the operator can make while the automated procedure is engaged

3.1.24
parallel event handling
background process of handling a received DSC message that is not pertinent to the active automated procedure

3.1.25
pertinent to the automated procedure
indication that the message has something to do with the procedure and is therefore "handled" by the procedure

Note 1 to entry: A DSC message is pertinent to an automated procedure if the set of information characters in the DSC message has the correct values.

3.1.26
pertinent to the station
any DSC message that would start an automated procedure if the equipment were in standby

3.1.27
self-terminating alarm
short alarm that stops by itself without operator intervention

Note 1 to entry: The purpose of this alarm is to inform the operator that a DSC message is received but it does not require his immediate attention.

3.1.28
snooping
situation where a station receives and handles DSC messages pertinent to other stations as if it were that station

3.1.29
standby
status of an equipment not handling an automated procedure, either active or on hold, but being able to receive DSC messages

3.1.30
symbol
<as part of the DSC sentence> 7 binary bits of a 10 bit DSC word that have the information content

3.1.31
toggle
<between automated procedures> ability to make one automated procedure active assuring that all other procedures go on hold

3.1.32
top level
items, buttons, or functions present and visible without requiring any action by the operator (such as scrolling, opening up menus, or removing any obscuring covers)

3.1.33
distress alarm
two tone alarm consisting of a repetition of the 2 200 Hz frequency for 250 ms followed by a 1 300 Hz frequency for 250 ms used for the initiation of the received distress DSC automated procedure

3.1.34
urgency alarm
alarm consisting of a repetition of the 2 200 Hz frequency for 250 ms followed by 250 ms period of silence used for the initiation of the received non-distress DSC automated procedure when the category of the initiating DSC message is "urgency"

3.1.35
watch receiver
separate receiver in DSC radios that continuously monitors the DSC distress frequencies on MF/HF, 2 187,5 kHz on MF, and channel 70 on VHF

Note 1 to entry: On MF/HF, it is sometimes referred to as the scanning receiver.

3.1.36
word
<as part of the DSC sentence> 10 binary bits that make up the coded entities of a transmitted DSC message

Note 1 to entry: The 10 bits consist of a 7 bit "symbol" that gives the information content and 3 bit error check that gives the number of 0 binary bits in the 7 bit symbol.

3.2 Abbreviated terms

AGC	automatic gain control
BAM	bridge alert management
DROBOSE	distress relay on behalf of someone else
DSC	digital selective calling
e.m.f.	electromotive force
ECC	error check character
EUT	equipment under test
HF	high frequency
HMI	human machine interface
MF	medium frequency
MOB	man overboard
MMSI	maritime mobile service identity

NBDP	narrow band direct printing
PGN	parameter group number
RF	radio frequency
RMS	root mean square
SINAD	signal + noise + distortion/ noise + distortion
TE	test equipment
VHF	very high frequency

4 Performance requirements

4.1 Object

Digital selective calling is used in the MF, HF and VHF maritime mobile services for distress alerting, urgency and safety and routine calling in the GMDSS and in connection with public correspondence.

(803/1) *The* DSC equipment, *in addition to meeting the requirements of the Radio Regulations, the relevant ITU-R Recommendations and the general requirements set out in* IMO *Resolution A.694(17)* as described in IEC 60945*,* shall *comply with the following.*

4.2 Test requirements

4.2.1 General

Tests shall be carried out under normal test conditions and also, where stated, under extreme test conditions.

Tests under normal test conditions shall be carried out using the normal power source voltage as defined in 4.2.6.2 under conditions of normal temperature and humidity as defined in 4.2.6.1.

Tests under extreme test conditions shall be carried out using extreme values of power source voltage as defined in 4.2.6.2 at the extremes of temperature defined in 4.2.6.1.

4.2.2 Test site

The testing facility shall be capable of:

a) generating correctly all types of digital selective calls in accordance with Table A1-4 of Recommendation ITU-R M.493-14:2015 and relevant for the EUT. The calibrated apparatus shall also be capable of generating incorrect signals;

b) generating the standard test signals contained in 4.2.11 for transmission to the EUT; and

c) examining, by means of calibrated apparatus for decoding, the information content of DSC signals generated by the EUT. It shall also be possible to print out the information content of call sequences received.

4.2.3 Environment 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 normal test voltage unless otherwise stated.

Environmental tests, as applicable to the category of equipment, shall be carried out as defined in IEC 60945.

4.2.4 Environmental test procedure

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

Unless otherwise stated, the equipment shall be connected to an electrical power source during the periods for which it is specified that electrical tests shall be carried out. These tests shall be performed using the normal test voltage specified in 4.2.6.2, and the sequence of testing shall be in the order given.

The following apply to VHF.

- Performance checks shall be carried out on channel 16.
- Transmitter checks shall be carried out with output power set at maximum.

The following apply to MH/MF.

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

4.2.5 Performance checks

4.2.5.1 VHF performance checks

4.2.5.1.1 Telephony transmitter frequency

Arrangements for monitoring the transmitter output are specified in 4.2.10. The carrier frequency shall be measured in the absence of modulation.

The frequency error shall be within ±1,5 kHz (for a definition of frequency error, see J.3.2).

4.2.5.1.2 Telephony transmitter carrier power

Arrangements for monitoring the transmitter output are specified in 4.2.10. The power delivered to the antenna transmission line shall be measured.

The carrier power shall be between 6 W and 25 W (for a definition of carrier power, see J.3.3).

4.2.5.1.3 Telephony transmitter audio frequency harmonic distortion of the emission

Arrangements for modulating the transmitter are specified in 4.2.9.2. Arrangements for monitoring the transmitter output are specified in 4.2.10.12. The transmitter shall be modulated with normal test modulation as specified in 4.2.9.3. The harmonic distortion of the audio frequency signal shall be measured.

The harmonic distortion shall not exceed 10 % (for a definition of audio frequency harmonic distortion, see J.3.8).

4.2.5.1.4 Telephony receiver sensitivity

A wanted test signal at +12 dBμV e.m.f., modulated by the normal test modulation as specified in 4.2.9.3, shall be applied to the receiver RF input port as specified in 4.2.11. The receiver output shall be monitored, the SINAD ratio at the receiver audio output shall be measured.

The SINAD ratio shall be at least 20 dB.

4.2.5.1.5 DSC receiver

Check of the calling sensitivity as described in K.5.1 shall be carried out. The input level shall be +6 dBµV, and the decoded symbol error shall be less than 10^{-2}.

4.2.5.1.6 DSC transmitter

Check of the mean output power of DSC transmitter as described in J.4.3 shall be carried out. The frequency error shall be as described in J.4.1. The decoded call sequences shall be as described in 4.3.3.3.

4.2.5.2 MF/HF performance checks

4.2.5.2.1 Telephony transmitter frequency error

With the transmitter connected to an artificial antenna (see 4.2.10), the transmitter shall be tuned to the frequency 2 182 kHz for MF equipment or 8 291 kHz for MF/HF equipment and operated in J3E mode, and shall be modulated with a signal of 1 000 Hz ± 0,1 Hz. The 1 000 Hz signal shall be subtracted from the measured frequency to get the transmitter frequency. The transmitter frequency shall be within ±10 Hz of the selected frequency.

The output frequency shall be within ±10 Hz.

4.2.5.2.2 Telephony transmitter output power

The output power Is the value of peak envelope power delivered by the transmitter to the artificial antenna in J3E mode.

With the transmitter connected to an artificial antenna (see 4.2.10), the transmitter shall be tuned to the frequency 2 182 kHz for MF equipment or 8 291 kHz for MF/HF equipment and operated in J3E mode. The transmitter shall be modulated by a test signal consisting of two audio frequency tones, applied simultaneously to the microphone input, at frequencies of 1 100 Hz and 1 700 Hz. The level of the tones shall be adjusted so that they produce equal output power and it shall be possible to obtain an output power of greater than 60 W PEP.

For MF, the output power shall be within 60 W PEP and 400 W PEP.

For HF, the output power shall be within 60 W PEP and 1 500 W PEP.

The level of the input test signal shall be increased until the transmitter power output is not more than 1,5 dB below the rated output power as declared by the manufacturer. The level of the input signal shall then be increased by 10 dB. The peak envelope power shall be measured.

4.2.5.2.3 Telephony receiver sensitivity

With the AGC operative, the receiver shall be adjusted to 2 182 kHz for MF equipment or 8 291 kHz for MF/HF equipment and operated in J3E mode. A test signal as specified in 4.2.11 shall be applied. The level of the input signal shall be adjusted until the SINAD at the output of the receiver is 20 dB, and the output power is at least the standard output power (see K.4.1.3).

The level of the input signal shall be not greater than +22 dBµV at 2 182 kHz or not greater than +17 dBµV at 8 291 kHz.

4.2.5.2.4 DSC receiver

Check of the calling sensitivity as described in K.5.1 shall be carried out. The input level shall be +6 dBµV and the decoded symbol error shall be less than 10^{-2}.

4.2.5.2.5 DSC transmitter

Check of the mean output power of DSC transmitter as described in K.3.2 shall be carried out. The frequency error shall be as described in K.3.1. The decoded call sequences shall be as described in 4.3.3.3.

4.2.6 Normal test conditions

4.2.6.1 Temperature and humidity

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

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

The test conditions shall be recorded in the test report.

4.2.6.2 Test power source

4.2.6.2.1 AC power source

The normal test voltage for equipment to be connected to the AC power supply 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 shall be 50 Hz or 60 Hz ± 1 Hz.

4.2.6.2.2 DC power source

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).

4.2.7 Extreme test conditions

4.2.7.1 Temperature

For tests at extreme temperatures, measurements shall be made at a lower temperature of –15 °C and an upper temperature of +55 °C.

Before making measurements at extreme temperatures, the equipment shall have reached thermal balance in the test chamber. 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.

4.2.7.2 Test power source

4.2.7.2.1 AC power source

The extreme test voltages for equipment to be connected to an AC power supply shall be the normal voltage ±10 %. The frequency of the test power mains shall be 50 Hz or 60 Hz ± 1 Hz.

4.2.7.2.2 DC power source

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).

4.2.8 Unspecified test conditions

Any requirement for which no test is specified shall be checked by inspection of the equipment, its manufacturing drawings or other relevant documents. The result of the inspection shall be stated in the test report.

4.2.9 General conditions of measurement

4.2.9.1 Receiver squelch facility

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

4.2.9.2 Applying test signal to the transmitter input

Unless stated otherwise, a signal generator shall be used to provide the audio frequency signal to modulate the transmitter. The signal generator shall be connected in place of the microphone transducer, and the signal shall be applied to the connection terminals normally used for the microphone transducer.

4.2.9.3 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.

4.2.9.4 Transmitter output power

Unless otherwise specified, the transmitter output power shall be at maximum for these tests.

4.2.9.5 Test of equipment with duplex filter

If the equipment is provided with a built-in or an external duplex filter, the requirements of this document shall be met when the measurements are carried out using the antenna terminals of the filter.

4.2.10 Artificial antennas

4.2.10.1 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;
- all other frequency ranges:
  - the artificial antenna shall consist of a resistance of 50 Ω.

This does not imply that the transmitter shall only work with antennas having these characteristics.

4.2.10.2 Receivers

For the purpose of conformance testing, the receiver shall meet the requirements of this document when connected to sources of test signals so that the impedance presented to the receiver input is 50 Ω resistive. In the frequency range 1 605 kHz to 4 000 kHz, at the request

of the manufacturer, a network consisting of a 10 Ω resistor in series with a 250 pF capacitor may be used.

The arrangement used shall be stated in the test report.

This does not imply that the receiver should operate satisfactorily only with antennas having these impedance characteristics.

4.2.11 Standard test signals

4.2.11.1 Connection of test signals to receiver

4.2.11.1.1 Sources

Test signals shall be connected through a network as specified in 4.2.10.2. 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.

Except where otherwise stated, radio frequency test signals applied to the receiver input shall be as given below:

- Class of emission J3E:
  - An unmodulated signal 1 000 Hz ± 0,1 Hz above the carrier frequency to which the receiver is tuned.
- Class of emission F1B:
  - DSC and NBDP with analogue interfaces: an unmodulated signal on the assigned frequency.
  - DSC and NBDP with digital interfaces: a signal on the assigned frequency modulated as appropriate.

4.2.11.1.2 Levels

The levels of test input signals shall be expressed in terms of the e.m.f. that would exist at the output terminals of the source including the associated network referred to in 4.2.10.2.

4.2.11.2 DSC test signal

4.2.11.2.1 References to standard DSC signals

Standard DSC signals consist of a series of identical DSC message sequences, each of which contains a known number of information symbols (format specifier, address, category, identification, etc., of Recommendation ITU-R M.493).

4.2.11.2.2 Standard test signal No. 1 (STS-1)

Standard DSC test signal 1 shall be a signal at the nominal receiver DSC frequency with frequency shift of ±85 Hz and modulated with various types of DSC signals at a modulation rate of 100 Bd. The signals shall be generated by means of calibrated apparatus.

4.2.11.2.3 Standard test signal No. 2 (STS-2)

Standard DSC test signal 2 shall be a signal at the nominal receiver DSC frequency with frequency shift of ±85 Hz and modulated with a continuous dot pattern at a modulation rate of 100 Bd.

4.2.11.2.4 Standard test signal No. 3 (STS-3)

Standard DSC test signal 2 shall be a signal at the nominal receiver DSC frequency phase modulated with modulation index equal to 2,0. The modulation signal shall have nominal frequency 1 700 Hz and frequency shift of ±400 Hz modulated with various types of DSC signals at a modulation rate of 1 200 baud. The signal shall be generated by means of calibrated apparatus.

4.2.11.2.5 Symbol error rate at the DSC receiver

The DSC decoder is evaluated by determination of the symbol error rate (SER). The decoded DSC call sequence applied with forward error correction, interleaving techniques and check-sum information is divided into blocks each corresponding to one information symbol in the received signal. The ratio between the numbers of incorrect blocks to the total number of blocks is determined as the symbol error rate.

NOTE IMO Resolutions are phrased in terms of character error ratio. In this document, equivalent bit error ratio measurements are taken to demonstrate compliance with IMO requirements.

Sufficient calls shall be used in each test in order to ensure the statistical significance of the result.

4.2.11.3 Test frequencies

4.2.11.3.1 General test frequencies

Unless otherwise stated, the testing frequencies shall be the following:

- MF band: 2 187,5 kHz or 2 177 kHz;
- HF band: 8 414,5 kHz or 8 436,5 kHz;
- VHF band: 156,525 MHz (channel 70), the lowest frequency usable, the highest frequency usable, channel 16 (156,8 MHz).

4.2.11.3.2 Additional test frequencies for HF equipment

Where stated, the testing frequencies for HF equipment shall additionally be the following:

- for equipment intended for distress/safety purposes, the test frequencies shall be the DSC distress/safety frequencies 4 207,5 kHz, 6 312 kHz, 12 577 kHz and 16 804,5 kHz as applicable for the range of the equipment;
- for the equipment not intended for distress and safety purposes, the test frequencies shall be any of the DSC calling frequencies in each of the 4 MHz, 6 MHz, 12 MHz, 16 MHz, 18 MHz, 22 MHz and 26 MHz bands as applicable for the range of the equipment.

4.2.11.3.3 Transmitter exclusion bands for emissions testing

Frequencies ±12 kHz of the assigned frequency shall be excluded from test.

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

4.2.12 Measurement uncertainty

Absolute measurement uncertainties: maximum values

RF frequency

– for VHF ±1 × 10^{-7}

– for MF/HF ±1 × 10^{-8}

RF power

– for VHF	±0,75 dB
– for MF/HF with 50 Ω load	±1,5 dB
– for MF/HF with 10 Ω, 250 pF load	±2,5 dB
Maximum frequency deviation:	
– within 300 Hz to 6 kHz of audio frequency	±5 %
– within 6 kHz to 25 kHz of audio frequency	±3 %
VHF deviation limitation	±5 %
Conducted spurious of transmitter	±4 dB
Audio output power	±0,5 dB
Sensitivity at 20 dB SINAD	±3 dB
Conducted emission	±3 dB
Radiated emission	±6 dB
Two-signal measurement	±4 dB
Three-signal measurement	±3 dB
VHF Receiver desensitization at duplex operation	±0,5 dB
VHF Transmitter transient time	±20 %
VHF Transmitter transient frequency	±250 Hz

For the test methods according to this document, the uncertainty figures are valid to a confidence level of 95 %.

4.2.13 Reference bandwidths for spurious measurements

The reference bandwidths applicable for all spurious measurement are given in Table 1.

Table 1 – Reference bandwidths applicable for spurious measurement

Frequency range	Bandwidth (BW)
9 kHz to 150 kHz	1 kHz
150 kHz to 30 MHz	10 kHz
156 MHz to 165 MHz	10 kHz
30 MHz to 1 GHz	100 kHz
Above 1 GHz	1 MHz
NOTE The BW specified for the frequency range 156 MHz to 165 MHz is only valid for the receive mode of operation.	

The measurement detector shall be a peak detector.

4.2.14 Interpretation of measurement results

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

- The measured value related to the corresponding limit shall be used to decide whether equipment meets the requirements of this document.
- The actual measurement uncertainty of the test laboratory carrying out the measurements, for each particular measurement, shall be included in the test report.
- The values of the actual measurement uncertainty shall be, for each measurement, equal to or lower than the figures given in 4.2.12 (absolute measurement uncertainties).

4.2.15 Testing method terminology

Testing method terminology terms for application to this document are:

- measurement – refers to measurement or calculation of a variable concerning the presentation of information, accuracy, or the equipment performance;
- observation – means to examine or inspect the equipment to confirm that a particular observable condition has been met. Observations can be made by anyone who has the necessary skill to systematically check the presentation of information and make the determination;
- document inspection – means to confirm by inspection that any relevant documented information, facility or function is compliant with the requirement;
- analytical evaluation – requires the informed judgement of equipment performance from a study of observations or measurements by an expert, a suitably qualified person who has the necessary skill and experience to judge the relevant property in the relevant subject. The method is typically used for the evaluation of properties which can be judged only in the context of other information or knowledge.

4.3 Functional requirements

4.3.1 Display of information

4.3.1.1 Requirements

The equipment shall meet the requirements for the presentation of information on shipborne displays set out in Resolution MSC.191(79) as further specified in IEC 62288.

4.3.1.2 Method of test and required results

Verify compliance with the general requirements for the presentation of navigation-related information in accordance with the test methods and required results specified in IEC 62288.

4.3.2 User interface

4.3.2.1 Requirements

(493/5) *Shipborne DSC equipment* shall *be designed to provide a simplified user interface*.

(541/4) Ensuring *that the equipment* shall *be simple to operate.*

See Annexes C, D, E, F, G and H of this document.

4.3.2.2 Method of test and required results

See Annexes C, D, E, F, G and H of this document.

4.3.3 Categories of calls

4.3.3.1 Requirements

(803/2.2) *The equipment* shall *provide for the following categories of calls using DSC:*

a) distress, urgency and safety;

b) ship operational requirements; and

c) public correspondence

The EUT shall be capable of encoding, transmitting, receiving and decoding all categories of calls relevant to the class for which it shall be certified (see Table A1-4 of Recommendation ITU-R M.493-14:2015).

4.3.3.2 Generated call sequence – Method of test and required results

The output of the EUT is connected to a calibrated apparatus for decoding and printing out the information content of the call sequences generated by the EUT.

The EUT is set to transmit DSC calls in order to verify that the requirements of Recommendation ITU-R M.493 regarding message composition and content are met.

The generated calls are analysed with the calibrated apparatus for correct technical format of the call sequence, including time diversity and repetition of calls.

Confirm by observation that the encoder correctly transmits all types of calls applicable to the class to be certified. The observed telecommands used shall be stated in the test report.

4.3.3.3 Correct decoding of call sequences – Method of test and required results

The input of the EUT shall be connected to validated apparatus for generating DSC signals.

DSC calls relevant for the class of EUT are applied to the equipment in order to verify that the requirements of Recommendation ITU-R M.493 regarding message composition and content are met.

The decoded call sequences at the output of the EUT are analysed for correct technical format, including error-check character.

When decoder measurements are made by use of a printer or a computer, a check is made to ensure accordance between EUT display and printer output.

The validated apparatus is then set to generate incorrectly composed DSC signals.

Confirm by observation that the decoder correctly receive all types of calls applicable to the class for which the EUT is to be certified. The telecommands used are stated in the test report.

Confirm by observation that on the receipt of incorrectly composed calls the EUT neither displays nor prints out the information content of such calls. The indication of "information error" in the display is acceptable. See C.4.2.6.2.

4.3.4 General purpose equipment characteristics

(493/3) *General purpose DSC equipment* shall *be designed in accordance with the characteristics given in Annex 1* of Recommendation ITU-R M.493-14.

Compliance to this document fulfils the above requirement.

NOTE The types of calls applicable to DSC shipboard equipment Classes A, B, D, E, H and M and the associated telecommands are given in Table A1-4 of Recommendation ITU-R M.493-14:2015.

4.3.5 Construction

4.3.5.1 Requirements

(803/A-2.4.5, 804/A-2.4.5, 806/A-2.4.6) *The DSC equipment may be a separate equipment or be integral part* with a radio transmitter and/or a receiver. If the DSC equipment is separated, then dedicated devices are to be specified and tested together as one system.

This document only deals with equipment integrated or associated with a radio transmitter/receiver and the watchkeeping receiver.

NOTE "Integral part" means that the DSC function is physically integrated into a radio transmitter and/or a receiver so that the DSC functions can only be tested by RF measurements (see also IEC 61097-7 and IEC 61097-9).

(803/A-2.4.6, 804/A-2.4.6, 806/A-2.4.7) *The equipment* shall *comprise a dedicated DSC watchkeeping facility to maintain a continuous watch on the distress alerting channels.*

(806/A-2.4.7) *For MF/HF where a scanning receiver is employed to watch more than one DSC distress channel, all selected channels* shall *be scanned within 2s and the dwell time on each channel* shall *be adequate to allow detection of the dot pattern which precedes each DSC call. The scan* shall *only stop on detection of a 100 baud dot pattern.*

(803/A-2.6, 804/A-2.5, 806/A-2.5) *A distress alert* shall *be activated only by means of a dedicated distress button. This button* shall *not be any key of an ITU-T digital input panel or an ISO keyboard provided on the equipment.*

(MSC/Circ.862/1.1) *This button* shall *not be any key of an ITU-T digital input panel or an ISO keyboard associated with the equipment and* shall *be physically separated from functional buttons/keys used for normal operation. This button* shall *be a single button for no other purpose than to initiate a distress alert.*

(803/A-2.7, 804/A-2.6, 806/A-2.6) The dedicated distress button shall:

1) be clearly identified;

   (MSC/Circ.862/1.2) *The distress button* shall *be red in colour and marked "DISTRESS". Where a non-transparent protective lid or cover is used, it* shall *be also marked "DISTRESS".*

   and

2) be protected against inadvertent operation, requiring at least two independent actions.

   (803/A-2.8, 804/A-2.7, 806/A-2.6) *The distress alert initiation* shall *require at least two independent actions.*

(MSC/Circ.862/1.4) *Lifting the protective lid or cover is considered as the first action. Pressing the distress button is considered as the second independent action*.

(803/A-2.9, 804/A-2.8, 806/A-2.8) *The equipment* shall *indicate the status of the distress alert transmission.*

The required protection of the distress button shall be physically mounted on the equipment and consist of a spring loaded lid or cover permanently attached to the equipment by, for example, hinges. It shall not be necessary for the user to remove additional seals or to break the lid or cover in order to operate the distress button.

The operation of the distress button shall generate a visible and audible indication and start a countdown of at least 3 s. To keep the countdown running, the distress button shall be kept pressed for the entire time of the countdown at least 3 seconds. A flashing light and an intermittent acoustic signal shall start immediately. After the 3 seconds countdown is completed, the transmission of the distress alert is initiated and the indication shall become steady.

NOTE These requirements conform to IMO Circular MSC/Circ.862.

(803/A-5) *The equipment* shall *be operational within 1 min of switching on.*

(806/A-Part B-4, C-5) *The equipment* shall *be capable of operating within 1 min of switching on.*

(804/A-Part B-4, C-5) *For MF or MF/HF the equipment* shall *be operating on 2,182 kHz and 2,187.5 kHz within 1 min after switching on.*

See C.6.1.4.

4.3.5.2 Method of test and required results

When the DSC facility is a separate component from the radio transmitter and/or a receiver, then identify and document these separate components and test them as one system.

Confirm that the unit provides *a* dedicated DSC watchkeeping facility to maintain a continuous watch on the distress alerting channels.

For HF and combined MF/HF equipment confirm that when a scanning receiver is employed to watch more than one DSC distress channel, all selected channels are scanned within 2s and the dwell time on each channel is adequate to allow detection of the dot pattern which precedes each DSC call and that the scan shall only stop on detection of a 100 baud dot pattern.

Confirm that a distress alert is activated only by means of a dedicated distress button. That this button is not any key of an ITU-T digital input panel or an ISO keyboard provided on the equipment is physically separated from functional buttons/keys and is not used for normal operation, and that this button is a single button for no other purpose than to initiate a distress alert.

Confirm that the dedicated distress button:

- is physically mounted on the equipment;
- is clearly identified;
- is protected against inadvertent operation;
- that this button includes a spring loaded lid or cover permanently attached to the equipment. That it is not necessary for the user to remove seals or to break the lid or cover in order to operate the distress button;
- that this button is red in colour and marked "DISTRESS". Where a non-transparent protective lid or cover is used, it is also marked "DISTRESS";
- that the operation of the distress button generates a visible and audible indication;
- that when the distress button is kept pressed for at least 3 s a flashing light and an intermittent acoustic signal are started immediately. After the 3 s, the transmission of the distress alert is initiated and the indication becomes steady.

Confirm that the distress alert activation requires at least two independent actions.

Confirm that the equipment is operational within 1 min of switching on.

See C.6.2.1.

4.3.6 Memory

4.3.6.1 Requirements

Pre-programmed DSC distress alerting frequencies and other information, including the list of nature of distress (see Recommendation ITU-R M.493) inherent to the operation of the equipment, shall be stored in non-volatile devices.

If the equipment contains information in operator programmable memory devices, such devices shall be protected from interruptions in the power supply up to at least 10 h duration.

4.3.6.2 Method of test and required results

Confirm that the DSC distress alerting frequencies and other information, including the list of nature of distress inherent to the operation of the equipment, are pre-programmed and are stored in non-volatile devices.

Confirm that, if the equipment contains information in operator programmable memory devices, such devices are protected from interruptions in the power supply for at least 10 h duration.

4.3.7 Warm-up period

4.3.7.1 Requirements

The equipment shall be operational and shall meet the requirements of this document 1 min after switching on.

If the equipment includes parts which require to be heated in order to operate correctly, for example crystal ovens, then a warming-up period of 30 min from the instant of application of power to those parts shall be allowed, after which the requirements of this document shall be met.

4.3.7.2 Method of test and required results

Confirm that the equipment is operational and meet the requirements of this document as applicable after switching on.

4.3.8 Protection of the antenna input circuit

4.3.8.1 Requirement

The receiver shall not suffer damage when an unmodulated radiofrequency signal at an input level of 30 V RMS at any frequency in each range in which the receiver is designed to operate is applied to its antenna input terminal for a period of 15 min. See also Annexes I, J and K.

4.3.8.2 Methods of test and required results

Confirm that the receiver does not suffer damage when an unmodulated radiofrequency signal at an input level of 30 V RMS for one frequency in each selectable frequency band in which the receiver is designed to operate is applied to its antenna input terminal for a period of 15 min.

4.3.9 Protection of the transmitter

4.3.9.1 Requirement

The equipment shall be so designed and constructed that the transmitter is protected against damage resulting from disconnection of the antenna or short-circuiting of antenna terminals. If this protection is provided by means of a safety device, that device shall automatically be reset following removal of the antenna open-circuit or short-circuit conditions. See also Annexes I, J and K.

4.3.9.2 Method of measurement and required result

After the transmitter has been turned on, tuned and turned off, the antenna terminals shall be short-circuited. Then the transmitter shall be turned on for a period of 5 min. Then the transmitter shall be turned off, the antenna terminals shall be open-circuited, and the transmitter shall be turned on for a period of 5 min.

The test only needs to be carried out on one frequency and mode of operation.

The transmitter shall not be damaged and it shall be able to operate normally for all available modes of operation.

4.3.10 Antenna static protection

4.3.10.1 Requirement

In order to provide protection against damage due to static voltages that may appear at the input of the receiver, there shall be a DC path from the antenna terminal to ground not exceeding 100 kΩ.

4.3.10.2 Methods of test and required results

Confirm by measurement that, for the protection against damage due to static voltages that may appear at the input of the receiver, a DC path from the antenna terminal to ground does not exceed 100 kΩ.

4.3.11 Safety precautions

4.3.11.1 Power supply

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

4.3.11.2 Earthing

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

4.3.11.3 Access

All parts and wiring in which the direct or alternating voltages or both (other than radio frequency voltages) combine to give a peak voltage greater than 50 V shall be protected against accidental access and shall be automatically isolated from all sources of electrical energy when the protective covers are removed. Alternatively, the equipment shall be so constructed that access to such voltages may only be gained after having used a tool for this purpose (e.g. a spanner or screwdriver) and warning labels shall be prominently displayed both within the equipment and on protective covers.

4.3.12 Compass safe distance

The compass safe distance shall be determined and labelled as specified in IEC 60945.

4.3.13 Audio interface

Transmitters:

- 600 Ω earth free line input;
- microphone input.

Receivers:

- 600 Ω earth free line output (0 dBm ±3 dB);
- earphone output;
- loudspeaker output.

The line input/output are not mandatory.

4.3.14 Activation of transmitter and maximum transmission time

4.3.14.1 Requirement

The equipment shall have a manual, non-locking push to talk switch to operate the transmitter with a visual indication that the transmitter is activated and facilities to limit the transmission time to a maximum of 5 min. The 5 min limitation applies only to the manual push to talk switch. A short audible announcement and a visual indication may be provided to show when the transmission will be automatically terminated within the next 10 s. It shall be possible to re-operate the push to talk switch and reactivate the transmitter after a 10 s period.

4.3.14.2 Method of measurement and required result

Confirm by observation that the equipment:

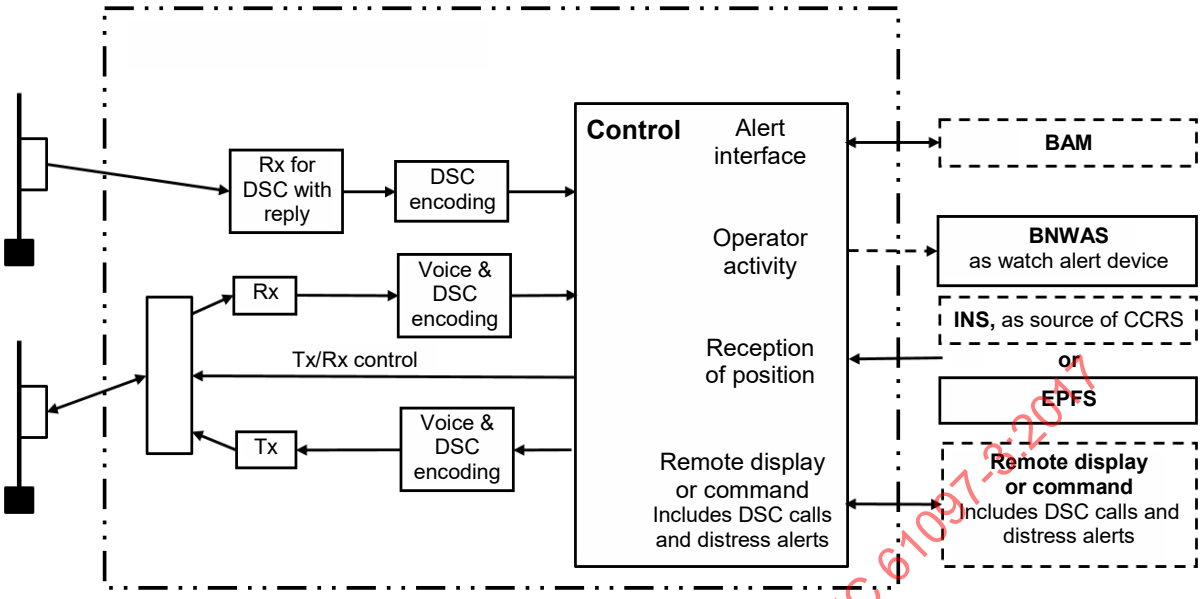
- includes a manual, non-locking push to talk switch;
- includes an indication of activated transmitter;
- limit the transmission time to max 5 min;
- if applicable, provide a short audible announcement and visual indication 10 s before the automatic termination of the transmission;
- is able to re-activate the transmission 10 s after automatic termination of the transmission.

4.3.15 Data interface

4.3.15.1 Requirements

Data interfaces for the connection of electronic navigational aids and for radio control purposes shall be compatible with at least one of IEC 61162-1, IEC 61162-2 and IEC 61162-450. The manufacturer shall specify which alternative of IEC 61162 each physical interface supports (see Figure 2).

Logical interfaces are shown in Figure 1. The manufacturer shall specify if any of the provided logical interfaces share the same physical interface.



Note
Solid line indicates mandatory part
Dashed line indicates optional part

Figure 1 – Interfaces of a DSC

As a minimum, the IEC 61162-1 sentences GLL, GGA, NSR, RMC and GNS shall be recognised for reception of position information. See Table 2.

Additionally, for remote display and/or command purposes, the equipment may optionally be capable of transmitting and receiving the sentences AUC, AUQ, AUS, CUL, DSC, DSE, ECI, EPV, FSS, NAK, OCC and SFI (see Table 3, Table 4, Annex B and Annex N).

Equipment forming integral parts of a specific radio equipment only may instead utilise other protocols.

Optionally, if provided, the DSC may include an interface to report operator activity in order that the BNWAS can reset the dormant period (see Table 5). The EVE sentence as specified IEC 61162-1 shall be output in response to user-interaction with the DSC under conditions described in the user manual.

Sentences used by a BAM interface are in Table 6 and Table 7.

Digital interface network IEC 61162-3 PGNs equivalent to the specified network IEC 61162-1 sentences are described for information in Annex A.

No connection of, or failure within any connected equipment shall affect the required performance of the DSC equipment.

Table 2 – IEC 61162-1 sentences received by the DSC equipment for position information

Mnemonic	Interface (see Figure 1)	Name	Comment
GLL GGA GNS RMC	INS, as source of CCRS or EPFS	Geographic position – latitude/longitude	
NSR	INS, as source of CCRS	Navigation status report	Plausibility and integrity of CCRS

Table 3 – IEC 61162-1 sentences transmitted by the DSC equipment

Mnemonic	Interface (see Figure 1)	Name	Comment
AUS[a]	Remote display or command	Automated Procedure Status	Report status of the ITU procedure Support for ITU-R M.493:2015, Annexes 3 and 4
CUL[a]	Remote display or command	Cyclic Procedure List	Control proper operation of the ITU procedure Support for ITU-R M.493:2015, Annexes 3 and 4
DSC DSE ECI[a]	Remote display or command	Digital selective calling information	Report a received DSC call detail information
EPV	Remote display or command	Equipment property value	Report equipment property values
FSS[a]	Remote display or command	Frequency selection set	Report setting of DSC
NAK	Remote display or command	Negative acknowledgement	Used to inform commander about refusal to set equipment property values
OCC[a]	Remote display or command	Occupation Control	Control possible multiple command sources Support for ITU-R M.493:2015, Annexes 3 and 4
SFI	Remote display or command	Scanning frequency information	Report setting of DSC

[a] See Annex N.

Table 4 – IEC 61162-1 sentences received by the DSC equipment

Mnemonic	Interface (see Figure 1)	Name	Comment
AUC[a]	Remote display or command	Automated Procedure Control	Used to control the ITU procedure Support for ITU-R M.493:2015, Annexes 3 and 4
AUQ[a]	DSC Automated procedure query information	Automated Procedure Query	Used to query for details of an automated DCS procedure
DSC DSE ECI[a]	Remote display or command	Digital selective calling information	Specifies details of a DSC initiation
EPV	Remote display or command	Equipment property value	Used to control equipment property values
FSS[a]	Remote display or command	Frequency selection set	Used to control DSC
SFI	Remote display or command	Scanning frequency information	Used to set scanning frequencies of DSC
[a] See Annex N.			

Table 5 – IEC 61162-1 sentences transmitted by the DSC equipment for BNWAS

Mnemonic	Interface (see Figure 1)	Name	Comment
EVE	BNWAS, as watch alert device	Operator activity	Reset dormant period of the BNWAS

Table 6 – IEC 61162-1 sentences transmitted by the DSC equipment for BAM

Mnemonic	Interface (see Figure 1)	Name	Comment
ALC	BAM	Cyclic alert list	List of current alerts
ALF	BAM	Alert sentence	Details of a new alert
ARC	BAM	Alert command refused	Alert command not accepted
HBT	BAM	Heartbeat	Supports reliable alert related communication

Table 7 – IEC 61162-1 sentences received by the DSC equipment for BAM

Mnemonic	Interface (see Figure 1)	Name	Comment
ACN	BAM	Alert command	Alert command e.g. acknowledge
HBT	BAM	Heartbeat	Supports reliable alert related communication

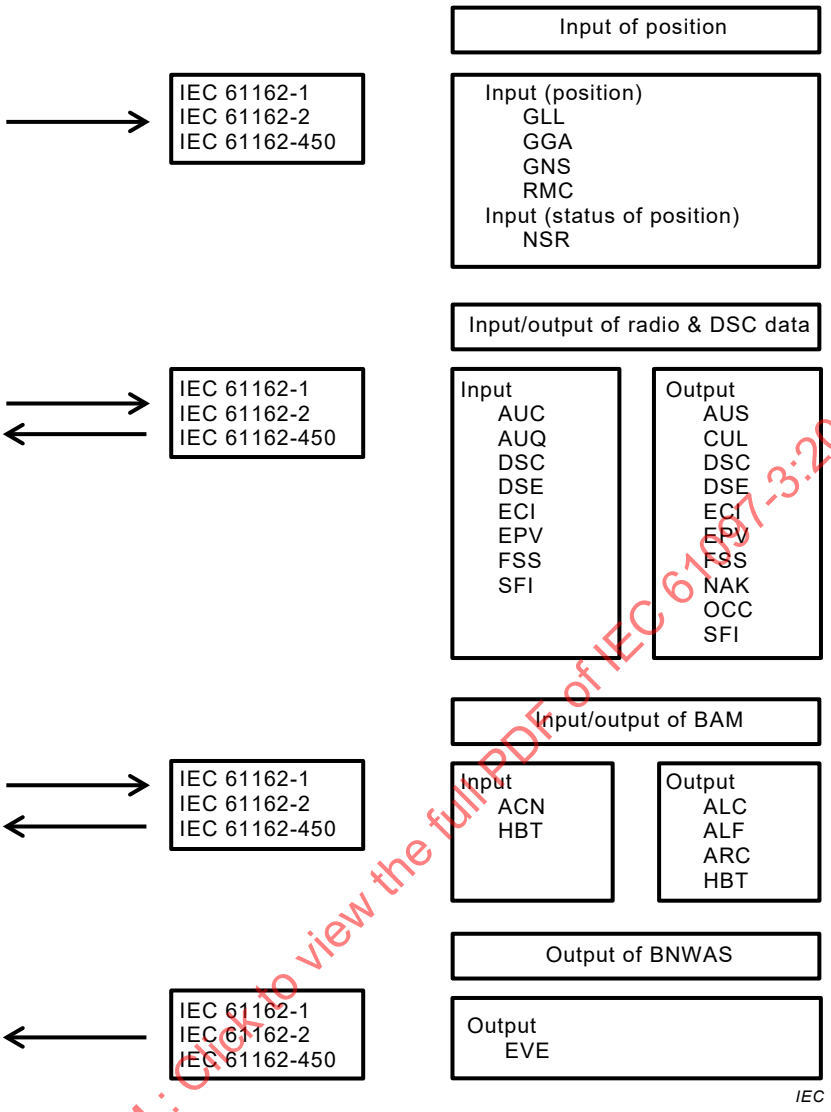


Figure 2 – DSC Interface overview

4.3.15.2 Methods of test and required results

If means for automatic entry of position information and time is provided, confirm by observation that the input characteristics at the EUT comply with the requirements.

If the equipment is intended to control an associated RF transmitter and receiver, particular attention is paid to ensure the correct operation of any control functions between the individual units. Confirm by observation that the interfaces at least comply with the requirements.

If an interface to report operator activity is provided, confirm by inspection of the user manual that it describes the conditions which cause reporting of operator activity and that EVE sentence is sent for each of the described condition.

4.4 Operational requirements

4.4.1 Basic requirements

4.4.1.1 Requirements

(803/A-11.2) *The DSC facility shall comprise:*

a) (803/A-11.2.1, 804/A-Part D-2.1, 806/A-Part D-2.1) *means to decode and encode DSC messages*;

b) (803/A-11.2.1, 804/A-Part D-2.2, 806/A-Part D-2.2) *means necessary for composing the DSC message for example* (M.541 3.1) *manual entry or selection of address, type of call, category and various messages into a DSC sequence*;

c) (803/A-11.2.3, 804/A-Part D-2.3, 806/A-Part D-2.3) *means to verify the prepared message before it is transmitted* (M.541 3.3) *and if necessary the correction of such manually or automatically formed sequences*;

   1) (803/A-11.2.4) means to display the information contained in a received call, in plain language;

   2) (804/A Part D-2.4, 806/A-Part D-2.4) means to display, in plain language with a minimum of 160 characters in two or more lines, the information contained in a received call;

      – (M.541 3.7.1) *type of received call address (to all stations, to a group of stations, geographical, individual);*

      – (541/3.7.2) *category;*

      – (541/3.7.3) *identity of calling station;*

      – (541/3.7.4) *numerical or alphanumerical type of information, for example frequency information and telecommand;*

      – (541/3.7.5) *type of "end-of-sequence" character;*

      – (541/3.7.6) *detection of errors, if any;*

d) (803/A-11.2.5, 804/A-Part D-2.5, 806/A-Part D-2.5) *facilities to automatically update the ship's position and the time at which the position was determined from a suitable electronic position-fixing aid which may be an integral part of the equipment. For equipment which does not have an integral position-fixing aid, such facilities* shall *include a suitable interface conforming to the appropriate international standard;*

e) (803/A-11.2.6, 804/A-Part D-2.6, 806/A-Part D-2.6) *means for the manual entry of position information and the time at which the position was determined;*

f) (803/A-11.2.7, 804/A-Part D-2.7, 806/A-Part D-2.7) *means to activate an* alert *when no position data is received from the electronic position-fixing aid or, in the case of manual input, the position information is over 4 hours old;*

g) (493/A1-12.7) *If the automatic position update is not available, a displayed and audible reminder to manually update the position* shall *occur when a) no position information is provided during start up and b) before the position information is 4 hours old. The displayed reminder* shall *remain until position updating has been carried out;*

h) (803/11.2.7, 804/A-Part D-2.7, 806/A-Part D-2.7. MSC.68(68), 493/A1-12.7) *Any position information not updated for more than 23 ½ hours* shall *be erased*;

i) (803/A-11.4, 804/A-Part D-4, 806/A-Part D-4) *means for initiating a distress alert. It* shall *be possible to initiate and make distress and safety calls from the position from which the ship is normally navigated*;

j) (803/A-2.9, 804/A-Part A-2.8, 806/A-Part A-2.8) means to *indicate the status of the distress alert transmission* and additionally its other operational status for example transmitting, waiting for acknowledgement, auto retransmit;

k) 1. (803/A-11.5, 804/A-Part D-3.5) *Initiation of DSC distress* alerting shall *supersede any other operation of the facility* including the selection of the nature of distress;

   2. (806/A-Part D-3.5) *Initiation of DSC distress* alerting shall *take precedence over any other operation of the facility* including the selection of the nature of distress;

l) (803/A-2.10, 804/A-Part A-2.9, 806/A-Part A-2.9) *It* shall *be possible to interrupt and initiate distress* alerting *at any time but it* shall *not be possible to interrupt a distress alert which is in progress*;

m) (803/A-11.3.1, 804/A-Part D-3.1, 806/A-Part D-3.1) *If the received messages are not printed immediately, sufficient message storage capacity* shall *be provided to enable at least 20 received distress messages to be stored in the DSC facility;*

n) (803/A-11.3.2, 804/A-Part D-3.2, 806/A-Part D-3.2) *These messages* shall *be stored until read out and* shall *be erased 48 hours after their reception.*

4.4.1.2 Method of test and required results

Confirm that means are provided:

a) to decode and encode DSC messages;

b) to compose a DSC message, for example manual entry or selection of address, type of call, category and various messages, into a DSC sequence;

c) to verify the prepared message before it is transmitted and that such manually or automatically formed sequences can be corrected if necessary;

   1) to display the information contained in a received call in plain language;

   2) for MF and HF equipment, to display, as a minimum of 160 characters in two or more lines, the information contained in a received call.

   Confirm that

   – the type of received call address (to all stations, to a group of stations, geographical, individual),

   – the category,

   – the identity of calling station,

   – the numerical or alphanumerical type of information, for example frequency information and telecommand,

   – the type of "end-of-sequence" character, and

   – the detection of errors, if any,

   are shown.

d) to automatically update the ship's position and the time at which the position was determined from a suitable electronic position-fixing aid, which may be an integral part of the equipment, and that these means are operational; confirm that for equipment which does not have an integral position-fixing aid, a suitable interface conforming to the appropriate international standard is provided;

e) to manual entry of position information and the time at which the position was determined is provided;

f) see C.4.1.3 c) and d);

g) see C.4.1.3 c) and d);

h) to erase any position information not updated for more than 23,5 h;

i) to initiate a distress alert. Confirm by inspection of the installation manual that a facility to initiate the distress alerts and safety calls can be provided at the position from which the ship is normally navigated;

j) to indicate the status of the distress alert transmission and additionally its other operational status, for example transmitting, waiting for acknowledgement, auto retransmit;

   1) to initiate DSC distress alerting which supersedes any other operation of the facility including the selection of the nature of distress;

   2) to initiate DSC distress alert which shall take precedence over any other operation of the DSC facility including the selection of the nature of distress;

k) to interrupt and initiate distress alerting at any time but that it is not possible to interrupt a distress alert which is in progress;

l) for sufficient message storage capacity to enable at least 20 received distress messages to be stored in the DSC facility if the received messages are not printed immediately.

m) to store these messages until read out and that they are erased 48 h after their reception.

4.4.2 Additional requirements

4.4.2.1 Aural alarm

4.4.2.1.1 Requirements

(803/A-11.8) *Provisions* shall *be made for:*

a) (803/A-11.8.1, 804/A-Part D-3.8, 806/A-Part D-3.8) a *specific aural alarm and visual indication to indicate receipt of a distress or urgency call or a call having distress category. It* shall *not be possible to disable this alarm and indication. Provisions* shall *be made to ensure that they can be reset only manually;*

b) (493/A1-12.1) *Shipborne alarms* shall *start softly and increase in volume if not silenced by the operator. This will give the operator the opportunity to acknowledge the alarm without interrupting the ship's current communications. It* shall *be possible for the operator to disable all audible alarms except those of category distress and urgency;*

c) (493/-A1-12.1) *The audible distress alarm* shall *have a distinctive two tone alarm. The alarm* shall *consist of two substantially sinusoidal audio-frequency tones, transmitted alternately. One tone* shall *have a frequency of 2 200 Hz and the other a frequency of 1 300 Hz. The duration of each tone* shall *be 250 ms;*

d) (493/A4-2.25) *The audible urgency alarm* shall *consist of repetition of the 2 200 Hz frequency for 250 ms followed by 250 ms period of silence.*

e) (493/A1-12.1) The reception of a *distress* alert *and urgency call* shall *activate an alarm* and signal a BAM warning*;*

f) (493/A1-12.1) *For HF and MF distress* alert*, the alarm* shall *activate only when a distress alert, distress acknowledgement, or a distress alert relay is received and the distress position is within 500 NM (926 km) of the receiving vessel's position, or if the distress position is in the polar areas (latitude greater than 70º N or 70º S). The alarm* shall *also activate when the call is received and the distance between the vessel in distress and the receiving vessel cannot be determined;*

NOTE Disabling of aural alarm does not affect handling of the call.

g) (493/A1-12.1) *For geographic area calls, the alarm appropriate to the category* shall *activate when the receiving station's position is within the area specified by the call or the receiving station's position is not known*;

h) (493/A1-12.1) *The alarm* shall *not be activated where duplicate distress alert relay calls are received within one hour. A duplicate distress alert relay call is one having format specifier all ships or geographic area that contains identical message information and an identical distress MMSI*;

i) (803/A-11.8.2/) For VHF *aural alarms and visual indication for calls other than distress and urgency* shall be provided. (541/3.6) *The aural alarm(s) may be capable of being disabled*.

4.4.2.1.2 Method of test and required results

Confirm that (see Annexes C and H):

a) the specific aural alarm and visual indication to indicate receipt of a distress or urgency call or a call having distress category is used and that it is not possible to disable this alarm and indication; provisions are made to ensure that they can be reset only manually;

b) shipborne alarms start softly and increase in volume if not silenced by the operator;

   1) the operator can acknowledge the alarm without interrupting the ship's current communications;

   2) the operator can disable all audible alarms except those of category distress and urgency;

c) distinctive two tone alarms are used for distress and urgency calls. Confirm that one tone has a frequency of 2 200 Hz and the other a frequency of 1 300 Hz and that the duration of each tone is 250 ms;

d) the audible urgency alarm consists of the 2 200 Hz frequency for 250 ms followed by 250 ms period of silence;

e) reception of distress alert and urgency call activate an alarm, and signal a BAM warning;

f) for HF and MF distress alert, the alarm is activate only when a distress alert, distress acknowledgement, or a distress alert relay is received and the distress position is:

   1) within 500 NM (926 km) of the receiving vessel's position;

   2) in the polar areas (latitude greater than 70º N or 70º S);

   3) where the distance between the vessel in distress and the receiving vessel cannot be determined;

g) for geographic area calls, the alarm appropriate to the category is activated when the receiving station's position is within the area specified by the call or the receiving station's position is not known;

h) the alarm is not activated where duplicate distress alert relay calls are received within one hour. A duplicate distress alert relay call is one having format specifier all ships or geographic area that contains identical message information and an identical distress MMSI;

i) the aural alarms and visual indication for calls other than distress and urgency are provided and the aural alarm(s) may be capable of being disabled.

4.4.2.2 Inactivity timer

4.4.2.2.1 Requirements

(493/A1-12.2) *During normal operation, the equipment* shall *include an inactivity timer to return the DSC system display to default or standby mode if the operator is in a menu where DSC call reception is disabled and does not make any selections or changes for 10 min.*

4.4.2.2.2 Method of test and required results

Confirm by observation that the display of the EUT returns to default or standby mode after 10 min of no selection or changes by the operator.

4.4.2.3 Automatic switching to a subsequent communications channel

4.4.2.3.1 Requirements

(493/A1-12.5) *Automatic switching to a subsequent communications channel on receipt of a DSC call may be implemented on VHF equipment. Prior to an automatic switch to the proposed frequency or channel, the user* shall *accept the change, which* shall *be carried out after the acknowledgement.*

(493/A1-12.5) *Automatic switching to a subsequent communications channel on receipt of a DSC call might in some cases disrupt important ongoing communications. Where such capability exists, a means for disabling that function* shall *therefore be provided for all calls other than individual station calls of category distress or urgency. The DSC equipment* shall *provide visual indication that the automatic switching function is disabled.*

See C.7.1.7 and C.9.1.6.

4.4.2.3.2 Method of test and required results

See C.7.2 and C.9.2.

4.4.3 Distress alerts

4.4.3.1 General

4.4.3.1.1 Requirements

(541/A1-3.1.1) *The DSC equipment* shall *be capable of being pre-set to transmit the distress alert with "undesignated" nature of distress on at least one distress alerting frequency.*

See C.6.1.4.

4.4.3.1.2 Method of test and required results

Confirm by observation that the EUT is capable of being pre-set to transmit the distress alert with "undesignated" nature of distress on at least one distress alerting frequency.

See C.6.2.2.

4.4.3.2 Composition of distress alerts

4.4.3.2.1 Requirements

(541/A1-3.1.2) *The distress alert* shall *be composed in accordance with Recommendation ITU-R M.493.* The procedure for transmitting a distress alert is given in Recommendation ITU-R M.541:2015, Annex 3.

See C.6.1.

4.4.3.2.2 Method of test and required results

See C.6.2.

4.4.3.3 Distress alert attempt

4.4.3.3.1 Requirements

(541/A1-3.1.3) *At MF and HF a distress alert attempt may be transmitted as a single-frequency or a multi-frequency alert attempt. At VHF only single-frequency alert attempts* shall *be used.*

(541/A1-3.1.3.1) *A single-frequency alert attempt* shall *be transmitted as 5 consecutive calls on one frequency. To avoid call collision and the loss of acknowledgements, this alert attempt may be transmitted on the same frequency again after a random delay of between 3½ and 4½ min from the beginning of the initial alert. The random delay* shall *be generated automatically for each repeated transmission, however it* shall *be possible to override the automatic repeat manually.*

(541/A1-3.1.3.2) *A multi-frequency alert attempt may be transmitted as up to 6 consecutive calls dispersed over a maximum of 6 distress frequencies (1 at MF and 5 at HF). A VHF call may be transmitted simultaneously with an MF/HF call. Equipment transmitting multi-frequency distress alert attempts* shall *be able to complete the call attempt within 1 minute. Multi-frequency call attempts may be repeated after a random delay of between 3½ and 4½ min from the beginning of the previous call attempt.*

(541/A1-3.3.5) *The automatic repetition of a distress alert attempt* shall *be terminated automatically on receipt of a DSC distress acknowledgement.* It shall also be possible to terminate the automatic repetition manually.

See C.6.1.

4.4.3.3.2 Method of test and required results

See C.6.2

4.4.3.4 Distress alert acknowledgement and distress relay

4.4.3.4.1 Requirements

(541/A1-3.3) *Acknowledgement of DSC distress alerts* shall *be initiated manually and transmitted on the same frequency* that *the distress alert was received;* automatic means to acknowledge distress alerts shall be excluded.

(541/A1-3.3.3) *The acknowledgement of a distress alert* shall *consist of a single DSC distress acknowledgement call and include the identification of the ship whose distress alert is being acknowledged.*

(541/A1-3.4.1) *A distress alert relay* shall *use the call format for distress alert relays as specified in Recommendation ITU-R M.493 and the calling attempt* shall *follow the procedures described in* 4.4.3.4.

See C.7.1.9.

4.4.3.4.2 Method of test and required results

Confirm that an acknowledgement of DSC distress alerts can only be initiated manually and transmitted on the same frequency where the distress alert was received. Confirm that automatic means to acknowledge distress alerts are not available.

Confirm that the acknowledgement of a distress alert consists of a single DSC distress acknowledgement call and includes the identification of the ship whose distress alert is to be acknowledged.

Confirm that a distress alert relay is using the call format for distress alert relays as specified in Recommendation ITU-R M.493 and the calling attempt is in compliance with the procedures described in 4.4.3.4.

See C.7.2.7 and C.7.2.8.

4.4.4 Other calls

4.4.4.1 Composition of calls

4.4.4.1.1 Requirements

It shall be possible to compose all calls applicable to the class of equipment (see Tables A1-4.1 to A1-4.11 of Recommendation ITU-R M.493:2015).

(689/A1-2.1.1)(1082/A1-2.1.1) If the EUT supports the optional automatic/semi-automatic service *it* shall *be possible for the user to only key in the coast station address and the required subscriber number, all other information being inserted automatically*.

4.4.4.1.2 Method of test and required results

Confirm by observation that is possible to compose all calls applicable to the class of the EUT.

If the EUT supports the optional automatic/semi-automatic service, confirm by observation that for automatic/semi-automatic calls other information than the coast station information and the subscriber number are applied automatically by the EUT.

See C.4.2.4.

4.4.4.2 Acknowledgement of calls

4.4.4.2.1 Requirements

Acknowledgement calls, except distress acknowledgement calls, may be transmitted automatically.

(541/A2-2.2.2) *When a received call sequence contains an end-of-sequence signal RQ, an acknowledgement sequence* shall *be composed and transmitted. The format specifier and category information* shall *be identical to that in the received calling sequence.*

(541/A2-2.2.3) If an acknowledgement has not been transmitted by a ship's operator *within 5 min of receiving the calling sequence the ship station* shall *transmit a calling sequence to the coast station*.

4.4.4.2.2 Method of test and required results

Confirm by observation that distress acknowledgement calls are not transmitted automatically without operator action.

Confirm by observation that an acknowledgement sequence is transmitted after reception of an end-of-sequence signal RQ.

4.4.4.3 Operation in the automatic/semi-automatic service

4.4.4.3.1 General

Requirements of this clause apply, if the EUT supports the optional automatic/semi-automatic service.

4.4.4.3.2 Requirements

(541/A2-2.2.4) *If the ship is equipped for automatic DSC operation, the ship station* shall *automatically transmit an acknowledgement with an end-of-sequence signal "BQ". The start of the transmission of this acknowledgement sequence* shall *be within 30 s for HF and MF or within 3 s for VHF after the reception of the complete call sequence.*

(689/A1-2.2.5) *Fully automated ship stations* shall *be capable of automatically transmitting on the VHF working channel a DSC call and a carrier for a minimum period of 2 s on receipt of an error-free acknowledgement "able to comply" from the called coast station.*

(689/A1-2.1.3) *If the ship station does not receive a VHF error-free acknowledgement from the called coast station within 5 s, the calling sequence* shall *be automatically repeated.*

(1082/A1-2.1.3) *If the ship station does not receive a MF or HF error-free acknowledgement from the called coast station within 25 s, the calling sequence* shall *be manually repeated.*

4.4.4.3.3 Method of test and required results

When fully automatic DSC operation is in use, confirm by observation that the EUT automatically transmits an acknowledgement with an end-of-sequence signal "BQ" within 30 s for HF and MF and within 3 s for VHF.

For fully automatic DSC operation and for VHF, confirm by observation that the EUT automatically transmits a carrier for at least 2 s in working channel after receipt of an error-free acknowledgement "able to comply" from a calling coast station.

For VHF, confirm by observation that the EUT repeats the calling sequence if the EUT does not receive error-free acknowledgement from a calling coast station within 5 s.

For MF and HF confirm that the user has to repeat the calling sequence manually, if the EUT does not receive error-free acknowledgement from a calling station within 25 s

4.4.4.4 Routine testing of the DSC equipment

4.4.4.4.1 Requirements

(803/A-11.7, 804/A-Part D-3.7, 806/A-Part D-3.7) *Means* shall *be provided to enable routine testing of the DSC facility without radiation of signals.*

The equipment shall additionally provide for a test call facility in accordance with Recommendation ITU-R M.493-14.

4.4.4.4.2 Method of test and required results

Confirm by observation that the EUT has means for routine testing without radiation of signals.

Confirm by observation that the EUT reverts to previous (watchkeeping) condition automatically on completion of the routine test.

4.4.5 Self-identification

4.4.5.1 Requirements

(803/A-11.6, 804/A-Part D-3.6, 806/A-Part D-3.6) *Self-identification data* shall *be stored in the DSC unit* in a non-volatile memory (see 4.3.6). *It* shall *not be possible for the user easily to change these data.*

Facilities shall be included in the EUT to permit an authorized operator (e.g. a manufacturer, dealer or service agent) to delete the MMSI stored in the EUT, so that a new MMSI can be entered in the EUT.

(493/A1-12.4) *DSC equipment* shall *not transmit any DSC call until own ship's MMSI allocated to the ship by the relevant administration has been configured and stored in the DSC equipment. Once stored, it* shall *not be possible for the user to change the MMSI without advice from the manufacturer.*

The DSC equipment shall *display own ship's MMSI on start-up unless the MMSI has not been configured. If the MMSI has not been configured, the equipment will display a warning that the unit will not transmit any DSC calls until own ship's MMSI is entered. The equipment* shall *stay in this state until the operator confirms he has read the display and input own ship's MMSI.*

The MMSI shall *be readily displayed on the HMI when the DSC equipment is on.*

See C.4.1.1

4.4.5.2 Method of test and required results

Confirm by observation that it is not possible for the user to change the self-identification data after an initial set up which may only be run a limited number of times. It shall easily be possible to verify the self-identification.

Confirm by observation that there are facilities available for an authorized operator to delete the MMSI so that a new MMSI can be set.

See C.4.2.2.

4.5 Scanning efficiency

4.5.1 Requirements

Scanning efficiency is the ability of the EUT to correctly identify calls preceded by more than 20 bits of a 200-bit dot pattern and transmitted on one frequency whilst scanning up to six frequencies, ignoring all other signals and noise and to generate suitable signals to control an associated scanning receiver.

4.5.2 Method of test and required results

Two standard test signals STS-1 containing a series of call sequences is applied alternately to the decoder at a random interval of 2,5 s to 4 s.

The level of the two STS-1 applied to the receiver is 20 dBμV. The receiver is set to scan the maximum number of frequencies for which it is designed.

One standard test signal is modulated with a single distress call. The other standard test signal is modulated with DSC calls containing a 20-bit dot pattern.

The number of transmitted distress calls is 200 and the symbol error rate is determined as described in 4.2.11.2.5.

Confirm by observation that the total number of received distress calls is equal to or exceed 95 % of distress calls transmitted and the symbol error rate is $\leq 10^{-2}$.

Confirm by observation that the signals from the decoder to control the scanning receiver comply with the requirements in 4.6 for all DSC distress calls decoded correctly.

4.6 Watch and scanning facilities

4.6.1 Requirements

4.6.1.1 Multi-frequency distress alert attempts and watch receiver capabilities (MF/HF)

The equipment shall either:

a) be capable of receiving DSC messages on all distress frequencies (except for the transmit frequency in use) whilst the distress alert is being transmitted; or

b) be able to complete the multi-frequency distress alert attempt within one minute. Then be capable of receiving DSC messages on all distress frequencies.

The decoder shall provide a suitable signal to stop the scanning process on the detection of a dot pattern of more than 20-bit length.

The decoder shall provide a suitable signal to restart the scanning process when the dot pattern continues for more than 3 s, after receipt of a DSC call or, during the reception of a DSC call which is not addressed to the ship, as soon as this is recognised.

Means shall be provided to program the frequencies to be scanned by the watch receiver. The manufacturer shall provide information on how the programming is done. If the remote control interface is supported, the SFI sentence may be used to program the set of DSC distress frequencies in accordance with IEC 61162-1.

The set of frequencies shall at least include the DSC distress frequencies in the 2 MHz band, the 8 MHz band and one additional band. Default shall be all six bands.

The DSC distress frequencies programmed shall correspond with the frequencies on which a multi-frequency distress alert attempt will be transmitted.

4.6.1.2 Watch receiver capabilities (MF and VHF)

The watchkeeping receiver part of the DSC equipment shall be designed for continuous operation on channel 70 (on VHF) and 2 187,5 kHz (on MF) but the receiver need not operate when the transmitter is in use on that channel.

4.6.2 Method of test and required results

4.6.2.1 MF/HF

4.6.2.1.1 Default test method

Program the watch receiver to scan all six distress frequencies. Assure the main receiver is programmed for another frequency than any of the six distress frequencies.

From the TE, send a distress message on any of the distress frequencies.

Validate the call is received correctly by the EUT and the band of which it is received is indicated.

Repeat the test on all remaining distress frequencies. Validate all calls are received on EUT.

On EUT, send a multi-frequency alert attempt.

1 min after the alert attempt has been transmitted, send a distress acknowledgement from TE on any of the used distress frequencies.

Validate the distress acknowledgement is received on the EUT and the band of which it is received is indicated.

Repeat the test, sending first distress acknowledgement from TE on any of the remaining distress frequencies. Validate all distress acknowledgements are received on EUT.

4.6.2.1.2 Alternative test method

If remote control interface is implemented, the watch receiver can be programmed using the SFI sentence, and the currently used watch frequency can be reported using the FSS sentence according to IEC 61162-1.

Program the watch receiver to scan all six distress frequencies. Assure that the main receiver is programmed for another frequency than any of the six distress frequencies.

Let the TE (once) apply a dot pattern of 200 bits length on any of the DSC distress frequencies.

Validate the frequency is reported on FSS with mode "t" (F1B/J2B, receive only, teleprinter/DSC).

Repeat the test on all remaining distress frequencies. Validate that all frequencies are reported by the EUT.

If feasible, apply a continuous dot pattern on two distress frequencies simultaneously.

Validate that the watch receiver is reporting the two frequencies sequentially via FSS sentences within intervals of maximum 5 s.

4.6.2.2 MF and VHF

Validate that any distress message can be received on channel 70 (VHF) or 2 187,5 kHz (on MF) regardless of the frequency tuned to on the main receiver.

4.7 Bridge alert management (BAM)

4.7.1 Classification of BAM alerts

4.7.1.1 Requirements

The DSC equipment shall use the relevant alert classification available in Table 8. The manufacturer shall provide a document listing all available BAM alerts and their classification in the DSC equipment.

The ALF sentence is used to report details of BAM alerts. For easy identification of the origin of distress or other call, the ALF sentence shall be filled as below:

- Field Alert identifier as specified in Table 8 (for example 310, 311);
- Field Alert text for first ALF sentence as specified in Tables 9 to 14 Alert title column (for example “DISTRESS:RX);

  NOTE The source of an alert, for example "VHF", "VHF number 1", "MF", "HF", "MF/HF", is available in IEC 61162-1 or IEC 61162-2 as a combination of talker ID and physical serial interface (i.e. configuration parameter within receiver). For IEC 61162-450, the source is available as combination of talker ID and TAG block parameter source identification.

- Field Alert text for second ALF sentence as defined by the manufacturer after consulting Tables 9 to 14 Alert description column. The manufacturer shall provide a detailed description of the text options.

Table 8 – Classification of GMDSS equipment alerts for alert management purposes

GMDSS alarm Source	Cause	BAM Alarm	BAM Warn.	BAM Caut.	Categ. A	Categ. B	Unique identifier at alert source[a]
VHF DSC radio MF/HF DSC radio	Receipt of distress or urgency DSC call		x		x		310
VHF DSC radio MF/HF DSC radio	Receipt of DSC calls other than distress or urgency			x		X	311
VHF DSC radio MF/HF DSC radio	No position data received by equipment			x		x	312
MF/HF DSC radio	Antenna Tuner Error or other detected antenna failure		x			x	313
VHF DSC radio MF/HF DSC radio	Transmission power error or otherwise inhibited transmission		x			x	314

[a] Manufacturer specified unique identifiers at alert source are allowed within the range 10 000 to 9 999 999.

NOTE 1 Alerts related to the reception of distress and urgency call are categorized as category A, as the OOW has to read the information in the received message before being in a position to acknowledge the alert.

NOTE 2 This classification of GMDSS equipment alerts for alert management purposes set out in this table originates from IEC 62940.

4.7.1.2 Methods of test and required results

Confirm by inspection of the manufacturer's documentation that the classification of BAM alerts follows requirements of 4.7.1.1.

4.7.2 Alert management

4.7.2.1 General requirements

4.7.2.1.1 Requirements

The performance standards for BAM tailor the IMO Code on alerts and indicators to harmonize the priority, classification, handling, distribution and presentation of alerts on bridge equipment.

DSC shall provide bridge alert management handling and an interface compliant with the requirements of BAM Modules A and C as further specified in the state diagram of IEC 61924-2:2012, Annex J.

Alert management requires:

a) classification of all alerts available in the EUT (see 4.7.1);

b) presentation of the alerts (see IEC 61924-2:2012, Module C);

c) reporting of alerts in the BAM interface (see IEC 61924-2:2012, Module C);

d) handling of unacknowledged warnings (see 4.7.2.2);

e) functionality of remote acknowledge and remote silencing (see 4.7.2.3).

4.7.2.1.2 Methods of test and required results

Confirm by observation that the DSC outputs an ALF sentence under the condition described in the user manual. Confirm by analytic evaluation that presentation of the alerts in the BAM interface conforms to IEC 61924-2:2012, Module C.

4.7.2.2 Unacknowledged BAM warnings

4.7.2.2.1 Requirements

An unacknowledged BAM warning shall be repeated as a BAM warning after a limited time period not exceeding 5 min. Unacknowledged BAM warnings shall not be changed to BAM alarm priority.

4.7.2.2.2 Methods of test and required results

Confirm by observation that an unacknowledged BAM warning is repeated as a BAM warning after a limited time period not exceeding 5 min. Confirm by observation that an unacknowledged BAM warning is not changed to BAM alarm priority.

4.7.2.3 Remote acknowledgement and silencing of BAM alerts

4.7.2.3.1 Requirements

Remote temporary silencing and remote acknowledgement shall be provided via alert related communication according to the state diagram in IEC 61924-2:2012, Annex J.

Remote silencing of the relevant audible alarms of the GMDSS equipment shall be possible at any time.

4.7.2.3.2 Methods of test and required results

Confirm by using a BAM simulator that remote temporary silencing and remote acknowledgement is provided via alert related communication according to the state diagram in IEC 61924-2:2012, Annex J.

Confirm by using a BAM simulator that remote silencing of the relevant audible alarms of the GMDSS equipment is possible at any time.

4.8 Alert source identification and reporting in ALF sentence

4.8.1 General requirements

4.8.1.1 Requirements

The ALF sentence is used to report the status of any BAM alert in the system. Alert IDs and categorization for DSC are defined in Table 8.

The source equipment of the BAM alert is solely determined by the talker identifier (IEC 61162-1) and/or the source identification parameter SFI (IEC 61162-450).

DSC origin BAM alerts shall initially be created upon the creation of the automated procedure handling the call. The unique identifier shall be assigned by the BAM alert source for that particular cause.

Several identical causes may be active in parallel. To be able to identify and control parallel incidents from the BAM, the equipment shall assign a unique instance number for each similar cause. The automated procedures described in Annex C are the mechanism able to handle DSC parallelism. Each automated procedure shall be assigned an instance number to be used in the ALF/ALC sentences.

The ALF sentence shall be transmitted each time a call is received which causes a state transition in the automated procedure. The ALF revision counter shall be incremented and the alert text may be updated on each changed state.

4.8.1.2 Method of test and required results

Make the EUT receive a number of DSC calls that will initiate multiple automated procedures in the un-acknowledged state. Select a mixture of received calls that cover the call causes in Table 8. Validate category and priority.

Confirm by using a BAM emulator that the call types can be distinguished from each other by Alert ID, and that parallel causes of same type can be distinguished from each other by instance number.

Confirm the talker identifier is CT for MF/HF equipment and CV for VHF equipment.

Handle some of the received calls in their respective procedures to see they are independently being acknowledged, silenced or otherwise updated, and that events lead to a renewed emission of the ALF sentence.

4.8.2 Receipt of distress or urgency call

4.8.2.1 Requirements

4.8.2.1.1 General

The BAM alert priority is warning and the BAM category is A, and shall be handled accordingly.

If the received call activates a new continuous audible alarm (two-tone, distress acknowledge, urgency alarm and urgency acknowledge alarm) the alert state shall always be set to active-unacknowledged (V).

The BAM alert is acknowledged when the audible alarm is silenced on the EUT.

The BAM alert is rectified when the automated procedure is terminated.

4.8.2.1.2 Alert text

The alert text for this priority type of call is given in Table 9.

Table 9 – Alert text in ALF sentence for cause Distress

No.	Alert title (mandatory)	Alert description (manufacturer specific)
1	DISTRESS: RX	Information to consider: • Un-acknowledged/acknowledged/cancelled • Distress MMSI • Position/time • Nature of distress • Comm. Mode Example: *U 219380007 N57'12 E009'41 1426 05 09*
2	DISTRESS: RELAY	Information to consider: • Un-acknowledged/acknowledged • MMSI of sender • Distress MMSI • Position/time • Nature of distress • Comm. Mode Example: *U 001234567 219380007 N57'12 E009'41 1426 05 09*
NOTE The sending distress procedure does not lead to any generation of ALF sentences.		

The procedure type handling the distress related causes in Table 8 is always the Receiving Distress automated procedure. The alert title relates to the event which caused the procedure: (1) Received distress or (2) Received distress relay or transmitted DROBOSE.

The procedure type handling the urgency related causes in Table 8 is always the Receiving Non-distress automated procedure.

4.8.2.2 Methods of test and required results

Make the EUT receive distress DSC calls that will initiate the received distress automated procedure.

Confirm by using a BAM emulator that the mandatory alert title is according to Table 9. Confirm that the alert description in the ALF sentence transmitted (if applicable) is according to the manufacturer's manual.

Initiate a DROBOSE call that will initiate the received distress automated procedure.

Confirm by using a BAM emulator that the mandatory alert title is according to Table 9. Confirm that the alert description in the ALF sentence transmitted (if applicable) is according to the manufacturer's manual.

Make the EUT receive urgency DSC calls that will initiate the received non-distress automated procedure.

Confirm by using a BAM emulator that the mandatory alert title is according to Table 10. Confirm that the alert description in the ALF sentence transmitted (if applicable) is according to the manufacturer's manual.

For the entire test procedures above, check that the BAM alert is acknowledged when procedures are silenced on the EUT.

For the entire test procedures above, check that the BAM alert is rectified when procedures are terminated.

Table 10 – Alert text in ALF sentence for cause Urgency

No.	Alert title (mandatory)	Alert description (manufacturer specific)
1	URGENCY: RX	Information to consider: • Un-acknowledged/acknowledged • Address MMSI • Category • Comm. Mode • Frequency Example: *U 219380007 05 09 081820 021820*

4.8.3 Receipt of calls other than distress or urgency

4.8.3.1 Requirements

The BAM alert priority is caution, and shall be handled accordingly.

The alert text for this priority type of call is given in Table 11.

The BAM alert is rectified when the automated procedure is acknowledged or otherwise accepted on the EUT.

Table 11 – Alert text in ALF sentence for received calls other than Distress and Urgency

No.	Alert title (mandatory)	Alert description (manufacturer specific)
1	SAFETY: COM	Information to consider: • First telecommand • Second telecommand • MMSI • Comm. Mode • Frequency info • Position info
2	SAFETY: POS	
3	SAFETY: TEST	
4	ROUTINE: COM	
5	ROUTINE: POLL	

The procedure type handling the safety and routine causes in Table 8 is always the Receiving Non-distress automated procedure. The alert title relates to the event which caused the procedure: (1) Safety communication, (2) Safety position request, (3) Safety test request, (4) Routine communication and (5) Routine poll.

4.8.3.2 Methods of test and required results

Make the EUT receive safety communication, safety position, safety test, routine communication and routine poll DSC calls that will initiate a number of received non-distress automated procedure.

Confirm by using a BAM emulator that the mandatory alert titles are according to Table 11. Confirm that the alert descriptions in the ALF sentence transmitted (if applicable) are according to the manufacturer's manual.

For the entire procedures test above, check that the BAM alerts are rectified when procedures are acknowledged or otherwise handled on the EUT.

4.8.4 No position data received by equipment

4.8.4.1 Requirements

The BAM alert priority is caution, and shall be handled accordingly.

The alert text for this priority is given in Table 12.

The alert is rectified when the position data reception is re-established.

Table 12 – Alert text in ALF sentence for cause No position data received by equipment

No.	Alert title (mandatory)	Alert description (manufacturer specific)
1	POSITION:	Information to be considered by the manufacturer, for example: • last valid position; • last valid time of position; • position source for last received position.

4.8.4.2 Methods of test and required results

The EUT is initially provided with valid position input. Cease position input to the EUT.

Confirm by using a BAM emulator that the mandatory alert title is according to Table 12. Confirm that the alert descriptions in the ALF sentence transmitted (if applicable) are according to the manufacturer's manual.

Confirm that the BAM alert is rectified when the position data input is re-established.

4.8.4.3 Antenna tuner error or other detected antenna failures

4.8.4.3.1 Requirements

If optional facilities to detect errors that may compromise vessel safety are provided, the manufacturer shall provide a description on how antenna conditions and/or antenna tuner is set to normal condition and how a failure can be caused for test purposes.

The BAM alert priority is warning and the BAM category is B, and shall be handled accordingly.

The BAM alert text for this priority is given in Table 13.

This BAM alert can be acknowledged from the BAM and such acknowledgement shall result in silencing the corresponding audible alarm on the EUT.

This BAM alert is acknowledged when the audible alarm is silenced on the EUT.

This BAM alert is rectified when the antenna condition is normalized.

Table 13 – Alert text in ALF sentence for cause Antenna or Antenna tuner failure

No.	Alert title	Alert description (manufacturer specific)
1	ANTENNA: TUNER	Information to be considered by the manufacturer, for example: • antenna tuner equipment; • tuning error.
2	ANTENNA: FAILURE	Information to be considered by the manufacturer, for example: • SWR error; • antenna power.

4.8.4.3.2 Methods of test and required results

Connect antenna and, if provided, antenna tuner under normal test condition. If provided, follow the manufacturer's description on how to cause failure.

Confirm by using a BAM emulator that the alert title is according to Table 13. Confirm that the alert descriptions in the ALF sentence transmitted (if applicable) are according to the manufacturer's manual.

Confirm the BAM alert can be acknowledged from the BAM emulator and that this results in the silencing of the corresponding audible alarm on the EUT.

Confirm the BAM alert is acknowledged when the audible alarm is silenced or otherwise handled on the EUT.

Confirm that the BAM alert is rectified when antenna conditions are normalized.

4.8.4.4 Transmission power error or otherwise inhibited transmission

4.8.4.4.1 Requirements

If optional facilities to detect errors that may compromise vessel safety are provided, the manufacturer shall provide a description on how transmission power condition is set to normal condition and how transmit inhibit or failure can be caused for test purposes.

The alert priority is warning and category is B, and shall be handled accordingly.

The alert text for this priority is given in Table 14.

The alert can be acknowledged from the BAM and such acknowledgement shall result in silencing the corresponding audible alarm on the EUT.

The BAM alert is acknowledged when the audible alarm is silenced on the EUT.

The alert is rectified when the antenna condition is normalized.

Table 14 – Alert text in ALF sentence for cause Transmission power inhibit or failure

No.	Alert Title	Alert description (manufacturer specific)
1	TX POWER: INHIBIT	Information to be considered by the manufacturer, for example: • externally inhibited; • transmission blocked
2	TX POWER: FAILURE	Information to be considered by the manufacturer, for example: • insufficient power.

4.8.4.4.2 Methods of test and required results

Follow the manufacturer's description on how to cause transmission power failures.

Confirm by using a BAM emulator that the alert title is according to Table 14. Confirm that the alert descriptions in the ALF sentence transmitted (if applicable) are according to the manufacturer's manual.

Confirm the BAM alert can be acknowledged from the BAM emulator and that this results in the silencing of the corresponding audible alarm on the EUT.

Confirm the BAM alert is acknowledged when the audible alarm is silenced or otherwise handled on the EUT.

Confirm that the BAM alert is rectified when transmission power conditions are normalized.

4.9 Software and firmware maintenance

4.9.1 Requirements

Adequate software and firmware maintenance arrangements shall be supported by the DSC manufacturer in accordance with IMO MSC.1/Circ.1389. DSC equipment shall provide means to display on demand the current software/firmware version.

User authentication shall be provided as specified in IEC 61162-460:2015, 6.2.4.1.

Means shall be provided to replace or install updates to software/firmware in the DSC. The manufacturer shall implement appropriate security measures to protect against unwanted local access as specified in IEC 61162-460:2015, 6.2.3 and 6.2.4.

Manufacturers shall provide customers with timely access, at least by website, to DSC application software and firmware versions, compliance status and regulatory approvals for the listed configurations/versions, and operating system requirements. The procedures to do the above shall be part of the recognized quality system of the manufacturer.

4.9.2 Methods of testing and required test results

Confirm by observation that the current software and firmware versions can be displayed.

Confirm by inspection of documented evidence that replacement or installation of updates to software and firmware can be accomplished following information provided in the manufacturer's documentation.

Confirm by observation that user authentication is provided as specified in IEC 61162-460:2015, 6.2.4.1.

Confirm by inspection of manufactures documentation that appropriate security measures are implemented.

Confirm by observation that the DSC is protected against unwanted local access as specified in IEC 61162-460:2015, 6.2.3 and 6.2.4.

Confirm by observation that the manufacturer's website leads to information that provides compliance status for regulatory approvals for manufacturer's DSC software/firmware versions.

Confirm by inspection of documented evidence that manufacturer's recognized quality system includes procedures to maintain the list in a website.

5 Technical characteristics

5.1 General

5.1.1 Frequency

5.1.1.1 Requirements

(493/A1-1.1) *The system is a synchronous system using characters composed from a 10-bit error-detecting code.*

(493/A1-1.2) *Time diversity is provided in the call sequence.*

Apart from phasing characters, each character is transmitted twice in a time-spread mode; the first transmission (DX) of a specific character is followed by the transmission of four other characters before re-transmission (RX) of that specific character takes place, allowing for a time-diversity reception interval of:

a) *400 ms for HF and MF; and*

b) *33,33 ms for VHF.*

(493/A1-1.3) *The frequency shifts and modulation rates* shall *be as follows*:

a) on HF and MF: frequency-shift of ±85 Hz. When frequency-shift keying is effected by applying audio signals to the input of single-sideband transmitters (J2B), the centre of the audio-frequency spectrum offered to the transmitter shall be 1 700 Hz; the frequency tolerance of the 1 615 Hz and 1 785 Hz tones shall be ±1 Hz; and the modulation rate shall be 100 Bd (bit/s) ± 0,003 Bd (bit/s).

b) to care for the radio-frequency tolerances of old designs of both transmitters and receivers in the MF and HF bands, the DSC decoder shall have a capture range of at least ±85 Hz. However, the receiver bandwidth shall not exceed 300 Hz.

Equipment constructed for both MF/HF and VHF shall automatically select the signal characteristics relevant to the frequency range in use.

(493/A1-1.4) *The higher frequency corresponds to the B-state and the lower frequency corresponds to the Y-state of the signal elements*. At logic levels, the B-state shall be logic "0" and the Y-state shall be logic "1".

(493/A1-1.5) *The information in the call is presented as a sequence of seven-bit combinations constituting a primary code* as described in Tables A1-2 and A1-3 of Recommendation ITU-R M.493-14:2015.

The receiver decoder shall provide maximum utilisation of the received signals, including use of the error-check character.

(493/A1-1.3)) On VHF: frequency-shift of ±400 Hz; the subcarrier shall be at 1 700 Hz; the frequency tolerance of the 1 300 Hz and 2 100 Hz tones shall be ±10 Hz; and the modulation rate shall be 1 200 Bd (bit/s) ± 0,036 Bd (bit/s).

The frequency error of the encoder part of the EUT is the difference between the measured frequency and its nominal value.

See C.4.1.7 and Annex G.

5.1.1.2 Methods of test and required results

See J.4.2 and K.3.5.

See C.4.1.7 and Annex G.

5.1.2 Calling sensitivity

See I.4.1 and K.5.1.

5.1.3 Nominal modulation rate

5.1.3.1 Requirements

The nominal modulation rate is the number of bits per second, for example 100 bit/s for MF/HF and 1 200 bit/s for VHF.

5.1.3.2 Methods of test and required results

See I.4.1 and K.5.1.

5.1.4 Residual modulation

5.1.4.1 Requirements

The residual modulation is the ratio in dB of the noise power to the audio-frequency output power produced by a continuous dot pattern.

The residual modulation is the ratio in dB of the audio-frequency power produced after demodulation of the RF signal in the absence of wanted modulation to the audio-frequency output power produced by the transmission of a continuous dot pattern.

5.1.4.2 Methods of test and required results

See J.4.6 and K.3.5.

5.2 Technical format of a call sequence

5.2.1 Requirements

(493/A1-2.1) *The technical format of the call sequence is*:

Dot pattern	Phasing sequence	Call content	Closing sequence

Full details are given in Recommendation ITU-R M.493-14:2015, Clauses 2 to 11.

The receiver shall not require a dot pattern preceding the phasing sequence for correct bit phasing and unambiguous determination of the positions of the characters within a call sequence.

The self-identification shall be inserted automatically in the call.

The appropriate end-of-sequence code 117 (RQ), 122 (BQ), or 127 shall be inserted automatically.

The error-check character shall be inserted automatically.

5.2.2 Method of test and required results

Confirm by observation that the technical format of call sequence follows the specified format including correct determination of characters within a call sequence, self-identification, end-of-sequence code and error-check character.

5.3 Expansion sequence

5.3.1 Requirements

DSC equipment may also be capable of transmitting optional messages of more precise geographic coordinates, the navigation equipment used to derive the position, the datum used for its calculation and the resolution fix, ship's speed, course or alternative ship's identification. It shall then be designed in accordance with characteristics given in Annex 1 of Recommendation ITU-R M.821:1997.

(821/A1-1.2) *The expansion sequence directly follows the end of call sequence and error-check character of a defined DSC call.*

(493/A1-11.4) *Following a distress alert a DSC expansion message giving enhanced position resolution according to Recommendation ITU-R M.821* shall *be transmitted.*

5.3.2 Methods of test and required results

Confirm that the EUT will properly decode a distress message which contains the expansion sequence 100.

Confirm that the EUT will properly decode a distress message which contains expansion 100 and one or more of the additional expansion sequences.

Confirm that the EUT will properly handle a distress message which does not contain any expansion sequence.

Confirm that the EUT for distress calls will only add the expansion sequence 100.

See C.7.2.1.2.

5.4 Equipment for the automatic/semi-automatic service

5.4.1 Requirements

Requirements of 5.4.1 apply, if the EUT supports the optional automatic/semi-automatic service.

(689/A2-1.1)(1082 A2, 1.1) *The DSC equipment* shall *meet the technical characteristics of this document.*

(689/A2-1.2)(1082 A2, 1.2) *The transceiver* shall *be capable of automatic channel selection and carrier transmission under the control of the DSC equipment.*

5.4.2 Methods of test and required results

Confirm by observation that the EUT provides all necessary formats for automatic/semi-automatic DSC signalling.

Confirm by observation that the EUT provides automatic channel selection and carrier transmission.

Annex A
(informative)

Digital interface sentence to parameter group number equivalence

Table A.1 gives digital interface network IEC 61162-3 parameter group numbers (PGN) equivalent to network IEC 61162-1 sentences.

Table A 1 – Conversion from IEC 61162-1 to IEC 61162-3

IEC 61162-1 sentence	IEC 61162-3 PGN with description
GNSS/INS	
GGA	129025 Position, rapid update 129029 GNSS position update
GLL	129025 Position, rapid update 129029 GNSS position update
GNS	129025 Position, rapid update 129029 GNSS position update
RMC	129025 Position, rapid update 129026 COG & SOG, rapid update 129029 GNSS position update
NSR	n/a
DSC	
AUC	n/a
AUQ	n/a
AUS	n/a
CUL	n/a
DSC and DSE	129808 DSC call information
ECI	n/a
EPV	n/a
FSS	n/a
NAK	n/a
OCC	n/a
SFI	n/a
BNWAS	
EVE	n/a
BAM/INS	
ALC	127001 Alert list
ALF	126983 Alert PGN
ARC	126208 Acknowledge group function
ACN	126984 Alert response 127002 Responsibility transfer PGN
HBT	n/a

Annex B
(informative)

DSC remote control communication

B.1 General

Annex B concerns the support of remote control of multiple automated procedures as defined in Annex C and Recommendation ITU-R M.493-14:2015, Annexes 3 and 4.

It allows for the integration between radio and navigation equipment in the way that multiple automated procedures including subsequent communication can be handled on, for example, an ECDIS using compliant DSC radios.

NOTE DSC and DSE sentences from IEC 61162-1 only consider single received and transmitted DSC calls.

For symbol error rate test purposes only, DSC and DSE sentences shall be sufficient. For test purposes, the transmitter/receiver(s) shall be controlled by FSS and SFI sentences and simple call messages are signalled for transmit and receive on the applicable IEC 61162 interface. A valid symbol from IEC 61162-1 such as ? (HEX 3F) or _ (HEX 5F) is used to display symbols received in error.

B.2 Use of AUC

If the equipment cannot process an AUC command request, the equipment shall generate a NAK sentence response providing an appropriate "reason code".

In the case of the reason for generating the NAK is a result of a procedural or operational warning that can be resolved by a simple command (OK or CANCEL), the procedure may require the action to resolve this either by HMI entry or by using the AUC sentence (operative command).

The manufacturer shall specify how to identify those NAK sentences from other sentences, and the options shall be described in the NAK sentence.

Any subsequent communication within a procedure, if allowed, shall be controlled by using the FSS command.

B.3 Use of AUQ

The purpose of this sentence is solely the query for extra information in automated procedures.

It shall in no way change the status of any automated procedure.

B.4 Use of AUS

The AUS shall be broadcast to all upon any creation, state change or update of an automated procedure in the equipment, including a state changing command from an addressed device.

Furthermore, the AUS sentence shall be transmitted in reply to a query.

Self-terminating procedures shall be reported with all available states, but shall not require any control actions.

B.5 Use of CUL

The CUL sentence is periodically transmitted by the DSC equipment (at least each 30 s). The CUL sentence is used by the receiving device to assure no AUS sentence have been lost. The CUL provides condensed AUS information of the current active procedures. If no procedures are active in the product, the sentence is transmitted with the number of active procedures set to 0.

B.6 Use of OCC

The OCC is a supplementary sentence to resolve if multiple remote controllers exist in the system. The priority mechanism between multiple controllers may reside in the DSC equipment. The OCC sentence is used to provide equipment occupation status to remote controllers.

The OCC sentence shall be transmitted on a query.

Requesting control is done with the AUC sentence. If NAK is returned, the control is not gained.

B.7 Use of EPV

The EPV sentence for command or report equipment property value is defined in IEC 61162-1. Table B.1 lists all mandatory properties that are required to be available in the EUT and their property identifiers. Furthermore, the SFI sentence may be used to program frequencies for the (MF/HF) watchkeeping receiver.

Table B.1 – Property identifiers

Property identifier	Property meaning	Value range
0-300	Reserved	
301	Unique identifier [a]	How this value is defined initially is defined by the manufacturer. (e.g. IEC 61162 talker or serial number). Up to 10 characters
302	MMSI	0000000000 2000000000 to 7999999990 9820000000 to 9879999990
303	Manual position	10 digits in accordance with ITU-R.M.493
304	Manual UTC of position	4 digits in accordance with ITU-R.M.493
305	Send medical transport DSC messages	0: Disabled 1: Enabled
306	Send neutral crafts DSC messages	0: Disabled 1: Enabled
307	Automatic acknowledgement of polling DSC messages	0: Disabled 1: Enabled
308	Automatic acknowledgement of test DSC messages	0: Disabled 1: Enabled
309	Automatic acknowledgement of position request DSC messages	0: Disabled 1: Enabled

Property identifier	Property meaning	Value range
310	Automatic acknowledgement of individually addressed non-distress DSC messages	0: Disabled 1: Enabled
311	Maximum distance (nautical miles) for sounding a two-tone alarm that does not self-terminate upon initiation of a received distress automated procedure [b]	500 to 12500
312	Automatic channel or frequency change	0: Disabled 1: Enabled
313	No activity time-out (seconds) for any non-automated procedure activity	0: Never time-out Maximum value is decided by manufacturer
314	No activity time-out (seconds) for non-distress DSC automated procedure	0: Never time-out Maximum value is decided by manufacturer
315	No activity time-out (seconds) for received distress DSC automated procedure	0: Never time-out Maximum value is decided by manufacturer
316	No activity time-out (seconds) for communication automated procedure	10 to 600
317	Maximum amount of simultaneous automated procedures [c]	7 to 99
350-399 [d]	Manufacturer specific properties	
All other values	Reserved	

[a] It should always be possible to request the unique identifier, even when null is passed as unique identifier in the EPV sentence.

[b] Applies only to MF/HF equipment.

[c] Applies only to equipment that supports more than the required minimum of seven.

[d] Manufacturer defined properties shall be documented in the manufacturer's description.

B.8 Methods of testing and required results

B.8.1 General

Testing of the automated procedure remote interface shall be done along with the applicable clauses in Annex C where the automatic procedures are validated (see guidance in C.3.2).

The tests outlined in Annex B reflect chosen scenarios where values for MMSI numbers, frequencies, procedure instance numbers, etc. are inserted. These values may differ because of the actual test scenarios chosen by the test personnel. The important things to validate are the sequence of sentences and that the information and states coincides with the information and states shown on the display.

B.8.2 Standby information test

To validate the setup, options can be read out and modified from the remote interface.

Query for the options by applying:

```
$IICTQ,EPV*hh // for a MF/HF radio

$IICVQ,EPV*hh // for a VHF radio
```

Validate all available options are reported on the remote interface as the following:

```
$CVEPV,R,CV,123,301,1234567890*hh // VHF talker with unique id ‘123’

$CVEPV,R,CV,123,302,2193800070*hh

$CVEPV,R,CV,123,303,9999999999*hh

$CVEPV,R,CV,123,304,8888*hh

...
```

Continue validation of all options according to Table B.1.

Change one or more options from Table B.1 using the EPV sentence:

```
$IIEPV,C,CT,456,311,1000*hh // Command to MF/HF with unique id ‘456’
```

Validate the response on the remote interface:

```
$CTEPV,R,CT,456,311,1000*hh
```

Attempt to make an illegal change to one of the options from Table B.1:

```
$IIEPV,C,CT,456,307,4*hh // Command to MF/HF with unique id ‘456’
```

Validate the negative response on the remote interface:

```
$CTNAK,II,EPV,456,11,FIELD 307: OUT OF RANGE*hh // (Example text)
```

B.8.3 Creating sending distress automated procedure test

To initiate a designated distress, the information shall be passed in an ECI sentence following the AUC sentence. This sequence shows what is needed to initiate an undesignated distress on MF/HF and then cancel the alert via DSC and finally voice cancel on all relevant bands.

To initiate an undesignated distress on MF/HF, issue the following command (EUT watch receiver configured 2 MHz, 4 MHz and 8 MHz in this sequence):

```
$IIAUC,D,,,,TTOTOO,*24  // transmit on 2,4 and 8 MHz bands
```

Validate that the following sequence of commands is reflected on the remote interface (values may differ according to test setup):

```
$CTAUS,O,0,18,12,A,T,,,TOOOOO,359,000000,A,0,E*20 // Transmitting on 2MHz
$CTECI,12,1234567890,12,07,09,1571200941,1309,1234567890,,S,E,0*77
$CTDSE,1,1,A,1234567890,00,79311983*0A
...
$CTAUS,O,0,19,12,A,T,,,UTOOOO,349,000010,A,0,*7E // Transmitting on 4MHz
...
$CTAUS,O,0,20,12,A,T,,,UUOTOO,338,000021,A,0,*6A // Transmitting on 8MHz
...
$CTAUS,O,0,21,12,A,T,,,UUOUOO,328,000031,A,0,*6A // Waiting for ackn.
$CTFSS,0829100,0829100,m,0,,0R*6E
...
$CTCUL,1,1,27,1,O,0,21*29
```

Attempt to cancel the distress on all relevant bands:

```
$IIAUC,O,,C,,,TTOTOO,*16  // Cancel on 2,4 and 8 MHz bands
```

Validate that the following sequence of commands is reflected on the remote interface:

```
$CTAUS,O,0,22,12,A,T,,,TUOUOO,,OOOOOO,A,0,E*16 // Cancelling on 2MHz
$CTECI,16,1234567890,12,07,09,1571200941,1309,1234567890,109,S,E,0*4B
$CTDSE,1,1,A,1234567890,00,79311983*0A
...
$CTAUS,O,0,23,12,A,T,,,CTOUOO,,OOOO10,A,0,*45 // Cancelling on 4MHz
...
$CTAUS,O,0,24,12,A,T,,,CCOTOO,,OOOO21,A,0,*56 // Cancelling on 8MHz
...
$CTAUS,O,0,25,12,A,V,,,CCOCOO,,OOOO31,A,0,*43 // Cancelled - wait for
                                        // voice cancel
$CTFSS,0218200,0218200,m,0,R,0*6E  // Tuned for voice cancel on 2MHz
...
```

Indicate voice cancel has been done on 2 MHz and continue to next band:

```
$IIAUC,O,,V,,,,*1D  // Go to voice cancel on next band
```

Validate the response:

```
$CTAUS,O,0,26,12,A,V,,,VCOCOO,,OOO112,A,0,*55 // 2MHz voice cancelled,
                             // 4+8 waiting for voice
                                                // cancel
$CTFSS,041250,041250,m,0,R*68 // Tuned for voice cancel on 4MHz
...
etc.
```

Continue until all used bands are cancelled.

B.8.4 Receiving distress automated procedure test

B.2.4 illustrates the process of receiving a distress call on VHF equipment, leading to the initiation of a received distress procedure and the resulting output in the remote interface. Then a relay is sent to a coast station and finally the history of received calls is queried. For MF/HF, a similar sequence shall be tailored.

The receiving distress automated procedure is initiated when the EUT is receiving a distress alert from the TE (i.e.):

Distress MMSI: 1234567890

Nature of distress is sinking

Distress Position: 57°12.7931'N 9°41.1983'E

Time of Position: 13:09

Validate that a distress call is received and that the receiving distress automated procedure is started:

```
$CVAUS,D,2,27,12,A,U,,,U,,OOOOOO,A,0,E*57 // Received distress (sinking)
$CVECI,12,1234567890,12,05,00,1571200941,1309,1234567890,,S,E,2*7C
$CVDSE,1,1,A,1234567890,00,79311983*08
```

Alternative 1:

The operator can chose to mute the sound and decide not to participate in the distress communication:

```
$IIAUC,2,,M,,,,*04   // Mute sound (status handled in ALF sentence)
$IIAUC,2,Q,,,,,*18   // Quit procedure
```

If the EUT is designed to warn the operator before quitting a procedure which has not achieved its purpose, validate

```
$CVNAK,II,AUC,1234567890,49,QUIT INCOMPLETE? (Y/N)*37 // (Example text)
$IIAUC,2,,Y,,,,*10   // Confirm quit
```

Now observe the procedure terminates:

```
$CVAUS,D,2,27,13,Q,U,,,U,,000015,A,0,*07
```

Alternative 2:

Alternatively the operator can accept the call to participate in communication:

```
$IIAUC,2,,A,,,,*08   // Accept call
```

Validate that the communication link has been established and the main receiver is tuned to channel 16:

```
$CVAUS,D,2,27,13,A,X,,,U,,000020,A,0,E*59
$CVFSS,9000016,,d,0,R,2*59    // Tuned for voice on channel 16
```

Relay the call to a coast station (MMSI 0012345670) via remote interface:

```
$IIAUC,2,,F,,,,E*4A  // Initiate a distress relay
$IIECI,20,0012345670,12,05,00,1571200941,1309,1234567890,,R,E,2*68
$IIDSE,1,1,A,0012345670,00,79311983*1C
```

Validate the response. The EUT has now initiated a new automated procedure for the relay call:

```
$CVAUS,D,3,28,12,A,U,,,U,,000000,A,0,E*59 // Relay creates new procedure
$CVECI,20,0012345670,12,05,00,1571200941,1309,1234567890,,R,E,3*7C
$CVDSE,1,1,A,0012345670,00,79311983*08
```

Request the active procedures:

```
$IIAUQ,,Q*14  // Request status of all active procedures
```

Validate the response (two active procedures):

```
$CVAUS,D,2,29,12,H,U,,,U,,001902,R,0,*0C // Received distress (on hold)
$CVAUS,D,3,30,12,A,U,,,U,,000038,R,0,*0D  // Relay (active waiting for
ackn)
```

Request the received calls pertinent to the received distress automated procedure initiated:

```
$IIAUQ,,H*0D  // Request history of DSC calls for procedure
```

Validate the response (in this example, at least five distress calls have been received for the procedure):

```
$CVECI,12,1234567890,12,05,00,1571200941,1328,1234567890,,S,E,2*7F
$CVDSE,1,1,A,1234567890,00,79291979*04 // last received call
...
$CVECI,12,1234567890,12,05,00,1571200941,1313,1234567890,,S,E,2*77
$CVDSE,1,1,A,1234567890,00,79371989*04 // 2nd repeat of call

$CVECI,12,1234567890,12,05,00,1571200941,1309,1234567890,,S,E,2*7C
$CVDSE,1,1,A,1234567890,100,79311983*39 // Initial call
```

Finally the operator can chose to acknowledge the distress and take over the commander role:

```
$IIAUC,2,A,,,,*08   // Activate distress procedure
```

Observe receiver is tuned to channel 16:

```
$CVAUS,D,2,27,14,A,X,,,U,,000000,A,0,E*5C
$CVFSS,9000016,,d,0,R,2*59    // Tuned for voice on channel 16
```

Acknowledge distress procedure:

```
$IIAUC,2,,K,,,,*02   // Acknowledge the distress (no expansion needed)
```

If the EUT is designed to warn the operator before permitting to take over a distress event, validate

```
$CVNAK,II,AUC,1234567890,49,PERMITTED BY COAST? (Y/N)*13 // (Example text)
$IIAUC,2,,Y,,,,*10   // Confirm quit
```

Now observe the procedure state changes:

```
$CVAUS,D,2,27,13,A,X,,,A,,002015,A,0,*0C
```

B.8.5 Create sending non-distress automated procedure test

This scenario shows the sequence of initiating an individual safety call to a ship station. For VHF, similar scenarios shall be tailored:

The remote operator initiates a safety call on HF in the 6 MHz band to another ship:

```
$IIAUC,,C,,063120,,,E*7B  // transmit on 6 MHz distress frequency

$IIECI,20,1234567890,08,09,26,062150062150,,,,R,,*18
```

Validate the procedure status:

```
$CTAUS,S,5,1,08,H,U,063120,,,,000000,A,0,E*20 // Transmitted on hold

$CTECI,20,1234567890,08,09,26,062150062150,,,,R,,5*39   // DSC call
```

The called ship acknowledges the call. Validate this:

```
$CTAUS,S,5,2,08,H,A,063120,,,,000023,A,0,E*36 // Acknowledged
```

```
$CTECI,20,1234567890,08,09,26,062150062150,,,,B,,5*29   // DSC ack
```

Accept communication:

```
$IIAUC,5,,A,,,,*0F  // Accept call
```

Validate the communication link is established:

```
$CTAUS,S,5,2,08,A,X,063120,,,,000023,A,0,*63 // Link for comm.

$CTFSS,0621500,,m,0,R,5*5B  // Tuned for voice comm on 6215 kHz
```

B.8.6 Receive non-distress automated procedure tests

The sequence shown is for the reception of a group call on VHF. For MF/HF, similar scenarios shall be tailored.

A group call is received from TE which requires voice announcement on VHF channel 10:

```
$CVAUS,R,2,17,00,H,U,,,,,000000,A,0,E*1D    // Received non-distress
                                             // on hold

$CVECI,14,1234567890,00,00,26,900010,,,,S,,2*33   // Request announc.
                                                  // on ch. 10
```

The remote operator accepts the communication:

```
$IIAUC,2,,A,,,,*08  // Accept call
```

Validate the following indication that link is established on the channel:

```
$CVAUS,R,2,18,00,A,X,,,,,000023,A,0,*52 // Link for comm.

$CVFSS,9000010,,d,0,R,2*5F  // Tuned for voice comm on channel 10
```

Next, the sequence is shown for the reception of a position request following the automatic acknowledgement of the request.

Make sure the automatic position acknowledgement is enabled:

```
$IIEPV,C,CV,123,309,1*02  // Enable position auto-acknowledgement

$CVEPV,R,CV,123,309,1*02  // EUT reply
```

Make the EUT receive a position request from TE. Observe:

```
$CVAUS,R,3,1,08,H,U,,,,,000000,A,0,E*23 // Start received procedure

$CTECI,20,1234567890,08,21,26,9999999999,8888,,,R,,3*35 // DSC RQ
```

Observe the following on the remote interface, and that the position acknowledgement is received on the TE:

```
$CVAUS,R,3,2,08,R,A,,,,,000001,A,0,E*2F // Auto-acknowledge procedure

$CVECI,20,1234567890,08,21,26,1571200941,1309,,,B,E,3*65
```

```
$CVDSE,1,1,A,1234567890,00,79311983*08
```

Wait at least 30 s and observe that procedure is not listed anymore in CUL sentence.

B.8.7 Communication automated procedure test

This scenario initially is in standby. For MF/HF, similar scenarios shall be tailored.

The remote operator has just acknowledged an individual call with subsequent communication on channel 12. The state is exemplified as follows:

```
$CVAUS,R,2,60,00,A,A,,,,,000000,A,0,E*00     // Received non-
                                              // distress active
$CVECI,20,1234567890,00,00,26,900012,,,,B,,2*27    // Ackn. comm.
                                                   // on ch. 12
$CVFSS,9000012,,d,0,R,2*5D  // Stand-by on channel 12
$CVCUL,1,1,28,2,C,1,47,R,2,60*60
```

The subsequent communication is now on channel 12. The parties now agree to select channel 10 for communication:

```
$IIFSS,9000010,,d,0,C,*69  // Select channel 10
```

Validate the change is reflected on the remote interface:

```
$CVAUS,C,3,1,,A,,,,,,000000,A,0,*23 // Communication procedure created
$CVFSS,9000010,,d,0,R,3*5E     // Stand-by on channel 10Transmission on
                               // the channel is done on the active
                               // procedure:
$IIFSS,9000006,,d,9,R,3*45  // Transmit on channel 10
```

The remote operator choses to put the communication automated procedure on hold:

```
$IIFSS,9000010,,d,0,R,3*5E  // Stand-by on channel 10
$IIAUC,3,H,,,,,*00
```

Transmission on the channel is now not allowed:

```
$IIFSS,9000006,,d,9,R,3*45  // Attempt transmit on channel 10
```

Transmission on the channel is now not allowed:

```
$CVNAK,II,FSS,123,11,TX NOT ALLOWED*0A // (Example text)
```

B.8.8 Multiple automated procedures test

This scenario initially has an active ongoing non-DSC communications automated procedure with communication on VHF channel 6. For MF/HF, similar scenario shall be tailored.

Validate the state:

```
$CVCUL,1,1,27,1,C,1,47*26
$CVFSS,9000006,,d,9,R,2*52  // Voice transmitted on channel 6
```

An individual call is received from TE which requires subsequent communication on VHF. Validate:

```
$CVAUS,R,2,59,00,H,U,,,,,000000,A,0,E*17 // Received non-distress on hold
$CVECI,20,1234567890,00,00,26,900010,,,,R,,2*35 // Request comm. on ch. 10
```

The remote operator decides to acknowledge the call, but proposes another channel for communication. Apply the sentences:

```
$IIAUC,2,,A,,,,E*4D  // Acknowledge with new channel proposed
$IIECI,20,1234567890,00,00,26,900012,,,,B,,2*32 // Ackn. comm. on ch. 12
```

Validate the response:

```
$CVAUS,R,2,60,00,A,A,,,,,000000,A,0,E*00 // Received non-distress active
$CVECI,20,1234567890,00,00,26,900012,,,,B,,2*27 // Ackn. comm. on ch. 12
$CVFSS,9000012,,d,0,R,2*5D  // Stand-by on channel 12
$CVCUL,1,1,28,2,C,1,47,R,2,60*60
```

The remote operator decides to activate the original non-DSC automated procedure:

```
$IIAUC,1,A,,,,,*0B
```

The equipment may respond:

```
$CVAUS,R,2,61,00,H,A,,,,,000345,A,0,*4F // Procedure 2 on Hold
$CVAUS,C,1,62,,A,X,,,,,,A,0,*4C         // Procedure 1 active
$CVFSS,9000006,,d,0,R,1*5B       // Channel defined by procedure
```

Finally the remote operator choses to terminate the received non-distress automated procedure:

```
$IIAUC,2,Q,,,,,*18
```

The equipment may respond:

```
$CVAUS,R,2,63,00,Q,A,,,,,000355,A,0,*55 // Procedure 2 has terminated
...
$CVCUL,1,1,32,1,C,1,62*25              // Single procedure left
```

Annex C
(normative)

Interface and automation requirements, methods of testing and required test results

C.1 General

Annex C covers the minimum level of software automation, operational simplicity, and interface consistency requirements for shipborne fixed installations for digital selective calling equipment as specified in Recommendation ITU-R M.493-14:2015, Annex 1, Annex 3, and Annex 4.

Annex C describes the internal operation of the equipment. The manufacturer shall be aware that simple language or graphics shall be used in the user interface. This language shall be readily understood by the mariner required to carry this class of equipment. For instance, the interface shall use terms such as "OK" or "Cancel" instead of "terminate procedure", and "all ships" instead of "format 116", and "radio telephone" instead of "telecommand J3E", and use labels such as "Calling station 567555454" instead of "Sending non-distress automated procedure".

Perhaps the most important issue concerns an implied expectation for the use of the term "automated procedure" as used in this document to appear in the user interface. The term "automated procedure" describes the set of algorithms that are used to encapsulate all the activities necessary to perform multitasking, DSC, and non DSC communication events. The operator does not need to know anything about the existence of automated procedures in order to operate a radio that makes use of these algorithms. Though this document refers to items such as the "sending distress automated procedure", such language shall not appear on the user interface of the equipment.

C.2 Naming convention of DSC message types

A naming convention is used that is based upon how the messages are handled in software or by the automated procedures. This approach organizes the DSC messages into two major sets; DSC messages that contain the distress information (distress DSC messages), and those that do not (non-distress DSC messages).

Within the non-distress DSC messages, the operator generally has the option to specify the addressing mode or destination (format), the priority (category), the type of subsequent communication or activity (telecommand), and the frequency or channel (frequency message) parameters. Certain DSC messages require a fixed set of these parameter combinations, and these DSC messages have been given the names test, position request, group, individual routine, medical transports, and neutral craft. The remaining DSC messages are denoted as "general" when necessary.

C.3 Test setup

C.3.1 General

If the EUT is not an integrated radio and controller, the controller shall be provided with a compatible watch receiver, general receiver and transmitter whose transmitter output shall be fed into an artificial antenna.

The TE shall consist of a controller and certified RF equipment that may be integrated or separate but as a unit shall be capable of functioning as an operational DSC station supporting automated procedures. It is assumed that the RF equipment, for example the

transmitter, general and watch receiver, all have the necessary stability, sensitivity, and accuracy that they would satisfy all the requirements for marine RF equipment as defined in associated IEC standards except for the marine environmental conditions. Thus it is assumed that, when the TE is to transmit a DSC message, all the RF properties of the transmitted signal are appropriate for marine VHF or MF/HF (as the case may be) DSC equipment. The purpose of this TE equipment is to test the DSC functionality, support functionality, and the man-machine interface of the EUT.

The output of the TE transmitter is fed into an artificial antenna but also provides enough signal strength to the EUT receiver equipment to simulate those signals experienced in operational practice. The exact level is not critical. The only exception to this situation is for the prioritised wait test. In this case, the test facility will need to assure the signal strength reaching the EUT RF receiver equipment is at the required receiver sensitivity level (0 dBµV) as specified in this document.

The TE shall be compliant with the automated procedures with the addition that the sending distress procedure shall be able to be terminated without invoking the distress cancel.

The TE shall be able to operate automated procedures for received DSC messages addressed to other stations as if it were the other station (so-called "shooping").

The TE shall be able to compose DSC messages with arbitrary values in the 7-bit information symbols and/or three bit zero count for the purposes of error testing.

The TE shall be able to compose DSC messages compatible with previous versions of Recommendation ITU-R M.493.

The TE shall be able to display the numerical values of the symbols in both the DX and RX positions of the received DSC messages.

The MMSI of the TE shall be able to be changed while the TE is engaged in handling an automated procedure such that all subsequently transmitted DSC messages use the newly defined MMSI as the self-ID in order to play the role of multiple stations.

The TE shall have operator programmable channels (scan rate, pause, TX and RX frequencies, waveform) for both the watch receiver, general receiver and transmitter.

The TE shall be able to transmit the following test signals: a continuous dot pattern, and a continuous repetition of a DSC message.

The TE shall be able to provide the time in milliseconds between the stopping of a test DSC signal sent from the TE on a given DSC channel and the sending of a DSC signal sent by the EUT on that same channel for the testing of the prioritized wait. The TE shall also be able to insert periods of silence into an otherwise continuous DSC signal. The durations of this period of silence need to range from 0 ms to 10 000 ms in at least 10 ms steps.

At all times the TE shall monitor received DSC messages from the EUT. Inconsistencies of DSC messages initiated by the EUT with that of Table A1-4 of Recommendation ITU-R M.493-14:2015 shall be reported. Inconsistencies of all other DSC messages with the anticipated formats shall be reported.

The TE shall be capable of reading and stimulating the BAM alert signalling interface as described in 4.7.

The TE shall be capable of reading and stimulating the remote automated procedure interface as described in Annex B and Annex N.

C.3.2 Test methods

Each test in this Annex begins with a set of instructions for placing the EUT and TE in the desired states. These instructions may consist of configuring the equipment as well as performing operations on the equipment. The personnel shall then be asked to verify that a list of conditions is true. Passing the test requires that all the conditions specified in the list can be verified.

Most of the instructions and verifications that are asked of the test personnel involve actions that the intended operator will need to perform in real life. The actions that fall into this category are denoted by a raised circle (•). Thus, it is expected that these actions should be relatively easy to carry out. Given that the purpose of this test standard is to assure a reasonably consistent and operator friendly environment, difficulties or frustrations with the EUT in performing items marked by the raised circles shall be noted.

In some special frequently recurring cases, "verification" shall require extra actions that shall be taken by the test personnel each time the case appears. These cases, and their additional instructions, are listed below:

a) wherever the "display of a warning" is to be verified, the test personnel shall check for the proper warning and check to see that they can go back to the stage of the procedure where the action was taken that caused the warning;

b) when the "verification" is to make certain that an operator option is not available, either there is no visible means to perform the option, or, if there is a visible menu item, button, etc., the test personnel will be unable to perform the option when attempting to select it;

c) when it is required that an alarm can "only be silenced manually", it is sufficient to see that the alarm does not stop after a period of two minutes;

d) when an alert or warning shall lead to a BAM alert (warning or caution) as specified in Table 8, the appearance of the ALF sentence shall be validated and checked with the requirements as defined in 4.8;

e) when an automated procedure is created or changes state, it shall be verified the correct status of the procedure is reported via the AUS sentence along with the appropriate ECI, DSE and FSS sentences as exemplified in Clause B.8;

f) when operator options are available and tested, the selection of at least one of these options shall be performed via the AUC sentence (see Clause N.2), and validate the selection is be reflected on both display and via the AUS sentence in parallel.

C.4 Non automated features

NOTE Clause C4 describes the features of the equipment that are necessary to assure compliance to the ITU-R DSC functionality standards and support a smoother operation of the automation algorithms, but are not directly related to the automation algorithms.

C.4.1 Non automated features requirements

C.4.1.1 Own-MMSI

The EUT shall have facilities for entering and storing its own 9-digit MMSI with the 10th digit set automatically to 0 in its use in any DSC message unless the equipment is designed to use the 10th digit in accordance with Recommendation ITU-R M.1080; the factory default for this value shall be some indicator to the equipment that it is invalid.

Once an own-MMSI is entered, this number shall not be able to be edited by unauthorized personnel; the entry may be protected by a password combination, but if so, the password combination shall not be available in any of the printed documents.

No DSC message shall be able to be sent or received without the proper entry of a valid own-MMSI since all DSC messages contain this number.

If there is no valid own-MMSI entered, on power up the EUT shall sound a warning alarm and display the reason for the alarm and the means to silence it. The aural alarm may self-terminate. Until an MMSI is entered, the EUT shall display at all times that "there is no MMSI entered, DSC is disabled, your distress button will not work" or equivalent.

The own-MMSI shall be displayed on screen or via some other electronically controlled device and shall be visible at top level while in standby.

C.4.1.2 UTC time

The EUT shall display the current UTC time and it shall be visible at top level while in standby.

C.4.1.3 Own position

To enable updating of position:

a) the EUT shall have facilities for manually entering the ship's position;

b) a warning shall occur when no position data is received within 1 min at start-up of the EUT;

c) if position data is being updated automatically, an alert shall sound if no updating is received after a period of 10 min that can only be silenced manually or by the reception of new position data – the displayed reminder or error message that says the automatic position data is "offline" shall remain until the position data is updated;

d) if the ship's position information is older than 4 h, an alert shall sound that can only be silenced manually or by the reception of position data or entry of new position information, a displayed reminder shall remain until the position information is updated;

e) if the ship's position information is older than 23,5 h, the position information values shall be erased, an alert shall sound that can only be silenced manually or by the reception of position data or entry of new position information, a displayed reminder shall remain until the position information is updated.

The latest position information, time of that position information, and source of that position information shall be displayed on the EUT and visible at top level while in standby.

C.4.1.4 Group MMSI

Facilities shall be provided to permit the operator to program and store at least 20 group MMSIs to enable the equipment to recognize DSC messages addressed to either the ship's MMSI or the group MMSIs.

C.4.1.5 DSC message composition

The equipment shall provide factory default values for all non-distress DSC messages as specified in Recommendation ITU-R M.493-14:2015, Annex 3, and summarized in Figure D.1 for all parameters where the operator has the option to select or enter more than one value and has not already done so.

The default values for the distress relay on behalf of someone else (DROBOSE) shall be as given in Table D.1.

The default values for the operator-composed distress alert shall be the default distress alert as specified in the sent distress automated procedure.

An MMSI that does not have 9 digits or the "unknown" indicator is invalid.

The "unknown" indicator shall only be able to be used for the MMSI of the vessel in distress when composing a DROBOSE.

No DSC message shall be able to be sent that has an invalid parameter.

For simplicity of the user interface:

a) the DSC message composition interface shall be such that the operator needs no user manual to initiate the desired DSC message,

b) it shall require a maximum of two keystrokes, button pushes or actions plus the entry of a destination MMSI for the operator to send the default (routine individual) DSC message from standby,

c) parameter descriptions and terms shall be provided in plain language,

d) all parameters of the DSC message that do not require an operator choice shall be entered automatically,

e) as described in Recommendation ITU-R M.493-14:2015, Annex 3, operational guidance and/or prompting shall be provided for the entry of any necessary parameters of the DSC message if these parameters and/or their values are not plainly visible from context or on the display.

For data entry:

a) the equipment shall only allow the operator to compose and send DSC messages that are compliant with the latest version of Recommendation ITU-R M.493,

b) acknowledgements shall not be independently composed by the operator but are handled by the automated procedures,

c) the equipment shall provide the operator with the choice of specifying the geographic area parameters as either a circle of radius "r" about a centre point or the traditional latitude-longitude Mercator box and northwest corner point or about a centre point,

d) the equipment shall convert and round the radius-centre point entry according to the algorithm given in Annex E.

The equipment shall provide an automatic determination of the channel and or frequencies of subsequent communication according to the algorithm given in Recommendation ITU-R M.493-14:2015, Annex 3, and summarized in Annex F.

The automated channel selection shall be able to be overridden.

It shall not be possible to select a distress channel for subsequent communications for DSC messages of priority routine.

The equipment shall automatically set the dot pattern length to 20 bits for all DSC messages on VHF, and on MF/HF all DSC messages addressed to a coast station and all non-distress acknowledgements.

Furthermore, MF/HF equipment shall automatically set the dot pattern length to 200 bits for all transmitted DSC messages for:

- distress alerts;
- distress acknowledgements;
- distress relays addressed to a geographic area;
- distress relay acknowledgements addressed to all ships;
- all calls addressed to a ship station other than messages addressed to a coast station or all individual acknowledgements with format specifiers 120 and 123.

C.4.1.6 Transmission of DSC messages and prioritised wait

If the channel is free after the transmitter has powered up, the transmission shall begin immediately. If the channel is not free, and the DSC message is a distress alert, the alert shall be transmitted as soon as the channel becomes free or after 10 s on MF or HF or 1 s on VHF, whichever occurs first (the 10 s and 1 s values are approximate average times for HF and

VHF DSC messages, respectively.) Prioritised wait applies to each new frequency of a multi-frequency alert attempt. For all other DSC messages, the equipment shall wait for the channel to become free and then the equipment shall delay transmission of the DSC message for a specified wait time.

The specified wait time shall depend upon the message type and priority. Distress DSC messages (except for alerts), urgency, safety, routine and test DSC messages shall wait one, two, three, and four "fixed" units of time plus a random addition described below, respectively, before attempting to transmit. Transmission occurs if, and only if, the channel is still free after this wait time has elapsed, otherwise the process is repeated.

The fixed "unit" of time shall be 100 ms on MF and HF, and 50 ms on VHF. The randomly generated component shall be some positive integer with resolution in milliseconds between zero and the fixed interval. The random component serves as a tie breaker when multiple DSC messages of the same priority and type are waiting to be transmitted. The randomly generated part of the wait time shall be recomputed for every transmission attempt.

For example, on HF, the random interval would be some positive integer of milliseconds between 0 ms and 100 ms, for example, 56 ms. Thus, the wait time for a routine DSC message in this example would be 456 ms for the first attempt. If the channel was once again busy after the wait time expired, the new wait time might be 417 ms for the second attempt, etc.

C.4.1.7 Reception of DSC messages

The dedicated HF watch receiver shall be set at the factory to scan all six distress frequencies; if this setting can be changed by the operator, the 2 MHz, 8 MHz, and one other band shall be included.

For message detection and decoding:

a) the DSC message detection and decoding shall follow the flowchart given in Annex G,

b) the receiver shall not require a dot pattern preceding the phasing sequence for correct bit phasing and unambiguous determination of the positions of the characters within a DSC message sequence,

c) the decoder shall use word recognition for the purposes of word synchronization (Word synchronization is the stage at which the decoder is able to recognize that the dot pattern has completed and the 10-bit words of the message have started),

d) on MF/HF, the decoder shall stop the scanning of the dedicated watch receiver only if the length of the dot pattern preamble is greater than 20,

e) upon word synchronization, the decoder shall use the 3-bit zero count to check the 7-bit information content of all received words. The 7-bit symbol shall be considered received in error if the 3-bit zero count is incorrect,

f) the decoder shall reject the message if the format symbol cannot be received in any of its four positions error free,

g) the decoder shall reject the message if the error-free format symbol does not have a value allowed by Recommendation ITU-R M.493 unless the equipment is specifically designed to handle other values,

h) if the format symbol is either distress (112) or all ships (116), the message shall be rejected if the format symbol is not received correctly at least twice in either the DX or RX position,

i) for those words that are sent duplicated in the five-word time diversity pattern, the symbol shall be considered received in error if both of the symbols are received in error or both are received error free and are not equal,

j) the message shall be rejected if the format symbol is not distress (112) or all ships (116), and all five address symbols are not received correctly or if the address indicates that it is

not for this station (it does not contain the station MMSI or group MMSI or the station is not in the specified geographic area),

k) the equipment shall compute a local ECC if a set of received information symbols can be obtained error-free,

l) if the DSC message is a distress alert, the equipment shall follow the decoding techniques for each individual message and successively attempt to correct any information characters received in error in previous messages with the corresponding correctly received characters in the latest message,

m) the decoder shall recognize the end of sequence pattern as the termination of a standard DSC message, regardless of what follows, and shall be able to decode the standard part of the message,

n) equipment that supports the Recommendation ITU-R M.821 extensions shall be able to decode the standard part of the DSC message even when the extension is received in error,

o) if one of the four end of sequence symbols is not received error free at the end of the standard DSC message, the message shall be rejected. However, if the end of sequence character is received correctly at the end of the enhanced extension, the equipment shall not be prevented from using the latter end of sequence symbol to identify and accept the standard (and thus entire) message.

C.4.1.8 Alarms

Alarms shall have both a visual and aural component.

Any alarm that initiates for the purpose of getting the operator's attention shall provide the reason for and means to terminate the alarm.

Alarms shall be initiated for the reasons given in Table H.1.

The means to terminate the alarms are given in Table H.1.

The "two-tone" and "urgency-sound" alarms shall not be able to be disabled.

The default aural alarms are given by Table H.2.

Some alarm tones may be customized by the operator as shown in Table H.2.

C.4.2 Non automated features tests

C.4.2.1 General

The tests and set ups marked with a raised circle (•) are actions that an operator will most likely have to perform in real life. Thus, these items are expected to be easy to perform. The test personnel are to note any difficulties or frustrations in performing these actions in the test report. The tests noted here are a sample selection of test sequences. The test house may use additional test sequences for improved coverage of the system capabilities.

C.4.2.2 Own-MMSI tests

C.4.2.2.1 Purpose

These tests check that DSC messages cannot be sent or received, and an alarm sounds on power up if there is no valid own-MMSI entered in the EUT and that the own MMSI is properly protected and displayed.

C.4.2.2.2 Method of test and required results

Power up the EUT before entering a valid own-MMSI. Verify that:

a) a warning alarm sounds upon power up,

b) the reason for (there is no own-MMSI entered and one will be unable to send a distress alert or any other DSC message until a valid own-MMSI is entered) and the means to silence the alarm are displayed,

c) subsequent to the alarm, a displayed message remains stating that "there is no MMSI entered, DSC is disabled, your distress button will not work" or equivalent,

d) one is unable to send a default distress alert attempt using the dedicated distress button•,

e) one is unable to send a non-distress DSC message•,

f) one is unable to send a DROBOSE•.

Send a default distress alert from the TE. Verify that:

g) the EUT does not respond to the DSC message (no automated procedure is started).•

Send a DROBOSE from the TE addressed to all ships or an area. Verify that:

h) the EUT does not respond to the DSC message (no automated procedure is started).•

i) the EUT does not initiate a DSC automated procedure when any AUC sentences initiating a DSC automated procedure is entered (e.g., but responds with a NAK sentence).

Follow the manufacturer's instructions to enter an own-MMSI and enter an own MMSI. Verify that:

j) the MMSI is displayed on the screen or in some other controlled electronic device,

k) the operator is unable to change the MMSI without consulting the manufacturers or authorized source,

l) after shutdown and re-power up, the MMSI is still present and properly displayed,

m) the MMSI is properly transmitted when sending• a default distress alert.

n) the EUT does initiate a DSC automated procedure when an AUC sentence initiating a DSC automated procedure is entered.

C.4.2.3 Own position tests

NOTE All remaining tests assume that a valid own MMSI entry is made in the EUT.

C.4.2.3.1 Purpose

This tests checks that the EUT provides manual and automatic means of updating the position, that the proper alarms are sounded when the position has not been appropriately updated, and that the latest position and UTC time of that position are displayed.

C.4.2.3.2 Method of test and required results

Connect an automatic position updating device to the EUT. Place the EUT in standby. Verify that:

a) the position and time of the position is displayed on the screen or some other electronic device,

b) the source of the position is displayed on the screen or some other electronic device,

c) the position and position-time properly updates when an automatic positioning device is operating,

d) there is a means to enter the position manually and override automatic position entry•,

e) it is possible to enter an "unknown" value or indicator•,

f) when the position is manually entered•, the new value, time, and source of that value is displayed,

g) a warning alarm sounds 10 min after the automatic positioning device is disabled,

h) the reason for and means to silence the alarm is displayed,

i) the alarm automatically ceases when the automatic positioning device is enabled,

j) the alarm sounds again 10 min after the automatic positioning device is disabled,

k) the alarm can only be silenced manually,

l) upon silencing• the alarm, a message remains stating the automated updating is offline or equivalent,

m) a warning alarm sounds if the position is not updated after 4 h,

n) the reason for and means to silence the alarm is displayed,

o) the alarm can only be silenced manually,

p) upon silencing• the alarm, a message remains stating the position is older than 4 h,

q) the position is not erased,

r) a warning alarm sounds if the position is still not updated after 23,5 h,

s) the reason for and means to silence the alarm is displayed,

t) the alarm can only be silenced manually,

u) the position value is erased (set to unknown or some equivalent),

v) upon silencing• the alarm, a message remains stating the position is older than 23,5 h and has been erased,

w) the UTC position-time values show that it is unknown.

Turn off the EUT and disconnect the automatic position updating device from the EUT. Then turn on the EUT. Verify that an alert sounds within 1 min from turning on the EUT.

C.4.2.4 DSC message composition

C.4.2.4.1 Default specifications for non-distress DSC message tests

C.4.2.4.1.1 General

The default non-distress DSC message is format individual, priority routine, and subsequent communications radio telephone. However, the initialisation to this default assumes that the manufacturer has only provided the minimum number of top level menu items or buttons or equivalent in the interface. It is permitted for the manufacturer to provide further entry options at top level further reducing the operator selections at the next level. Such enhancements shall be taken into account when assessing subsequent levels.

C.4.2.4.1.2 Purpose

This test checks that the proper default values are entered into the non-distress DSC message parameters and that the priority (category) value is reset to the default value each time the composition option is selected.

C.4.2.4.1.3 Method of test and required results

Power up the EUT and select the option to send a non-distress DSC message•. If there are several selection options at top level, choose the "individual" addressing (if present), "routine" priority (if present) and "voice/phone" subsequent communications (if present). However, the manufacturer may have designed the interface such that it takes but one action by the operator to select the default individually addressed DSC message of routine priority to establish voice communications. Have the TE in standby. Verify that:

a) it takes only a single action• to initiate the composition of this DSC message,

b) it takes only a single action• to return to standby,

c) all the parameters of the DSC message are visible or able• to be viewed before sending,

d) the parameters of the DSC message the operator may select are described in plain language,

e) there is some indicator that the MMSI is invalid,

f) it takes only one additional action to start the sending of this DSC message,

g) an error is displayed stating that an MMSI needs to be entered when trying to send• the DSC message.

Enter the MMSI of the TE and send the DSC message from the EUT•. Verify that:

h) the DSC message is received on the TE,

i) the priority of the DSC message on the TE is "routine",

j) the subsequent communication on the TE is "telephone",

k) on MF/HF, the DSC message is received on 2 MHz on the TE,

l) on MF/HF, the working frequencies are in the 2 MHz band on the TE,

m) on VHF, the working channel is any channel but 16 on the TE.

Without restarting the EUT, select the option to send a non-distress DSC message•, set the priority to urgency•, return to standby•, and reselect the composition option•. Verify that the priority has been reset to "routine".

Select the option to send an individual call of routine priority, enter a group MMSI which starts with "0" followed by the three digits of a MID. Verify that the composing message has been changed to a group call which has the format specifier 114 automatically.

C.4.2.4.2 Defaults for the DROBOSE tests

C.4.2.4.2.1 Purpose

This test checks that the proper default values are entered into the fields for the DROBOSE and that the appropriate default values are reset each time the composition option is selected.

C.4.2.4.2.2 Method of test and required results

Power up the EUT and select the option to send a DROBOSE•. Have the TE in standby. Verify that:

a) it takes only a single action to initiate the composition of this DSC message•,

b) It takes only a single action to return to standby•,

c) all the parameters of the DSC message are visible or able• to be viewed before sending,

d) the parameters of the DSC message are described in plain language,

e) there is some indicator that the MMSI of the destination station is invalid if a pre-entered coast station MMSI is not pre-configured,

f) it takes only one additional action to start the sending of this DSC message,

g) an error is displayed stating that an MMSI needs to be entered when trying to send the DSC message• if a pre-configured Coast station MMSI is not already present.

Enter the MMSI of the TE (configured as a ship station) and send the DROBOSE from the EUT•. Verify that:

h) a warning is displayed stating one should direct this DSC message to a Coast station (send anyways),

i) the DROBOSE is received on the TE (but do not acknowledge),

j) the MMSI of the vessel in distress is "unknown",

k) the nature of distress is "undesignated",

l) the position of the vessel in distress is "unknown",

m) the UTC time of the position of the vessel in distress is "unknown",

n) the subsequent communication on the TE is "telephone",

o) on MF/HF, the DSC message is received on 2 MHz priority band on the TE.

Without restarting the EUT, select the option to send a DROBOSE•, set the nature of distress to "sinking"• and enter any appropriate values for the position•, time of position•, and MMSI of the vessel in distress•, exit the composition option•, and reselect the option to send a DROBOSE•. Verify that the parameters are reset to their default values.

C.4.2.4.3 Defaults for the composed distress alert tests

C.4.2.4.3.1 Purpose

This test checks that the proper default values are entered into the fields for the distress alert when the operator chooses to compose the alert prior to using the dedicated distress button to initiate the sending distress automated procedure.

C.4.2.4.3.2 Method of test and required results

Power up the EUT and select the option to send/compose a distress•. Turn off any position updating. Have the TE in standby. Verify that:

a) it takes only a single action to initiate the composition of this DSC message•,

b) it takes only a single action to return to standby•,

c) all the parameters of the distress alert are visible or able• to be viewed before sending,

d) there is no way to send the distress alert without using the dedicated distress button.

Press the dedicated distress button and send the distress alert attempt•. Verify that:

e) the distress is received on the TE,

f) the MMSI of the vessel in distress is that of the EUT,

g) the nature of distress is "undesignated",

h) the position of the vessel in distress is that of the EUT,

i) the UTC time of the position of the vessel in distress is that of the EUT,

j) the subsequent communication on the TE is "telephone",

k) on MF/HF, the distress alert attempt was sent on all six distress frequencies.

C.4.2.4.4 Valid destination address tests

C.4.2.4.4.1 Purpose

This test checks that no DSC message that requires a destination address can be sent without a valid destination address entry.

C.4.2.4.4.2 Method of measurement and required results

Power up the EUT and perform the actions necessary to send the following DSC messages• and verify that:

a) one is prevented from sending• the default individually addressed non-distress DSC message of routine priority since no valid MMSI entry has been made,

b) one is prevented from sending• the default DROBOSE since no valid MMSI entry has been made,

c) one is prevented from sending• an individually addressed DSC message of routine priority after entering• an MMSI containing less than 9-digits (alternatively, the equipment may prevent one from entering less than 9 digits),

d) one is prevented from sending• an individually addressed DSC message of urgency priority after entering• an MMSI containing less than 9-digits (alternatively, the equipment may prevent one from entering less than 9 digits),

e) one is prevented from sending• an individually addressed DROBOSE after entering• an MMSI containing less than 9-digits (alternatively, the equipment may prevent one from entering less than 9 digits),

f) one is prevented from sending• a DSC message to a group after entering• a group MMSI containing less than 9-digits (alternatively, the equipment may prevent one from entering less than 9 digits),

g) one is prevented from sending• the default geographic area (centring on station) non-distress DSC message when there is no valid station position,

h) one is prevented from sending• the default geographic area (centring on station) DROBOSE when there is no valid station position

i) upon reception of a DROBOSE from the TE, one is prevented from sending• the default geographic area (centring on station) relay when there is no valid station position

j) there is no option to select "unknown" as an MMSI value except for the vessel in distress MMSI in the DROBOSE•.

NOTE This test requires manually entering the "no position or position unknown" value on the EUT.

C.4.2.4.5 Data entry tests

C.4.2.4.5.1 Purpose

This test checks that the only DSC messages that can be composed are those allowed by Recommendation ITU-R M.493 and summarized in Table D.2. The operator shall not need a user manual to send the specified DSC messages.

C.4.2.4.5.2 Method of test and required results

Power up the EUT and select the option to send a non-distress DSC message•. Have the TE in standby and turn off all automated acknowledgement options on the TE in order to inspect the parameters received on the TE. Configure the position of the TE to be within one degree of the EUT so that it receives geographic area DSC messages. Scrutinize and inspect the operator input options (often a menu selection) provided by the EUT operator interface. A "fixed" parameter means the operator is unable to edit or change the parameter. Verify that:

a) a position request requires only the entry of an MMSI address,

b) all other parameters of the position request are fixed in accordance with Table D.2,

c) no manual or assistance was required to select, find, or compose the position request•.

NOTE 1 The verification of the "manual assistance" compliance item is subjective, but the composition is a very straightforward task to perform.

Enter the MMSI of the TE• and send the position request•. On MF/HF, select a priority DSC frequency•. Verify that on the TE the DSC message received is identified as a position request, it was sent only to the TE, the priority is safety, and an acknowledgement is requested.

Return the EUT to standby•. Return to the DSC message composition option•. Verify that:

d) a test DSC message requires only the entry• of an MMSI address,

e) all other parameters of the test DSC message are fixed in accordance with Table D.2.

f) no manual or assistance was required to select, find, or compose the test message•.

NOTE 2 This is a subjective test but it is very straightforward.

Enter the MMSI of the TE• and send the test•. On MF/HF select a priority DSC frequency•. Verify that on the TE the DSC message received is identified as a test, it was sent only to the TE, the priority is safety, and an acknowledgement is requested.

Return the EUT to standby•. Return to the DSC message composition option•. Verify that:

g) with all ships (VHF) or area (MF/HF) addressing, it is only possible to use "safety" or "urgency" priority,

h) no manual or assistance was required to select, find, or compose these messages•.

NOTE 3 This is a subjective test but it is very straightforward.

Select the urgency priority• and send the DSC message•. On MF/HF, select a priority DSC frequency•. Verify that on the TE the DSC message received was sent to an area(MF/HF) or all ships (VHF), the priority is urgency, the subsequent communication is phone, and no acknowledgement is requested.

Return the EUT to standby•. Return to the DSC message composition option•. Verify that:

i) "group" addressing requires only the entry• of a valid group MMSI address and communication mode (MF/HF),

j) all other parameters of the "group" DSC message are fixed in accordance to Table C.2,

k) no manual or assistance was required to select, find, or compose the group message•.

NOTE 4 This is a subjective test but it is very straightforward.

Enter a group MMSI with a non-zero first digit• and send the DSC message•. Verify that:

l) a warning is displayed stating that the group MMSI shall have a leading zero,

m) if the equipment automatically enters the required leading zero, only eight digits are required,

n) one is only able to send the group DSC message if a valid group MMSI is entered•.

Enter a group MMSI for the TE• or allow the TE to snoop DSC messages and send the DSC message•. On MF/HF, select a priority DSC frequency•. Verify that on the TE the DSC message received was sent to a group, the priority is routine, the subsequent communication is phone, and no acknowledgement is requested.

Return the EUT to standby•. Return to the DSC message composition option•. Verify that none of the composition options on the EUT allow selecting acknowledgement options (end of sequence symbols).

Return to the DSC message composition option on the EUT• and choose the option to send a message to an area•. Verify that:

o) the option to enter the geographic area as a radius about a centre point is available,

p) the option to enter the geographic area as a Mercator box and NW corner point (or centre point) is available,

q) the centre or NW corner point can be entered with a resolution of at least whole degrees•,

r) the default value of the geographic area is a radius of 500 NM centred on the ship station,

s) no manual or assistance was required to select, find, or compose the area message•.

NOTE 5 This is a subjective test but it is very straightforward.

The following examples listed in Table C.1 test the conversion and rounding of the radius-centre point area specification. In each case, a radius "r" and station latitude "x" and longitude "y" of the EUT are given. First set the EUT• and TE into standby. The snooping option on the

TE will need to be turned on such that specified areas that do not include the TE are still received. Then set the EUT station position• as specified in the left column. Then select the option to compose a geographic area DSC message specified as a circle of radius "r" centred on the station•. Enter the radius• as shown in the left column and send• the DSC message. Verify that the area shown on the TE is the K° x L° lat-lon box with the (lat, lon) NW corner point (A, B) as shown in the right column of Table C.1.

Table C.1 – Geographic area tests

On EUT	On TE
r = 500 nm, x = 48° 29'S, y = 168° 55'E:	17°x26° box, NW corner point 40° S, 156° E.
r = 500 nm, x = 48° 29'N, y = 168° 55'W:	17°x26° box, NW corner point 57° N, 178° E.
r = 1100 nm, x = 72° 35'S, y = 94° 15'W:	36°x99° box, NW corner point 54° S, 144° W.
r = 1100 nm, x = 72° 35'N, y = 94° 15'E:	36°x99° box, NW corner point 90° N, 44° E.
r = 1100 nm, x = 22° 35'S, y = 124°15'E:	37°x41° box, NW corner point 4° S, 104° E.
r = 1100 nm, x = 22° 35'N, y = 124°15'W	37°x41° box, NW corner point 41° N, 145° W.
r = 80 nm, x = 31° 09'S, y = 61° 10'E:	4°x4° box, NW corner point 29° S, 59° E.
r = 80 nm, x = 31° 09'N, y = 61° 10'W:	4°x4° box, NW corner point 33° N, 63° W.

Power up the EUT and select the option to compose a distress alert•. Scrutinize and inspect the operator input options (often a menu selection) provided by the EUT operator interface. Verify that:

t) the only possible entries for the nature of distress are values from 100 to 110; fire, flooding, collision, grounding, listing, sinking, disabled/adrift, undesignated, abandoning ship, piracy, and man overboard, respectively (or equivalent) •. EPIRB should NOT be present.

u) the ability to check and correct (if necessary) the current position• is present,

v) the entry of a new position automatically updates the UTC time of position•,

w) it takes but one action to exit this distress alert composition option•,

x) on MF/HF, the option to select either radio telephone or FEC radio telex is present•,

y) on MF/HF, the option to select between the single and multi-frequency attempt is present•,

z) on MF/HF, the option to select the bands used for either attempt is present•,

aa) on an MF/HF multi frequency attempt, the 2 MHz and 8 MHz bands plus one other band shall always be included in the attempt (e.g. the operator cannot compose a 2 MHz, 8 MHz band only or a 2 MHz, 4 MHz, 6 MHz band only, 6 MHz, 8 MHz, 16 MHz band only, etc. multi- frequency attempt) •,

bb) the only possible items the operator is able to select and or enter are the nature of distress, the position, and on MF/HF the bands and method of the distress alert attempt (thus all other fields and parameters are entered automatically by the equipment),

cc) no manual or assistance was required to select, find, or compose the distress alert•.

NOTE 6 The verification of the "manual assistance" compliance item is subjective, but the composition is a very straightforward task to perform.

Sending of these various alerts is tested in C.6.

Power up the EUT and select the option to compose a DROBOSE•. Scrutinize and inspect the operator input options (often a menu selection) provided by the EUT operator interface. Verify that:

dd) the only possible entries for the nature of distress are values from 100 to 110 and 112; fire, flooding, collision, grounding, listing, sinking, disabled/adrift, undesignated, abandoning ship, piracy, and man overboard, and EPIRB respectively (or equivalent) •.

ee) the ability to enter the position of the vessel in distress is present●,

ff) the ability to enter the position of the vessel in distress as "unknown" is present●,

gg) the ability to enter the UTC time of position of the vessel in distress is present●,

hh) the ability to enter the UTC time of position of the vessel in distress as "unknown" is present●,

ii) a single-action option to use the position and UTC time of position of the sending vessel for the position and UTC time of position of the vessel in distress is highly recommended (but not required) ●,

jj) the ability to enter the MMSI of the vessel in distress is present●,

kk) the ability to enter the MMSI of the vessel in distress as "unknown" is present●,

ll) the option to send the DROBOSE to an individual, area (MF/HF), or all ships (VHF) is present●,

mm) the ability to enter the MMSI of the destination station is present when individual addressing is selected●,

nn) on MF/HF the ability to enter the area either in radius-center point or Mercator box-NW corner point when area addressing is selected●,

oo) it takes but one action to exit this DROBOSE composition option●,

pp) on MF/HF, the option to select the frequency band of the DROBOSE is present●,

qq) on MF/HF, the option to select either radio telephone or FEC radio telex is present●,

rr) no manual or assistance was required to select, find or compose the DROBOSEs●.

NOTE 7 The verification of the "manual assistance" compliance item is subjective, but the composition is a very straight forward task to perform.

Place the TE in standby. Configure the position of the TE to be within one degree of the EUT so that it receives all geographic area DSC messages and alarms with the full two tone distress alert alarm. Turn on the snooping option on the TE so that it receives all DROBOSEs sent by the EUT. A set of DROBOSEs shall be composed on the EUT with various sets of distress information. The following notation for the distress information shall be used:

- M = MMSI of vessel in distress
- N = nature of distress
- P = Position of the vessel in distress
- U = UTC time of the vessel in distress
- C = (MF/HF only) subsequent communication mode

Compose the following DROBOSEs on the EUT:

(1) individually addressed to the TE with M = unknown, N = sinking, P = EUT's position, U = EUT's position time, C = radio telephone●

(2) individually addressed to the TE with M = any ship station MMSI, N = fire, P = EUT's position, U = EUT's position time, C = radio telephone●

(3) individually addressed to the TE with M = any ship station MMSI, N = EPIRB, P = a position, U = the position time, C = radio telephone●

(4) individually addressed to the TE with M = any ship station MMSI, N = disabled and adrift, P = unknown, U = unknown, C = radio telephone●

(5) addressed an area (MF/HF) or all ships (VHF) with M = any ship station MMSI, N = flooding, P = EUT's position, U = EUT's position time, C = radio telephone●

(6) individually addressed to a coast station with M = unknown, N = man overboard, P = EUT's position, U = EUT's position time, C = radio telephone●

(7) individually addressed to a coast station with M = any ship station MMSI, N = piracy, P = EUT's position, U = EUT's position time, C = radio telephone●

(8) individually addressed to a coast station with M = any ship station MMSI, N = grounding, P = a position, U = the position time, C = radio telephone•

(9) individually addressed to a coast station with M = any ship station MMSI, N = collision, P = unknown, U = unknown, C = radio telephone•

For each of the 9 DROBOSEs above using the grid below, verify that

	1	2	3	4	5	6	7	8	9
For the first five DROBOSEs, a warning is displayed on the EUT that the call should be directed to a coast station									
A received distress automated procedure is started on the TE									
Only a single DSC message was sent									
The fields entered on the EUT are displayed on the TE									

Terminate any automated procedures on both the TE and EUT after each case.

C.4.2.4.6 Automatic frequency/channel selection tests

C.4.2.4.6.1 Purpose

This test checks that the proper HF channel of subsequent communication is selected.

C.4.2.4.6.2 Method of test and required results

Place the TE in standby and configure it with a ship station MMSI. On the EUT, select the option to send a non-distress DSC message to the TE requesting radio telephone•. Select the priority to be"'routine"•, and on HF send the DSC message on the 4 207,5 kHz priority frequency•. Verify that the channel of subsequent communication is a simplex channel (VHF) and one of the simplex phone channels in the 4 MHz band on HF.

Terminate the procedures on both the EUT• and TE. Configure the TE with a coast station MMSI. Resend• the above DSC message to the coast station• with priority "routine"• and on HF on the 12 577,0 KHz priority frequency•. Verify that the TE (coast station) needs to select the subsequent communication channels.

Place the TE in standby and configure it with a ship station MMSI. Configure the position of the TE to be within 60 nautical miles of the EUT. On the EUT, select the option to send a non-distress DSC message to all ships (VHF) or an area (MF/HF) requesting radio telephone•. On HF, select the 4 207,5 KHz priority frequency•. Select the priority to be "safety"• and send the DSC message•. Verify that the broadcast mode of transmission is indicated on the TE using a simplex channel and on HF the frequency is in the 4 MHz band.

C.4.2.4.7 MF/HF 20 bit dot pattern tests

C.4.2.4.7.1 Purpose

This test checks that all DSC messages individually addressed to coast stations use a 20 bit dot pattern.

C.4.2.4.7.2 Method of test and required results

Configure the TE with a coast station MMSI (the two leading digits are zeros; 00xxxxxxx) and pause the MF/HF watch receiver on one of the distress frequencies. On HF, make sure that all the DSC messages sent from the EUT are sent on that distress frequency•. Verify that:

a) a DROBOSE sent• to the TE has a 20 bit dot pattern,

b) an individual DSC message of priority safety sent• to the TE has a 20 bit dot pattern,

c) a test DSC message sent to the TE• has a 20 bit dot pattern.

NOTE This requirement was new to Recommendation ITU-R M.493-11; previously all distress DSC messages had to have 200-bit dot pattern.

C.4.2.5 Transmission of DSC messages tests

C.4.2.5.1 Requirements

This test checks that the EUT properly implements the prioritized wait prior to sending a DSC message. The tests include assuring that wait times are of proper length according to the type and priority of the message and that the random component is random, and that the EUT checks for a free channel after the wait time has elapsed. On VHF, this signal is typically detected by the presence of a threshold RMS level. On MF and HF, the ubiquitous presence of noise requires filtering and detection of the DSC signal component within the total signal. This filtering implies delays between the actual start of a DSC signal and the time at which it can be detected. Since the method of testing involves timing the interval from when the TE stops sending a signal to that time when the TE detects that the EUT sends the DSC message, on MF and HF, the time reported will be longer than the proposed wait times due to latency for signal detection. Note that the transmitter and any antenna coupler are required to be powered up and tuned prior to checking the channel and are not part of the latency. On MF and HF, an estimate of this latency time will be made by timing the reported interval in the case of sending a distress alert attempt on the EU. (with no latency, the reported interval would be zero). This estimated latency time shall be subtracted from all subsequent measurements as indicated.

C.4.2.5.2 Method of test and required results

C.4.2.5.2.1 Step one (MF/HF only)

For establishing the "latency" time:

a) from the TE, send a continuous dot pattern on the 2 MHz distress frequencies,

b) on the EUT, send a single frequency alert on that same frequency,

c) stop the DSC signal on the TE before the 10 s timeout has elapsed and record the time it takes to receive the alert signal,

d) repeat the exercise five times to get a range of values. The minimum of the five values shall be referred to as the "latency time" in the subsequent tests.

Record the five latency times: _____ _____ _____ _____ _____. Minimum value: _____.

C.4.2.5.2.2 Step two (all units)

For each of the DSC messages in Table C.2, set up the TE to transmit a continuous dot pattern to the EUT. On HF, send this DSC signal on the same frequency that the EUT shall attempt to send its DSC message on. The signal level from the TE shall be at a level of 0 dBµV which gives a 10^{-2} symbol error rate or better on the EUT.

Table C.2 – DSC messages to send from the EUT

(1) An individually addressed DSC message of priority routine.
(2) A test DSC message with priority safety.
(3) A group DSC message with priority routine.
(4) An individually addressed safety message.
(5) An individually addressed urgency message.
(6) An all ships (VHF) or area (MF or HF) DROBOSE.

On the EUT attempt to send• the DSC messages of Table C.2, verify that:

	DSC message of Table C.2					
	1	2	3	4	5	6
The automated procedure on the EUT indicates that it is waiting for a free channel						

Stop the transmission of the DSC signal on the TE and record the time it takes for the DSC message to be sent from the EUT. Verify that:

	DSC message of Table C.2					
	1	2	3	4	5	6
The time is ≥ 400 ms (MF/HF) or 200 ms (VHF) after subtracting the latency time				■	■	■
The time is ≥ 300 ms (MF/HF) or 150 ms (VHF) after subtracting the latency time	■	■	■		■	■
The time is ≥ 200 ms (MF/HF) or 100 ms (VHF) after subtracting the latency time	■	■	■	■		■
The time is ≥ 100 ms (MF/HF) or 50 ms (VHF) after subtracting the latency time	■	■	■	■	■	

Repeat the following tests four times to estimate the random nature of the wait.

Restart the DSC signal on the TE and attempt to resend• the DSC message from the EUT. Verify that:

		DSC message of Table C.2					
		1	2	3	4	5	6
The automated procedure on the EUT indicates that it is waiting for a free channel	1st time						
	2nd time						
	3rd time						
	4th time						
Stop the transmission of the DSC signal on the TE and record the time it takes for the DSC message to be sent from the EUT	1st time						
	2nd time						
	3rd time						
	4th time						
The time is ≥ 400 ms (MF/HF) or 200 ms (VHF) after subtracting the latency time and different in each case					■	■	■
The time is ≥ 300 ms (MF/HF) or 150 ms (VHF) after subtracting the latency time and different in each case		■	■	■		■	■
The time is ≥ 200 ms (MF/HF) or 100 ms (VHF) after subtracting the latency time and different in each case		■	■	■	■		■
The time is ≥ 100 ms (MF/HF) or 50 ms (VHF) after subtracting the latency time and different in each case		■	■	■	■	■	

For DSC messages No.1 and No.2 of Table C.2, proceed to the following.

Start the DSC signal on the TE on the frequency that will be used by the EUT. Set up the option to introduce a pulse of silence (simulating a free channel for that duration) into the otherwise continuous DSC signal being sent from the TE. This pulse of silence will need to be introduced frequently. Set the length of the pulse to be 400 ms (MF/HF) or 200 ms (VHF). From the EUT, attempt to send the indicated DSC message from Table C.2•. Introduce the

pulse of silence, wait a second, repeat, etc. until the pulse has been introduced ten times. Verify that:

The automated procedure on the EUT for all ten pulses of silence never transmits and continues to indicate that it is waiting for a free channel•	Message No.1	
	Message No.2	

Increase the length of the silence pulse to 450 ms (MF/HF) and 225 ms (VHF). The EUT shall still be waiting for a free channel. Introduce the pulse of silence. If the EUT transmits the DSC message, attempt to resend the DSC message from the EUT• before reintroducing the pulse of silence. Repeat the process until ten pulses of silence have been introduced and record the number of times the EUT sends and the number of times the EUT does not send. Increase the length of the pulse of silence to 500 ms (MF/HF) and 250 ms (VHF) and record the number of times the EUT sends the DSC message versus the number of times the EUT does not send. If the EUT sends the message less than five times, increase the length of the pulse of by 100 ms (MF/HF) and 50 ms (VHF) and repeat until the EUT sends at least five of the times. The grid is for recording whether or not the EUT sends during the pulse.

Results	Pulse No.	1	2	3	4	5	6	7	8	9	10
450 ms or 225 ms	Message No.1										
	Message No.2										
500 ms or 250 ms	Message No.1										
	Message No.2										
600 ms or 300 ms	Message No.1										
	Message No.2										
700 ms or 350 ms	Message No.1										
	Message No.2										

Verify that:

a) the number of times the EUT sends the DSC message increases with the length of the silence pulse,

b) the EUT sends the DSC message no more than 7 times for the 450 ms or 225 ms silence pulse.

For DSC message No.6 of Table C.2, proceed to the following.

Start the DSC signal on the TE on the frequency that will be used by the EUT. Set up the option to introduce a pulse of silence (simulating a free channel for that duration) into the otherwise continuous DSC signal being sent from the TE. Set the length of the pulse to be 100 ms (MF/HF) and 50 ms (VHF). From the EUT, attempt to send DSC message No.6•. Introduce the pulse of silence, wait a second, repeat, etc. until the pulse has been introduced ten times. Verify that the automated procedure on the EUT for all ten pulses of silence never transmits and continues to indicate that it is waiting for a free channel•.

Increase the length of the pulse of silence to 150 ms (MF/HF) and 75 ms (VHF). The EUT shall still be waiting for a free channel. Introduce the pulse of silence. If the EUT transmits the DSC message, attempt to resend the DSC message from the EUT• before reintroducing the pulse of silence. Repeat the process until ten pulses of silence have been introduced and record the number of times the EUT sends and the number of times the EUT does not send. Increase the length of the pulse of silence to 150 ms (MF/HF) and 75 ms (VHF) and record the number of times the EUT sends the DSC message versus the number of times the EUT does not send. If the EUT sends the message less than five times, increase the length of the pulse of by 100 ms (MF/HF) and 50 ms (VHF) and repeat until the EUT sends at least five of the times. The grid is for recording whether or not the EUT sends during the pulse.

Results	Pulse No.	1	2	3	4	5	6	7	8	9	10
150 or 75 ms											
200 or 100 ms											
300 or 150 ms											
400 or 200 ms											

Verify that:

c) the number of times the EUT sends the DSC message increases with the length of the silence pulse,

d) the EUT sends the DSC message no more than 7 times for the 150 ms or 75 ms silence pulse.

Return the EUT to standby• and start the DSC signal on the TE on a distress frequency and attempt to send a single frequency distress alert attempt on that same frequency from the EUT•. Verify that the EUT sends the distress alert attempt after 10 s (MF/HF) or 1 s (VHF) have elapsed•.

C.4.2.6 Reception/detection of DSC messages tests

C.4.2.6.1 MF/HF watch receiver

C.4.2.6.1.1 Purpose

This test checks that the watch receiver scans the proper frequencies

C.4.2.6.1.2 Method of test and required results

Verify that the dedicated watch receiver with factory settings scans all six distress frequencies.

The following tests are addressed only if the number of scanned frequencies may be changed by the operator. Verify that:

a) the operator is prevented from choosing a set of scanned frequencies that does not include the 2 MHz band,

b) the operator is prevented from choosing a set of scanned frequencies that does not include the 8 MHz band,

c) the operator is prevented from choosing a set of scanned frequencies that does not include at least 3 different bands.

C.4.2.6.2 Message detection and decoding tests

NOTE 1 In the following tests, the messages are assumed pertinent to the station; they would initiate one of the automated procedures if accepted. The TE is able to manipulate any one of the 10-bit values in either the DX or RX positions of the correctly composed DSC sentence.

NOTE 2 A "3-bit error" is generated by making the 7-bit information content inconsistent with the 3-bit zero count within a 10-bit word.

NOTE 3 The nomenclature for the individual DSC words "DX", "RX3", "A", etc. is that of Figure 1 in Recommendation ITU-R M.493-14:2015.

C.4.2.6.2.1 Purpose

This tests checks that the decoding of received DSC messages properly handles errors and completes the various tests listed in the requirements.

C.4.2.6.2.2 Method of test and required results

From the TE, compose the indicated DSC messages such that the messages are pertinent to the EUT and alter the respective DSC words within the messages as stated in the list. Prior to each test (except where indicated), the EUT shall be in standby. Verify that the following DSC messages are received error free after:

a) placing a 3-bit error in all the DX information words of a non-distress DSC message,

b) placing a 3-bit error in the DX and RX parts of the first format word A of an all ships non distress DSC message,

c) placing a 3-bit error in three of the four format words A of an individual non distress DSC message,

d) placing a 3-bit error in the 5 consecutive words DX-RX3-DX-RX2-A,

e) placing a 3-bit error in the DX and RX parts of the first end of sequence word H of a non-distress DSC message,

f) sending a position report with the 821 enhanced position sequence,

g) sending a position report with the 821 enhanced position sequence with 3-bit errors in the DX and RX positions of the enhanced position indicator word (7-bit value 100),

h) sending a position report with the 821 enhanced position sequence with 3-bit errors in all four of the enhanced position end of sequence characters.

NOTE A position report is similar to a position request except the sending vessel places its position in the frequency message (instead of 126's followed) by the UTC time of position. This DSC message is no longer allowed in ITU-R M.493 The EUT is only required to receive the standard part of the DSC message and not the extension.

Verify that the following DSC messages are rejected after:

i) placing a 3-bit error in the DX and RX parts of the first MMSI word B1 of an individual non distress DSC message,

j) placing a 3-bit error in three of the four format words A of an all-ships non distress DSC message,

k) setting all four format words A to the error free value 359 (7-bit value is 103) of a non-distress DSC message unless the EUT is specifically designed to handle this value (this is an ASI-DSC function),

l) placing a 3-bit error in all 4 end of sequence words H.

Verify that the following DSC messages are received but in error after:

m) placing a 3-bit error in both the DX and RX positions of the ECC word I,

n) changing both the DX and RX "category" words C of a non-distress DSC message of routine priority to safety without changing the ECC,

o) placing a 3-bit error in both the DX and RX category words C of a non-distress DSC message of priority routine,

p) placing a 3-bit error in both the DX and RX nature of distress words of a distress alert.

Verify that the EUT's received distress procedure indicates error free distress information after resending the same distress alert with the DX nature of distress word made error free and placing a 3-bit error in both the DX and RX telecommand (comms) words.

NOTE This test checks that the EUT uses the multiple messages of a distress alert attempt to correct errors. In this case, if both messages were treated independently from one another, they would both be received in error. The first message would have a nature of distress error and the second a comms error. But combined all characters can be obtained error free.

C.4.2.7 Alarm

C.4.2.7.1 General

The default alarm settings as specified in Table H.2 shall be used in all the remaining tests. The only aspect of the alarms tested in C.4.2.7 is the increase in volume feature. The remaining tests of the alarms are done in those clauses when the alarm arises.

C.4.2.7.2 Requirements

This test checks that the two tone and urgency alarms increase in volume and have the correct intensity.

C.4.2.7.3 Method of test and required results

Place the TE and EUT• in standby. Send a default distress alert from the TE. Verify that:

a) the EUT sounds the two-tone alarm,

b) the reason for and means to silence the alarm is displayed,

c) the alarm starts to get notably louder after 10 s have passed,

d) after 20 s have elapsed, the level of the alarm is at least 80 dB(A) at a distance of one metre,

e) the alarm shall be manually silenced.

Place the TE and EUT• in standby. Send an individual DSC message addressed to the EUT with an urgency priority. Verify that:

f) the EUT sounds the default urgency alarm,

g) the reason for and means to silence the alarm is displayed,

h) the alarm starts to get notably louder after 10 s have passed,

i) after 20 seconds have elapsed, the level of the alarm is at least 80 dB(A) at a distance of 1 m,

j) the alarm shall be manually silenced.

Examine the setup options/menus of the EUT and verify that:

k) the two-tone alarm cannot be customized or disabled,

l) the urgency alarm cannot be disabled or customized.

C.5 Standby

NOTE Standby is the state of the equipment when it is not engaged in a communications or DSC automated procedure. The state of the equipment is considered engaged whether the automated procedure is active or on hold.

C.5.1 Standby requirements

The following functions and or information shall be visible to the operator at top level while in standby:

a) the station MMSI;

b) the latest position of the vessel;

c) the UTC time of that position;

d) the dedicated distress button;

e) a clearly labelled means to compose a distress alert prior to sending distinct from the dedicated distress button;

f) a clearly labelled means to compose/send a non-distress DSC message;

g) a clearly labelled means to compose/send a DROBOSE.

The following setup options shall be available with the following factory defaults:

h) the option to send medical transport DSC messages: set to off;

i) the option to send neutral crafts DSC messages: set to off;

j) the option to auto acknowledge polling DSC messages: set to on;

k) the option to auto acknowledge test DSC messages: set to on;

l) the option to auto acknowledge position request DSC messages: set to off;

m) the option to auto acknowledge individually addressed, non-distress DSC messages: set to on;

n) the option on MF/HF equipment to set the maximum distance for sounding a two-tone alarm that does not self-terminate upon initiation of a received distress automated procedure to some value greater than or equal to 500 nautical miles that includes "never self-terminate": set to 500 nautical miles;

o) the option to set the no activity timeout to exit any non-automated procedure activity to some value that includes no timeout: set to 10 min;

p) the option to set the no activity timeout of non-distress DSC automated procedures to some value that includes no timeout: set to 15 min;

q) the option to set the no activity timeout of received distress DSC automated procedures to some value that includes no timeout: set to no timeout;

r) that there is no option to set any timeout of the unacknowledged sending distress automated procedure;

s) the option to set the maximum amount of simultaneous automated procedure (applies only to equipment that supports more than the required minimum of seven);

t) the option to set the no activity timeout of communications automated procedures to some value in the range [10 s to 10 min]: set 30 s;

u) the option to enable automatic channel or frequency change: set to on.

A record of the DSC activity shall be available containing the following information which shall be able to be displayed:

v) the UTC time and date of reception;

w) on MF/HF, the frequency of reception;

x) the information content of the DSC message;

y) a minimum of the twenty most recently received distress DSC messages; a single or multi frequency alert attempt shall be recorded as a single DSC message with an indication of how many of the alerts in the attempt were received. DSC alerts received on the same frequency within a period of 60 s (MF/HF) and 5 s (VHF) shall be considered part of the same distress alert attempt. On MF/HF, consecutive alerts received on different frequencies within a period of 60 s shall be considered a multi frequency attempt. In both cases, the information characters assimilated by the automated procedure handling the distress alerts shall be the recorded information characters. In other words, if any errors in the information characters of a received alert are corrected by the reception of other alerts within the attempt, only the corrected version shall be recorded;

z) a minimum of the twenty most recently sent DSC messages, where a distress alert attempt is recorded as a single message;

aa) a minimum of the twenty most recently received non-distress DSC messages.

C.5.2 Standby tests

C.5.2.1 Top level visibility while in standby tests

C.5.2.1.1 Purpose

This test checks that the operator is able to see the dedicated distress button, how to compose and send a distress alert (the distress function), how to compose and send a non-distress DSC message (the call function), and how to compose and send a DROBOSE (the DROBOSE function) as described in Recommendation ITU-R M.493-14:2015, Annex 3, simply by looking at the equipment. The means to perform these functions may be the selection of a menu item, the press of a labelled button, the touch of the screen, or equivalent, but they all shall be visible at top level. This test also checks that the position, time of position, source of position, current UTC time, and the station MMSI are displayed at top level by some electronic means.

C.5.2.1.2 Method of test and required results

This test requires a simple visual inspection of the equipment. Looking at the EUT while in standby without pressing any buttons or activating any menu trees verify that:

a) the station MMSI is displayed,

b) the latest position is displayed,

c) the UTC time of the latest position is displayed,

d) the source of the latest position is displayed,

e) the dedicated distress button is plainly visible and protected by a spring loaded lid or cover permanently attached to the equipment by, for example, hinges (applies at all times whether or not the EUT is in standby),

f) a clearly labelled means to compose a distress alert prior to sending, distinct from the distress button, is present,

g) a clearly labelled means to compose/send non-distress DSC messages is present,

h) a clearly labelled means to compose/send a DROBOSE is present.

C.5.2.2 Required setup options

C.5.2.2.1 Purpose

This test checks that the proper setup options are available and that the options have the proper factory default value.

C.5.2.2.2 Method of test and required results

After powering up the EUT, this test requires a simple visual inspection of the equipment's setup menus or equivalent. Verify that:

a) the options to send medical transports and neutral craft DSC messages are present and set to "off",

b) the options to auto acknowledge test and polling DSC messages are present and set to "on",

c) the option to auto acknowledge position requests is present and set to "off",

d) the option to auto acknowledge individually addressed, non-distress DSC messages is present and set to "on",

e) the option to set a timeout to exit any non-procedure menu with a default value of 10 min is present,

f) the above timeout may be set to no timeout,

g) on MF/HF, the option is present to set the distance threshold for sounding the two-tone alarm that needs to be manually silenced upon initiation of a received distress automated procedure, default value 500 nautical miles,

h) on MF/HF, the distance threshold cannot be set to less than 500 nautical miles,

i) on MF/HF, the distance threshold may be set to no threshold,

j) the option to set the no activity timeout of non-distress automated procedures is present and set to 15 min,

k) one may set the no activity timeout to no timeout,

l) the option to set the no activity timeout of received distress automated procedures is present and set to no timeout,

m) there is no option to set a no activity timeout of an unacknowledged sending distress automated procedure.

C.5.2.3 Remote setup control

C.5.2.3.1 Purpose

This test checks that the proper setup options are available on the remote interface and that the options can be changed using the EPV command.

C.5.2.3.2 Method of test and required results

After powering up the EUT, this test requires the query to one or more options in the product and modifying at least one option via the remote interface following the guidelines in B.8.2.

C.6 Sending distress automated procedure

C.6.1 Sending distress automated procedure requirements

C.6.1.1 Procedure

The sending distress automated procedure results when the operator presses the dedicated distress button to send a distress alert attempt. A schematic of the automated procedure is given in Figure C.1.

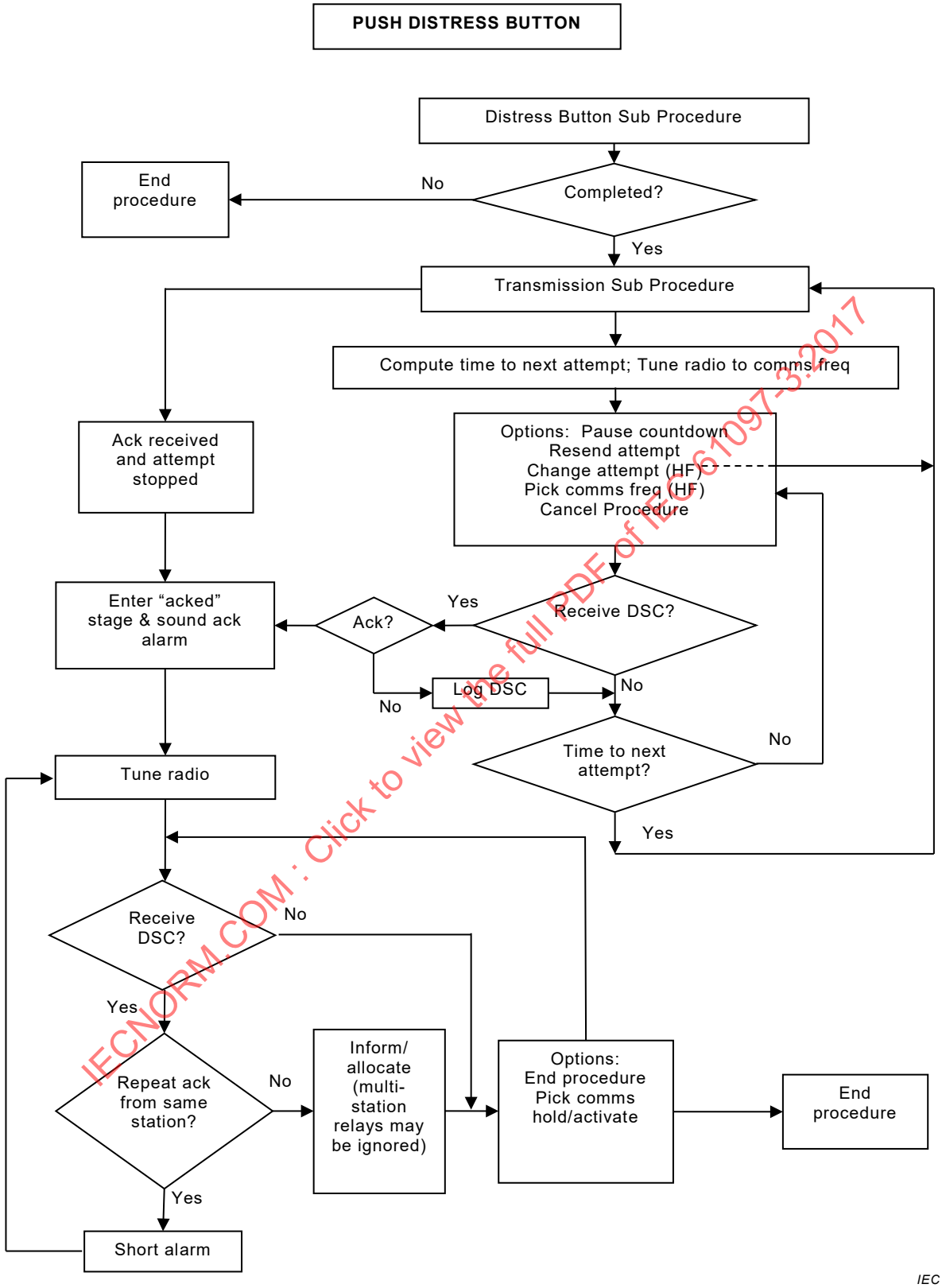


Figure C.1 – Sending distress procedure

C.6.1.2 Tasks

The EUT shall follow the sending distress automated procedure as shown in Figure C.1 complying with the automated procedures as defined in Recommendation ITU-R M.493-14:2015, Annex 4.

The sending distress automated procedure shall handle the following events:

a) the distress button sub procedure,

b) previous to the procedure being acknowledged:

   1) on HF, the setting of the watch receiver to scan all six distress frequencies (if not already doing so),

   2) the transmission of the alert attempt,

   3) calculating the time to an automated resending of the attempt (between 3,5 min and 4,5 min),

   4) tuning to the subsequent communication frequency (upon conclusion of the attempt),

   5) waiting for the reception of a distress alert acknowledgement,

   6) logging all other received DSC messages assuring they do not disrupt the procedure,

   7) retransmission of the alert attempt occurring after a 3,5 min to 4,5 min period,

   8) providing the valid operator options which are:

      i) pausing the countdown to automated resending,

      ii) resending the alert attempt, with the last entered other parameters, using the dedicated DISTRESS button,

      iii) cancelling the alert attempt,

      iv) selecting amongst the six frequencies of subsequent communications (HF only).

c) after reception of the acknowledgement:

   9) stopping the automatic resending of the alert attempt,

   10) transmitting any remaining single alert of the attempt to completion,

   11) allocating received DSC messages not pertinent to the procedure to their appropriate automated procedures or initiating their own procedure on hold, and

   12) providing the valid operator options which are:

      v) selecting amongst the six frequencies of subsequent communications (HF only),

      vi) activate or place the procedure on hold, and

      vii) terminating the automated procedure.

C.6.1.3 Display

During the sending distress automated procedure, the EUT shall display the following items and/or information as appropriate, at top level:

a) the fact one is engaged in sending a distress,

b) the time remaining to the next automated resending of the attempt (prior to acknowledgement),

c) the elapsed time since receiving the distress alert acknowledgement (after acknowledgment),

d) the indication of whether the procedure is on hold or is active (after acknowledgement),

e) the distress information,

f) a warning before the automated resending of the attempt in case engaged in traffic,

g) the frequency of subsequent communication (HF only),

h) the frequencies on which the alerts are sent (HF only),

i) the sender of the distress acknowledgement,

j) the sub-stages of the procedure:

   1) transmitting

   2) waiting for acknowledgement

3) alert acknowledged

4) waiting for a free channel,

k) the valid operator options.

C.6.1.4 Dedicated distress button sub procedure

The dedicated distress button shall be used for the following purposes in the following manner:

a) the use of the dedicated distress button is required to initiate the sending distress automated procedure.

b) the dedicated distress button shall be used exclusively for initiating the sending distress automated procedure.

c) the use of the dedicated distress button after entering parameters of the alert attempt via a menu or equivalent shall initiate the sending distress automated procedure with the alert attempt as composed by the operator.

d) the use of the dedicated distress button without entering parameters of the alert attempt via a menu or equivalent shall initiate the sending distress automated procedure with the default alert attempt. The default alert attempt is given by the following:

- the undesignated nature of distress,
- the latest position of the vessel,
- the UTC time of that position,
- the radio telephone for subsequent communication,
- on HF, the multi frequency attempt using all six frequencies.

Use of the dedicated distress button without entering parameters of the alert attempt via a menu or equivalent shall initiate the sending distress automated procedure with the default alert attempt regardless of the state of the EUT, except when the EUT is already engaged in the sending distress automated procedure.

The distress button sub procedure of the sending distress automated procedure shall be as follows:

a) lifting or opening of the lid or cover permanently attached to the equipment by, for example, hinges. This is ACTION 1,

b) pressing and holding the distress button (ACTION 2),

c) displaying the seconds remaining to transmission of the attempt starting at three,

d) invoking an intermittent audio and intermittent visual alarm once each second,

e) stopping the procedure if the distress button is released before the three seconds have elapsed (when releasing the button, the radio shall return to its previous state),

f) when the three seconds has elapsed regardless of whether the button is continued to hold down or released, completing ACTION 2 and starting the alert attempt,

g) sounding a steady tone of two-second duration after ACTION 2 has completed and displaying a visual indication that the distress alert attempt has been sent.

C.6.1.5 Transmission of the alert attempt

The transmission sub procedure of the sending distress automated procedure shall be as follows:

a) the appropriate frequencies for transmission shall be determined from the selected frequencies,

b) on VHF, it is always channel 70 and thus always a single frequency attempt,

c) on MF, it is always 2 187,5 kHz and thus always a single frequency attempt,

d) for an HF single frequency attempt, a frequency is chosen from a list of six possible frequencies (default all six) previously set up by the operator during equipment installation. Each time the attempt is automatically (or manually) repeated, the next frequency in the list is used until all frequencies are utilized at which time the cycle repeats,

e) for an HF multi frequency attempt, a list of three to six frequencies (2 MHz and 8 MHz mandatory, default all six) previously set up by the operator is utilized. The multi frequency attempt is completed when a distress alert has been transmitted on each of the frequencies in the list,

f) the transmission starts on the appropriate frequency,

g) the countdown to the next automated resending of the attempt is started,

h) if a distress acknowledgement is received, the attempt shall cease after completion of any ongoing distress alert within the attempt,

i) if a single frequency attempt, five alerts shall be sent without a break between alerts,

j) if a single frequency attempt, the extended position information shall be sent on only the 5th alert,

k) if a multi frequency attempt, the extended position information shall be sent on each alert.

C.6.1.6 Updating position

When a distress alert attempt is resent, it shall update the position and UTC time of position information.

C.6.1.7 Handling received DSC messages

Prior to acknowledgment of the sending distress automated procedure, only the distress acknowledgement describing the same distress event is pertinent to the procedure. All other DSC messages shall be ignored and only recorded in the log.

After the sending distress automated procedure has been acknowledged, all DSC messages describing the same distress event are pertinent to the procedure. Of these DSC messages, all ships, group, and area distress relays may be ignored. DSC messages not pertinent to the procedure shall be allocated to the appropriate automated procedure or initiate their own automated procedure on hold.

C.6.1.8 Alarms

The reception of the first distress alert acknowledgement pertinent to the procedure shall sound a distress acknowledgement alarm. Any subsequent acknowledgement shall only sound the self-terminating alarm.

C.6.1.9 Determining subsequent communications

On VHF, it is always channel 16.

On MF, it is always 2 182,0 kHz (voice) or 2 174,5 kHz (data).

On HF, the frequency band is given by:

a) the frequency band of a single frequency distress alert attempt, or

b) prior to acknowledgement, the distress telephony frequency in the 8 MHz band if a multi-frequency distress alert attempt, or

c) after reception or the sending of a distress alert acknowledgment, the frequency band of the sent or received distress DSC message.

The channel set is given by the mode of subsequent communication.

C.6.1.10 Automated tuning

Automatic tuning to the subsequent communications frequency or channel shall occur after transmission of the first distress alert attempt.

On HF, the operator shall have at least a 10 s warning prior to an automated resending of the alert attempt where the operator may pause the resending in case engaged in traffic.

Upon reception of the first distress alert acknowledgement, the tuning shall occur after the manual silencing of the alarm.

Subsequent acknowledgements from the same source demanding changes in subsequent communication frequencies shall occur automatically.

Subsequent acknowledgments from a different source shall indicate to the operator by some means that a change in frequency is requested; however, in the absence of any operator action, the tuning shall not occur.

C.6.1.11 Cancelling the distress alert

The distress cancel procedure consists of the cancel operation on all bands utilized by the distress alert attempts (on VHF and MF, there is only one cancel operation whereas on MF/HF there may be up to six). The cancel operation consists of a DSC cancel (a self-addressed distress alert acknowledgement) followed by a voice cancel on the corresponding frequency of subsequent communication. The phrase "voice cancel" refers to the part of the cancel done over the subsequent communication frequencies whether it is by radio telephony or on MF and MF/HF by data.

Cancellation of a distress alert shall only be possible prior to acknowledgement.

Selection of the cancellation option during the sending of a distress alert attempt shall stop the transmission as soon as possible but only after any ongoing distress alert within the distress alert attempt is completed.

Upon selection of the cancel option, the equipment shall provide an explanation of the cancel procedure, and for HF the frequencies requiring cancellation shall be indicated to the operator.

The radio shall prompt the operator to confirm continuing with the cancel, or to abort the cancel procedure. If the latter is selected, the sending distress automated procedure will be resumed.

If the user confirms the distress cancel, then:

a) if the distress alert was sent on VHF, transmit the distress cancel on channel 70;

b) if the distress alert was sent on MF, transmit the distress cancel on 2 187,5 kHz;

c) if the distress alert was sent on HF, transmit the distress cancel on the DSC distress frequencies of all bands that were used for the HF distress alerts.

After the transmission of all of the self-addressed distress alert acknowledgment, the operator shall be given the subsequent communication options to "voice cancel" by either telephony or data (telex).

If telephony is selected, the general receiver and transmitter shall in a sequence automatically be tuned to the subsequent communication frequency for all channels the cancel distress DSC call have been transmitted on. For each channel, the operator shall be prompted to make the voice cancellation, and the appropriate text for the voice cancellation shall be displayed. The operator shall acknowledge the voice cancel on each channel before the equipment is tuned to the next communication frequency.

In case data is selected for "voice cancel", the general receiver and transmitter shall in a sequence automatically be tuned to the subsequent communication frequency for all channels the cancel distress DSC call have been transmitted on, and automatically send the cancel.

Frequencies that have been cancelled shall be indicated.

On HF, once any single channel is cancelled, the operator shall be unable to exit the cancel procedure until all utilized channels have been cancelled.

Completion of the cancellation shall place the sending distress automated procedure in the acknowledged state.

The radio shall display to the operator the stages of the cancellation procedure such as "waiting for the operator to proceed" or equivalent, "transmitting the DSC cancel" or equivalent, "radio tuned for the voice cancel", or equivalent, "cancel procedure done" or equivalent.

C.6.1.12 Acknowledgments

The procedure shall be considered acknowledged upon reception of the first distress alert acknowledgement concerning the same distress event.

C.6.1.13 Termination

Prior to acknowledgement, the procedure cannot be terminated either by the operator or the equipment.

After acknowledgment, including distress self-cancel, the procedure is terminated manually.

C.6.1.14 Warnings

The procedure shall provide warnings for those reasons provided in Recommendation ITU-R M.493-14:2015, Annex 4. The operator shall have the option to go back to the stage of the procedure where the action was taken that caused the warning.

C.6.2 Sending distress automated procedure tests

NOTE Tests and set ups marked with a raised circle (•) are actions that an operator will most likely have to perform in real life. Thus, these items are expected to be easy to perform. The test personnel are to report any difficulties or frustrations in performing these actions.

C.6.2.1 Distress button sub procedure tests

C.6.2.1.1 Purpose

This test checks the distress button sub procedure on the EUT.

C.6.2.1.2 Method of test and required results

Have the EUT and TE in standby. Stop any automatic updates that lead to changes of the position on the EUT and note the MMSI, position, and UTC time of position of the EUT. Make sure the position has enhanced resolution in seconds or fractional minutes. The tests are to be performed using only the distress button (DB) on the EUT. The last test will require returning the EUT to standby. Verify that:

a) pressing the DB sounds an audio alarm such that one can count seconds by it,

b) pressing the DB invokes a visual indicator such that one can count seconds by it,

c) the seconds remaining to transmission of the alert attempt are displayed,

d) the release of the DB before the countdown has elapsed stops the sub procedure,

e) after the 3 s have elapsed, a steady tone of 2 s duration sounds,

f) the distress alert attempt is sent if the DB is released at least after the countdown is completed,

g) the distress alert attempt is sent if the DB is continued to be held down.

NOTE The condition is verified if the received distress automated procedure on the TE is invoked and the sending distress procedure on the EUT starts.

C.6.2.2 Default distress alert attempt tests

C.6.2.2.1 Purpose

This test checks the sending of the default distress alert attempt on the EUT from standby.

C.6.2.2.2 Method of test and required results

Place the TE in standby. Using only the distress button on the EUT, send the default distress alert attempt• and verify that:

a) the nature of distress on the TE is undesignated,

b) the MMSI of the vessel in distress on the TE is that of the EUT,

c) the position on the TE is that of the EUT,

d) the position on the TE includes the enhanced resolution,

e) the UTC time of the position on the TE is that of the EUT,

f) the means of subsequent communication on the TE is radio telephone,

g) HF only: the alert is received on all 6 distress frequencies on the TE,

h) the frequency of subsequent communication is 8 291,0 kHz on HF, 2 182,0 MF, and channel 16 on /VHF,

i) one can speak to the EUT from the TE,

j) one can speak to the TE from the EUT•.

C.6.2.3 Default distress alert attempt consistency tests

C.6.2.3.1 Purpose

This test checks that sending the default distress alert attempt always transmits the default values. It also tests the sending of the single frequency distress alert attempt on HF equipment (on VHF and MF, the latter test has already been performed).

C.6.2.3.2 Method of test and required results

From standby on the EUT, select the option to compose a distress alert•. Select any nature of distress except "undesignated"•. On HF equipment, select the single frequency method on 4 MHz•. Place the TE in standby. Send the distress alert attempt from the EUT• and verify that:

a) the distress button is required to send the distress alert attempt,

b) the enhanced position information is only sent on the 5th distress alert,

NOTE Inspect the individual characters of the distress alerts displayed on the TE and be sure the extension is only present on the 5th distress alert.

c) the nature of distress on the TE is that selected on the EUT,

d) on HF, the frequency of subsequent communication is 4 125,0 kHz on the EUT,

e) one can speak to the EUT from the TE,

f) one can speak to the TE from the EUT•.

Return the EUT• and TE to standby and use the distress button without entering parameters of the alert attempt via a menu or equivalent on the EUT to send the default distress alert attempt•. Verify that all the conditions listed under the default distress alert attempt are true.

C.6.2.4 Display

C.6.2.4.1 Purpose

This test checks that the required items of the automated procedure are properly displayed on the EUT.

C.6.2.4.2 Method of test and required results

This test requires visual inspection only of the EUT interface upon/after sending a distress alert attempt from the EUT without handling the equipment. Send the default distress alert attempt from the EUT• and verify that:

a) the EUT indicates that it is transmitting,

b) on HF, the frequency of transmission is indicated,

c) on HF, the frequencies used for transmitting the distress alert are indicated,

d) the remaining time to the next automated sending of the distress alert attempt is displayed,

e) the time to the next automated sending from the start of transmission is between 3,5 min and 4,5 min,

f) the interval is different each time when the test is repeated.

g) the five items of the sent distress information are displayed,

h) the operator is able to view the frequency of subsequent communication,

i) the EUT indicates that it is waiting for an acknowledgement after the distress alert attempt is sent,

j) the option to pause the countdown to the next distress alert attempt is available,

k) the option to cancel the distress alert is available,

l) on HF, the option to change the frequencies and method of the distress alert attempt is available,

m) on HF, the option to change the frequency of subsequent communication is available.

n) the option to resend the distress alert attempt is available.

C.6.2.5 Operator options prior to receiving distress alert acknowledgement

C.6.2.5.1 Purpose

This test checks the operator options previous to being acknowledged. The cancel option shall be tested in its own clause.

C.6.2.5.2 Method of test and required results

Continuing from the automated procedure of the previous test or after sending a default distress alert attempt from the EUT•, verify that:

a) the operator is able to pause the countdown to the next distress alert attempt•,

b) the operator is able to resume the countdown to the next distress alert attempt•,

c) the operato ris able to resend the distress alert attempt before the countdown has elapsed•,

d) the unacknowledged procedure cannot be terminated either by the operator or the equipment,

e) upon resending, the EUT indicates that it is retransmitting•,

f) the time to the next automated sending is reset to between 3,5 min and 4,5 min,

g) on HF, the operator is able to resend the multi frequency attempt on just 2 MHz, 8 MHz, and 12 MHz•,

h) on HF, the operator is unable to remove the 2 MHz and 8 MHz bands in the multi frequency attempt•,

i) on HF, the operator is able to resend the attempt using the single frequency method•,

j) on HF, the operator is able to change the frequency of subsequent communication•,

k) on HF, the operator is able to speak to the TE from the EUT on this new frequency•,

l) on HF, the operator is able to speak from the TE to the EUT on this new frequency.

NOTE It is assumed that the test personnel change the frequency of subsequent communication on the TE to that of the EUT for these checks.

C.6.2.6 Automatic resending of the distress alert attempt

C.6.2.6.1 Purpose

This test checks that the distress alert attempt is automatically resent at the proper time.

C.6.2.6.2 Method of test and required results

Continuing from the automated procedure of the previous test or after sending a default distress alert attempt from the EUT•, let the countdown to the automatic resending of the distress alert attempt elapse and verify that:

a) the operator is notified of the resending at least 10 s before the resending,

b) after the warning, the operator is able to easily pause and then resume the countdown•,

c) the distress alert attempt is automatically resent when the remaining time goes to zero,

d) the EUT indicates that it is transmitting,

e) the time to the next automated sending from the start of transmission is between 3,5 min and 4,5 min,

f) the TE receives the distress alerts.

C.6.2.7 Cancelling the distress alert

C.6.2.7.1 Purpose

These tests check that the sending distress automated procedure follows the proper distress alert cancellation protocol. Cancelling a distress alert involves sending the self-addressed distress alert acknowledgment followed by a voice cancel on the corresponding subsequent communications channel on all bands utilized by the distress alert attempts (on VHF, there is only the channel 70 DSC and channel 16 voice, and on MF there is only 2 187,5 DSC and 2 182 voice or 2 174,5 data). For the purposes of this set of tests, the "subsequent communication" cancel shall be referred to as a cancellation by voice, even though it may be a data transmission such as NBDP.

C.6.2.7.2 Method of test and required results

Send a default distress alert attempt from the EUT•. The received distress automated procedure shall start on the TE. Upon completion of the alert attempt on the EUT, select the option to cancel the alert attempt• and verify that:

a) a warning is displayed that one is trying to cancel the distress,

b) the channels that need to be cancelled are displayed (1 on VHF and MF, 6 on HF),

c) prior to selecting a channel to cancel, the operator is able to exit the cancel procedure•,

d) upon selection of a channel, it is indicated to the operator that the self-cancel is being sent,

e) the self-cancel is displayed and recognized on the TE,

f) the operator is informed when the EUT is ready to give the manual (voice) cancel,

g) the appropriate text for the manual (voice) cancel is provided,

h) the cancelled channel is indicated to the operator,

i) the operator is able to re-do the cancel operation on a band/channel•,

j) a warning is provided that the cancellation has already been done on this band/channel,

k) the operator's voice cancellation is heard on the TE,

l) on HF, the operator is required to cancel all channels before being able to exit the cancel•,

m) upon exiting the cancel, the sending distress automated procedure is acknowledged•.

C.6.2.8 Cancelling during the sending of a distress alert attempt

C.6.2.8.1 Purpose

This test makes sure that no distress alert attempt is stopped in the middle of a distress alert (a distress alert attempt consists of several distress alerts).

C.6.2.8.2 Method of test and required results

Place the TE and EUT• in standby. Send a default distress alert from the EUT•. If possible, on VHF, cancel• the distress alert attempt quickly enough to stop the distress alert attempt before all the constituent distress alerts of the distress alert attempt are sent. On HF, wait until at least one of the constituent distress alerts have been sent before cancelling•. The received distress automated procedure shall start on the TE. Verify that any distress alert started is sent to completion.

C.6.2.9 Handling distress alert acknowledgements

C.6.2.9.1 Purpose

This test checks that the sending distress automated procedure responds correctly to distress alert acknowledgements and that any auto timeout option that may be provided for the acknowledged sending distress automated procedure functions properly (recall that unacknowledged sending distress procedures SHALL NOT have an auto timeout option).

C.6.2.9.2 Method of test and required results

Set the EUT• and TE in standby and send a default distress alert attempt from the EUT• such that the received distress automated procedure is once again initiated on the TE. A distress acknowledgement shall then be sent from the TE. If the EUT provides an automatic timeout option for the acknowledged sending distress procedure, set the automated timeout• to a value that gives one enough time to complete the first 16 tests. Note that some manufacturers may provide more sophisticated timeout options in the equipment setup as well as more sophisticated operation options to control the automated timeout and respond to any warnings. These tests only address the minimum requirement of at least a 10 s aural and visual warning and a means of stopping the timeout. After the entire set of tests is completed, reset the timeout• on the EUT to "no timeout". Verify that:

a) a received distress alert acknowledgment message appears and corresponding alarm sounds,

b) the means to silence the alarm is displayed on the EUT,

c) the alarm can only be silenced manually,

d) the automatic resending of the alert attempt is terminated,

e) the EUT indicates that the distress event has been acknowledged,

f) the time since acknowledgment is displayed,

g) the MMSI of the sender is displayed,

h) on HF, the frequency of the acknowledgement is displayed,

i) on HF, the subsequent communication frequency is tuned to the band of the acknowledgement,

j) the operator can speak to the TE from the EUT•,

k) the operator can speak to the EUT from the TE,

l) the operator is no longer able to resend the distress alert attempt,

m) the option to pause the countdown (or elapsed time) is no longer available,

n) the option to cancel the alert is no longer available,

o) the option to terminate the sending distress automated procedure is now available,

p) the option to put the sending distress automated procedure on hold is now available,

q) if there is a timeout, a visual and aural warning appears at least 10 s before termination with the option to stop the termination.

C.6.2.10 Handling additional distress DSC messages pertinent to the automated procedure

C.6.2.10.1 Purpose

This test checks the handling of distress DSC messages pertinent to the sending distress automated procedure after acknowledgement.

C.6.2.10.2 Method of test and required results

The sending distress automated procedure on the EUT shall first be acknowledged by the TE. On HF, the acknowledgement shall be on 8 414,5 KHz which shall cause the EUT to be tuned to the 8 MHz band. Additional distress DSC messages shall then be sent from the TE concerning the same distress event being handled by the sending distress automated procedure on the EUT. The region of any area addressed DSC messages composed on the TE shall be specified to encompass the EUT. Verify that:

a) a repeat distress alert acknowledgment sounds the self-terminating alarm on the EUT,

b) on HF, a repeat distress acknowledgement (sent by the same station) sent on the 4 MHz band results in an automatic tuning of the subsequent communication frequency to the 4 MHz band•.

Change the MMSI of the TE and verify that:

c) on HF, a repeat distress acknowledgement sent on 6 MHz informs the operator of the request to change the subsequent communication frequency,

d) on HF, the frequency change is only performed if the operator requests it,

e) the procedure on the EUT is unaffected upon receiving an all ships or area distress relay,

f) a distress relay addressed to the EUT starts the received distress automated procedure,

g) the received distress automated procedure is initiated on hold.

C.6.2.11 Use of the distress button priority test

C.6.2.11.1 Purpose

This test checks the critically important feature that the distress button is able to send the default distress alert attempt regardless of the state of the EUT.

C.6.2.11.2 Method of test and required results

C.6.2.11.2.1 General

This test requires that the EUT be placed in as many as reasonable of its possible states. Instructions are given to place the EUT in one of these states. The default distress alert attempt is then started using the distress button. It is encouraged but not required that the EUT immediately terminate any ongoing automated procedures.

C.6.2.11.2.2 Case 1

From standby on the EUT•, select the option to send an individual DSC message of priority routine•. Enter/select the MMSI of the desired recipient•. Before the DSC message is actually sent, start the default distress alert attempt using the dedicated distress button• and verify that:

a) the three second countdown is followed by the two second steady alarm,

b) the received distress procedure is started on the TE,

c) the distress information on the TE is the default values and the sender is the EUT,

d) on HF, a multi frequency distress alert attempt is sent using all six bands.

C.6.2.11.2.3 Case 2

From standby, select the option to send an individual DSC message of priority routine•. Enter/select• the MMSI of the desired recipient and send the DSC message•. The sending non-distress DSC automated procedure shall start on the EUT. Start the default distress alert attempt using the dedicated distress button• and verify that:

a) the three second countdown is followed by the two second steady alarm,

b) the received distress procedure is started on the TE,

c) the distress information on the TE is the default values and the sender is the EUT,

d) on HF, a multi frequency distress alert attempt is sent using all six bands.

C.6.2.11.2.4 Case 3

Set the EUT into standby•. Send a distress alert attempt from the TE. After the received distress DSC automated procedure starts on the EUT•, return the TE to standby and start the default distress alert attempt on the EUT using the dedicated distress button• and verify that:

a) the three second countdown is followed by the 2-second steady alarm,

b) the received distress procedure is started on the TE,

c) the distress information on the TE is the default values and the sender is the EUT,

d) on HF, a multi frequency distress alert attempt is sent using all six bands.

C.6.2.11.2.5 Case 4

Set the EUT into standby•. Send an individual non-distress DSC message of priority urgency from the TE addressed to the EUT. After the received non-distress DSC automated procedure starts on the EUT, start the default distress alert attempt on the EUT using the dedicated distress button• and verify that:

a) the three second countdown is followed by the 2-second steady alarm,

b) the received distress procedure is started on the TE,

c) the distress information on the TE is the default values and the sender is the EUT,

d) on HF, a multi frequency distress alert attempt is sent using all six bands.

C.6.2.12 Distress alert composition tests

C.6.2.12.1 Purpose

This test checks the ability of the EUT to transmit the distress information correctly for different values of the nature of distress and from different positions on the globe.

C.6.2.12.2 Method of test and required results

Set the EUT• and TE into standby. Configure the EUT to be located in the Western half of the Southern Hemisphere•. Select the option to send a distress•. Choose "sinking" as the nature of distress•. Send the distress alert attempt• and verify that:

a) the dedicated distress button is required to send the alert attempt on the EUT,

b) a received distress automated procedure starts on the TE,

c) the position reported on the TE is that of the EUT,

d) the nature of distress is "sinking",

e) one is able to speak to the TE from the EUT•,

f) one is able to speak to the EUT from the TE.

NOTE If the positions were real, it is unlikely that communications would be possible, but in the laboratory setting the distances are not relevant.

Set the EUT• and TE into standby. Configure the EUT to be located in the Eastern half of the Southern Hemisphere•. Select the option to send a distress•. Choose "flooding" as the nature of distress•. Send the distress alert attempt• and verify that:

g) the dedicated distress button is required to send the alert attempt on the EUT,

h) a received distress automated procedure starts on the TE,

i) the position reported on the TE is that of the EUT,

j) the nature of distress is "flooding",

k) one is able to speak to the TE from the EUT•,

l) one is able to speak to the EUT from the TE.

Set the EUT• and TE into standby. Configure the EUT to be located in the Western half of the Northern Hemisphere•. Select the option to send a distress•. Choose "abandoning ship" as the nature of distress•. Send the distress alert attempt• and verify that:

m) the dedicated distress button is required to send the alert attempt on the EUT,

n) a received distress automated procedure starts on the TE,

o) the position reported on the TE is that of the EUT,

p) the nature of distress is "abandoning ship",

q) one is able to speak to the TE from the EUT•,

r) one is able to speak to the EUT from the TE.

Set the EUT• and TE into standby. Configure the EUT to be located in the Eastern half of the Northern Hemisphere•. Select the option to send a distress•. Choose "disabled/adrift" as the nature of distress•. Send the distress alert attempt• and verify that:

s) the dedicated distress button is required to send the alert attempt on the EUT,

t) a received distress automated procedure starts on the TE,

u) the position reported on the TE is that of the EUT,

v) the nature of distress is "disabled/adrift",

w) one is able to speak to the TE from the EUT•,

x) one is able to speak to the EUT from the TE.

Set the EUT• and TE into standby. Configure the EUT such that its position is unknown•. Select the option to send a distress•. Choose "grounding" as the nature of distress•. Send the distress alert attempt• and verify that:

y) the dedicated distress button is required to send the alert attempt on the EUT,

z) a received distress automated procedure starts on the TE,

aa) the position reported on the TE is that of the EUT (position is unknown),

bb) the nature of distress is "grounding",

cc) one is able to speak to the TE from the EUT•,

dd) one is able to speak to the EUT from the TE.

C.6.2.13 Remote initiating and cancelling sending distress procedure tests

C.6.2.13.1 Purpose

This test checks that it is possible to initiate and control the sending distress automated procedure from a remote controller using the sentences described in Annex N.

C.6.2.13.2 Method of test and required results

The test is executed via the remote interface following the guidelines in B.8.3. The test sequence shall be tailored to the current configuration of the EUT.

Any operator options selected by the test personnel and entered via the remote interface or HMI in combination shall work seamless.

C.7 Receiving distress automated procedure

C.7.1 Receiving distress automated procedure requirements

C.7.1.1 Procedure

The receiving distress automated procedure is initiated either by the reception of the first multi-station distress DSC message of a distress event, the reception of the first individually addressed distress DSC message of a distress event, or the sending of a DROBOSE. A schematic of the automated procedure is given in Figure C.2.

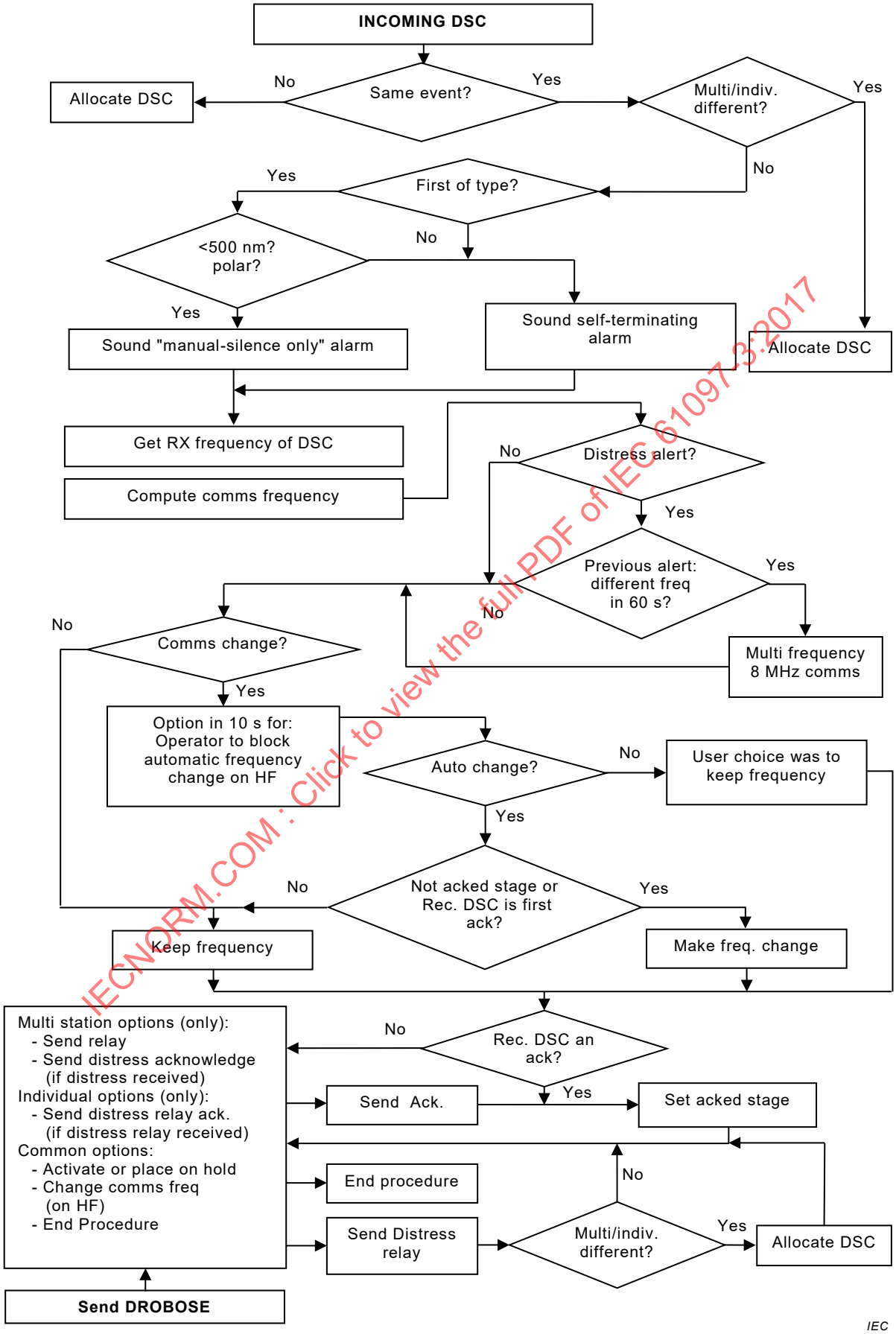


Figure C.2 – Receiving distress procedure

C.7.1.2 Tasks

The EUT shall follow the received distress automated procedure as shown in Figure C.2 complying with the automated procedures as defined in Recommendation ITU-R M.493-14:2015, Annex 4.

The received distress automated procedure shall handle the following events:

a) the sounding of the appropriate alarms for DSC messages pertinent to the procedure,
b) allocating all DSC messages pertinent to the station but not the procedure to their own procedures or initiating their own procedure,
c) on HF, keeping track of the frequencies of reception,
d) on HF, appropriate tuning to the frequency and mode of subsequent communication and providing at least a 10 s warning if that tuning involves a change from the current tuning and the option to pause the tuning,
e) on HF, scanning all 6 distress frequencies,
f) watching for the distress event acknowledgement and recognizing the self-cancel,
g) providing the operator with the option to:
    1) send a relay,
    2) send a distress acknowledgement (when and if a distress alert has been received),
    3) send a distress relay acknowledgement (when and if a distress relay has been received),
    4) on HF, change the frequency of subsequent communication,
    5) ability to activate or place the procedure on hold,
    6) end the procedure.

C.7.1.3 Display

During the received distress automated procedure, the EUT shall display or make available to the operator the following items and/or information:

a) the fact one is engaged in receiving a distress,
b) the elapsed time since the procedure started (prior to acknowledgment),
c) the elapsed time since acknowledgement (after acknowledgment),
d) indicating whether the procedure is on hold or is active,
e) the distress information (MMSI of vessel in distress, nature, position, time of position, comms) and the distance in nautical miles to the vessel in distress,
f) the type (alert, relay, alert acknowledgement, relay acknowledgement), sender, and intended destination (individual, area, group, all ships) of the latest received DSC message,
g) at least a 10 s warning before any automated change in communications frequencies are invoked in case engaged in traffic,
h) the frequency of subsequent communication (HF only),
i) the frequencies on which the DSC messages have been received (HF only),
j) displaying the valid user options,
k) the ability to display information about the history of at least the received DSC messages pertinent to the procedure,
l) the sub-stages of the procedure, which are:
    1) waiting to send acknowledgement,
    2) transmitting
    3) waiting for acknowledgement,

4) cancelled,

5) acknowledged

6) waiting for a free channel.

At top level, the elapsed time, the stage of the automated procedure, and operator options shall be displayed.

C.7.1.4 Handling received DSC messages

DSC messages pertinent to the station but not the procedure shall be allocated to the appropriate automated procedure or initiate their own automated procedure on hold.

DSC messages that are pertinent to the procedure are all DSC messages concerning the same distress event. If the MMSI is unknown, DSC messages that are pertinent to the procedure are all DSC messages that have the same distress information. However, individually addressed DSC messages shall initiate their own automated procedures on hold if engaged in a received distress procedure handling multi-station (for example, all ships, area) addressed DSC messages or vice versa.

In the case of an event triggered by MOB devices, then multiple alerts from different MOB devices shall be handled as one event and within the same automated procedure.

C.7.1.5 Alarms

In a given procedure, only the reception of the initial DSC message and the DSC message that first acknowledges the procedure shall sound an alarm unique to the DSC message type (with the two-tone sound reserved for the distress alert or relay if it initiates the procedure) which shall be manually silenced.

All subsequent examples of the DSC messages shall only sound the self-terminating alarm.

C.7.1.6 Determining subsequent communications

On VHF, it is always channel 16.

On MF, it is either 2 182,0 kHz (voice) or 2 174,5 kHz (data).

On HF, the frequency band is given by:

a) the frequency band of a single frequency distress alert attempt, relay, distress alert acknowledgement, and relay acknowledgment,

b) the 8 MHz band if a multi-frequency distress alert attempt is received. A distress alert attempt is considered to be multi-frequency if two consecutive distress alerts are received on two different frequencies within a period of one minute. This rule applies even if neither of the two distress alerts were received on the 8 MHz band,

c) the channel set is given by the mode of subsequent communication,

NOTE The band of subsequent communication given in (c) is used as the default DSC band for any subsequent distress DSC messages sent by the operator.

C.7.1.7 Automated tuning

The tuning to the subsequent communication frequencies as determined in C.7.1.6 shall occur automatically upon reception of a distress DSC message in the following manner:

a) on HF, the operator shall have a 10 s warning prior any tuning if the new subsequent frequency is different from the current. The operator shall be able to pause the tuning if engaged in traffic or accept the tuning,

b) prior to acknowledgement, the tuning to the new frequency shall occur in the absence of any operator action. If automatic tuning function has been switched off, the radio shall remain on the current channel or frequency and prompt the user to accept the channel change. There shall be no change until manually accepted.

c) after acknowledgment, the tuning to the new frequency shall only occur if the operator requests it (note that the procedure is not yet acknowledged until after the first acknowledgement starts the alarm).

C.7.1.8 Acknowledgments

The procedure handling all-ships and area distress DSC messages and distress alerts shall be considered acknowledged upon reception of the first distress alert acknowledgement or all ships distress relay acknowledgement.

A distress alert acknowledgement sent by the vessel in distress shall be recognized as a self-cancel.

The procedure handling a received individually addressed distress relay shall be considered acknowledged when the operator first transmits the corresponding individually addressed distress relay acknowledgement to the sender.

The procedure handling a distress relay sent to an individual station shall be considered acknowledged when the first corresponding individually addressed distress relay acknowledgement is received from that station.

C.7.1.9 Sending relays and acknowledgments

On HF, the operator shall always have the option to send a distress relay to coast station.

The operator shall not have the option to send a distress relay acknowledgment until a distress relay has been received.

The operator shall not have the option to send a distress alert acknowledgment until a distress alert has been received.

Once the option to send any of the distress DSC messages (distress relay, distress alert acknowledgement, distress relay acknowledgement) referenced above becomes available, the options shall remain available until the procedure is terminated.

The procedure shall automatically compose the distress DSC messages referenced above except:

a) the distress relay where the operator shall have the option to select the addressing mode and address where the default shall be individual and on MF/HF the communications mode, and

b) in a procedure handling an individually addressed relay or relay acknowledgement, the operator shall have the option to send an all ships relay acknowledgement in addition to the default individual relay acknowledgement even though this DSC message is typically forbidden to be sent by ship stations.

NOTE It is only possible to send an individually addressed distress relay acknowledgement upon reception of an individually addressed relay.

On HF, the operator shall have the option to override the default band of the DSC message and send the distress DSC messages (distress relay, distress alert acknowledgement, distress relay acknowledgement) referenced above on any one of the six distress channels.

C.7.1.10 Termination

The procedure can be terminated manually or by the automated timeout. At least ten seconds prior to automated termination, a visual and discrete aural warning shall be displayed with the option to stop the automatic termination.

If the procedure is terminated manually by the user, then integrated equipment may revert to the channel or frequency that was previously selected before the DSC procedure.

C.7.1.11 Warnings

The procedure shall provide warnings for those reasons provided in Recommendation ITU-R M.493-14:2015, Annex 4. The operator shall have the option to go back to the stage of the procedure where the action was taken that caused the warning.

C.7.2 Receiving distress automated procedure tests

NOTE Tests and set ups marked with a raised circle (•) are actions that an operator will most likely have to perform in real life. Thus, these items are expected to be easy to perform. The test personnel are to report any difficulties or frustrations in performing these actions.

C.7.2.1 Normal sequence of the received distress automated procedure tests

C.7.2.1.1 Purpose

This test checks the behaviour of the automated procedure through the "normal" sequence of receiving a distress alert attempt, perhaps a repeat of the attempt and a few distress relays, and then a distress alert acknowledgement.

C.7.2.1.2 Method of test and required results

Make sure that the position on the TE has enhanced resolution in fractional minutes. Send the default distress alert attempt from the TE using the distress button and verify that:

a) the EUT sounds the two tone alarm,

b) the reason for and means to silence the alarm is displayed,

c) the alarm can only be silenced manually,

d) the distress information and distance to the vessel in distress is displayed and correct,

e) the position contains the enhanced resolution data (fractional minutes or seconds of lat and lon),

f) the sender, intended recipients, and DSC message type are displayed,

g) the frequency of subsequent communication is channel 16 (VHF), 2 182,0 kHz (MF), 8 219,0 kHz (HF),

h) the elapsed time since receiving the first alert is displayed,

i) HF: the frequencies of reception are displayed or available to the operator,

j) the operator is informed that the procedure is waiting for an acknowledgement,

k) the option to send a distress relay is available,

l) upon selection of the option, a warning is provided that three minutes have not elapsed yet•,

m) the option to send a distress alert acknowledgement is available,

n) the option to send a distress relay acknowledgement is NOT available,

o) the option to activate/place the procedure on hold is available,

p) the option to terminate the procedure is available,

q) the history of at least the received DSC messages reveals that the following have been received: HF: alert 6, alert ack 0, relay 0, relay ack 0; MF/VHF: alert 5, alert ack 0, relay 0, relay ack 0, and that on HF, DSC messages have been received on all six frequencies•,

r) the elapsed time, stage, and operator options are visible at top level,

s) upon selection of the option to terminate the procedure, a warning is provided that one is terminating the procedure•,

t) HF: the option to change the frequency of subsequent communication is available

u) one can speak to the EUT from the TE,

v) one can speak to the TE from the EUT•.

Change the position on the TE and then resend the distress alert attempt from the TE. Verify that:

w) the reason for and means to silence the self-terminating alarm are displayed,

x) the alarm self-terminates,

y) the history of at least the received DSC messages reveals that the following have been received: HF: alert 12, alert ack 0, relay 0, relay ack 0; MF/VHF: alert 10, alert ack 0, relay 0, relay ack 0, and that on HF, DSC messages have been received on all six frequencies,•

z) the changed position is displayed in the distress information on the EUT.

Resend the attempt from the TE as a single frequency attempt on 2 MHz. Verify that:

aa) the means to silence the self-terminating alarm is displayed,

bb) the alarm self-terminates,

cc) there is a 10 s warning and countdown before the automated tuning changes frequency,

dd) the option to pause/resume, invoke, or block the frequency change is available,

ee) the operator has the ability to remain engaged on the current traffic channel•,

ff) in the absence of operator action, the frequency automatically changes,

gg) the automatic frequency changes to the 2 MHz band.

Resend the single frequency attempt from the TE on 4 MHz. Verify that:

hh) one is able to pause/resume, invoke, or block the frequency change•,

ii) the history of at least the received DSC messages reveals that the following have been received: alert 22, alert ack 0, relay 0, relay ack 0, and that on HF, DSC messages have been received on all six frequencies•.

Reconfigure the TE MMSI and send an area or all ships distress relay concerning this event (HF: on 6 MHz). Verify that:

jj) the EUT sounds the self-terminating alarm,

kk) the reason for and means to silence the alarm is displayed,

ll) the alarm self-terminates,

mm) the sender, intended recipients, and DSC message type are displayed,

nn) HF: a warning appears that there is a subsequent communication frequency change,

oo) HF: the frequency of subsequent communication automatically tunes to the 6 MHz band,

pp) the option to send a distress relay acknowledgement is NOT available,

qq) the history of at least the received DSC messages reveals that the following have been received: HF: alert 22, alert ack 0, relay 1, relay ack 0; MF/VHF: alert 10, alert ack 0, relay 1, relay ack 0, and that on HF, DSC messages have been received on all six frequencies•,

rr) the elapsed time, stage, and operator options are visible at top level.

Reconfigure the TE MMSI and send an area or all ships distress relay concerning this event (HF: on 12 MHz). Verify that:

ss) the EUT sounds the self-terminating alarm,

tt) HF: a warning appears that there is a subsequent communication frequency change,

uu) HF: the frequency of subsequent communication automatically tunes to the 12 MHz band.

Reconfigure the TE MMSI and send a distress alert acknowledgement (HF: on 16 MHz). Verify that:

vv) the EUT sounds the distress alert acknowledgement alarm,

ww) HF: a warning appears that there is a subsequent communication frequency change,

xx) HF: the frequency of subsequent communication automatically tunes to the 16 MHz band,

yy) the operator is informed that the procedure (distress event) has been acknowledged,

zz) the sender, intended recipients, and DSC message type are displayed,

aaa) the options to send a distress alert relay and distress alert acknowledgement are still available.

bbb) the option to send a distress alert relay acknowledgement is NOT available,

ccc) the option to activate/place the procedure on hold is available,

ddd) the history of at least the received DSC messages reveals that the following have been received: HF: alert 22, alert ack 1, relay 2, relay ack 0; MF/VHF: alert 10, alert ack 1, relay 2, relay ack 0, and that on HF, DSC messages have been received on all six frequencies●,

eee) the time since acknowledgement, stage, and operator options are visible at top level.

Send a second distress alert acknowledgement from the TE (HF: on 8 MHz). Verify that:

fff) the EUT sounds the self-terminating alarm,

ggg) HF: a warning appears that there is a subsequent communication frequency change,

hhh) HF: the frequency of subsequent communication remains on the 16 MHz band,

iii) the history of at least the received DSC messages reveals that the following have been received: HF: alert 22, alert ack 2, relay 1, relay ack 0; MF/VHF: alert 10, alert ack 2, relay 1, relay ack 0, and that on HF, DSC messages have been received on all six frequencies●.

C.7.2.2 Distress event self-cancel recognition and auto timeout tests

C.7.2.2.1 Purpose

This test checks that the automated procedure recognizes the distress event self-cancel and that the automated timeout option functions properly.

C.7.2.2.2 Method of test and required results

Reset the EUT into standby●. Set the automated timeout of received distress procedures on the EUT● to a value that gives one enough time to complete the first ten tests. Note that some manufacturers may provide more sophisticated timeout options in the equipment setup as well as more sophisticated operation options to control the automated timeout and respond to any warnings. These tests only address the minimum requirement of at least a 10 s aural and visual warning and stopping the timeout. After the entire set of tests is completed, reset the timeout on the EUT to "no timeout"●. Send the default distress alert attempt from the TE. Silence the alarms on the EUT●. When the TE is finished sending the distress alert attempt, send the self-addressed distress alert acknowledgement and verify that:

a) the EUT sounds the distress acknowledgement alarm,

b) the reason for and means to silence the alarm is displayed,

c) the alarm can only be silenced manually,

d) the sender, intended recipients, and DSC message type are displayed,

e) the procedure indicates it is acknowledged,

f) the acknowledgement is recognized as a self-cancel,

g) the history of at least the received DSC messages reveals that the following have been received: HF: alert 6, alert ack 1, relay 0, relay ack 0; MF/VHF: alert 5, alert ack 1, relay 0, relay ack 0, and that on HF, DSC messages have been received on all six frequencies●,

h) the time since acknowledgement, stage, and operator options are visible at top level,

i) one can speak to the EUT from the TE,

j) one can speak to the TE from the EUT●.

k) a visual and aural warning appears at least 10 s before termination with the option to stop the termination.

C.7.2.3 Received distress automated procedure started by a distress relay tests

C.7.2.3.1 Purpose

This test checks the setup of the automated procedure when the first received distress DSC message of a distress event is a distress relay.

C.7.2.3.2 Method of test and required results

Reset the EUT to standby●. From the TE, send a distress relay on behalf of someone else addressed to an area (MF/HF) or all ships (VHF). Provide parameters for all five components of the distress information, and on MF/HF send the distress relay on 2 MHz and verify that:

a) the EUT sounds the two-tone alarm,

b) the reason for and means to silence the alarm is displayed,

c) the alarm can only be silenced manually,

d) the distress information and distance to the vessel in distress is displayed and correct,

e) the position contains the enhanced resolution data (fractional minutes of lat and lon),

f) the sender, intended recipients, and DSC message type is displayed,

g) the frequency of subsequent communication is channel 16 (VHF) 2 182,0 kHz (MF/HF),

h) the elapsed time since receiving the relay is displayed,

i) HF: the frequency of reception is displayed or available to the operator,

j) the operator is informed that the procedure is waiting for an acknowledgement,

k) the option to send a distress relay is available,

l) the option to send a distress alert acknowledgement is NOT available,

m) the option to send a distress relay acknowledgement is NOT available,

n) the option to activate/place the procedure on hold is available,

o) the option to terminate the procedure is available,

p) the history of at least the received DSC messages reveals that the following have been received: HF: alert 0, alert ack 0, relay 1, relay ack 0; MF/VHF: alert 0, alert ack 0, relay 1, relay ack 0, and that on HF, DSC messages have been received on the 2 MHz band●□

q) the elapsed time, stage, and operator options are visible at top level,

r) one can speak to the EUT from the TE,

s) one can speak to the TE from the EUT●,

t) MF/HF: the option to change the frequency of subsequent communication is available.

C.7.2.4 Received distress automated procedure started by a distress alert acknowledgement tests

C.7.2.4.1 Purpose

This test checks the setup of the automated procedure when the first received distress class DSC message of a distress event is a distress alert acknowledgement.

C.7.2.4.2 Method of tests and required results

Reset the EUT to standby•. From the TE, send a distress alert acknowledgement and on HF send the acknowledgement on 12 MHz and verify that:

a) the EUT sounds the distress alert acknowledgement alarm,
b) the reason for and means to silence the alarm is displayed,
c) the alarm can only be silenced manually,
d) the distress information and distance to the vessel in distress is displayed and correct,
e) the position contains the enhanced resolution data (fractional minutes of lat and lon),
f) the sender, intended recipients, and DSC message type is displayed,
g) the frequency of subsequent communication is channel 16 (VHF), 2 182,0 kHz (MF), 12 290,0 kHz (HF),
h) the elapsed time since being acknowledged is displayed,
i) HF: the frequency of reception is displayed or available to the operator,
j) the operator is informed that the procedure is acknowledged,
k) the option to send a distress relay is available,
l) the option to send a distress alert acknowledgement is unavailable,
m) the option to send a distress relay acknowledgement is unavailable,
n) the option to activate/place the procedure on hold is available,
o) the option to terminate the procedure is available,
p) the history of at least the received DSC messages reveals that the following have been received: HF: alert 0, alert ack 1, relay 0, relay ack 0; MF/VHF: alert 0, alert ack 1, relay 0, relay ack 0, and that on HF, DSC messages have been received on the 12 MHz band•,
q) the time since acknowledgement, stage, and operator options are visible at top level,
r) one can speak to the EUT from the TE,
s) one can speak to the TE from the EUT•,
t) HF: the option to change the frequency of subsequent communication is available.

C.7.2.5 Received distress automated procedure started by an individually addressed distress relay tests

C.7.2.5.1 Purpose

This test checks the setup of the automated procedure when the first received distress DSC message of a distress event is a distress relay addressed only to the station.

C.7.2.5.2 Method of tests and required results

Reset the EUT to standby•. From the TE, send a distress relay addressed to the EUT. Place information in all of the distress message elements (MMSI of vessel in distress, nature of distress, position, time of position, communication type). On HF, use the 6 MHz band. Verify that:

a) the EUT sounds the distress relay alarm,

b) the reason for and means to silence the alarm is displayed,

c) the alarm can only be silenced manually,

d) the option to acknowledge the individual DSC message is presented (do not acknowledge),

e) the distress information and distance to the vessel in distress is displayed and correct,

f) the position contains the enhanced resolution data (fractional minutes or seconds of lat and lon),

g) the sender, intended recipient, and DSC message type is displayed,

h) the frequency of subsequent communication is channel 16 (VHF), 2 182,0 kHz (MF), 6 215,0 kHz (HF),

i) the elapsed time since receiving the initial relay is displayed,

j) HF: the frequency of reception is displayed or available to the operator,

k) the operator is informed that the DSC message needs to be acknowledged,

l) the option to send a distress relay is available,

m) the option to send a distress alert acknowledgement is unavailable,

n) the option to send a distress relay acknowledgement is available,

o) the option to activate/place the procedure on hold is available,

p) the option to terminate the procedure is available,

q) HF: the option to change the frequency of subsequent communication is available,

r) the history of at least the received DSC messages reveals that the following have been received: HF: alert 0, alert ack 0, relay 1, relay ack 0; MF/VHF: alert 0, alert ack 0, relay 1, relay ack 0, and that on HF, DSC messages have been received on the 6 MHz band•,

s) the elapsed time, stage, and operator options are visible at top level.

Select the option to send a relay acknowledgement on the EUT•. Verify that:

t) no warning is given when the relay acknowledgement option is selected,

u) the default addressing mode is "individual" and the MMSI is that of the sender,

v) one is unable to edit the destination MMSI address,

w) the option to send an "all ships" acknowledgement is present,

x) HF: the default frequency band is that of the current subsequent communications,

y) HF: the currently used frequency band is indicated (6 MHz),

z) HF: the operator is able to select from among any of the six frequency bands•.

Send the relay acknowledgement from the EUT• (HF: on the 16 MHz band)•. Verify that:

aa) the received distress DSC message procedure is acknowledged on the TE,

bb) the distress relay acknowledgment is received on the frequency selected,

cc) it is indicated on the EUT that the event has been acknowledged,

dd) the history of at least the received DSC messages reveals that the following have been received: HF: alert 0, alert ack 0, relay 1, relay ack 0; MF/VHF: alert 0, alert ack 0, relay 1, relay ack 0, and that on HF, DSC messages have been received on the 6 MHz and 16 MHz bands)•,

ee) the time since acknowledgement, stage, and operator options are visible at top level,

ff) one can speak to the EUT from the TE,

gg) one can speak to the TE from the EUT•.

C.7.2.6 Received distress automated procedure started by sending a DROBOSE tests

C.7.2.6.1 Purpose

This test checks the setup of the automated procedure on the EUT when the EUT sends a distress relay on behalf of someone else. Recall that the sending of this distress DSC message is functionally equivalent to receiving a distress alert and then relaying it.

C.7.2.6.2 Method of tests and required results

Reset the EUT to standby•. Send a DROBOSE from the EUT• using the default values except for position and time of position. On HF, use the 4 MHz band•. Verify that:

a) the received distress automated procedure is started on the TE,
b) the distress information and DSC message type is received on the TE correctly,
c) the received distress automated procedure also starts on the EUT,
d) there is no alarm sounded by the EUT,
e) the distress information and distance to the vessel in distress is displayed and correct,
f) the sender, intended recipients, and DSC message type is displayed,
g) the frequency of subsequent communication is channel 16 (VHF), 2 182,0 kHz (MF), 4 125,0 kHz (HF),
h) the elapsed time since sending the initial relay is displayed,
i) HF: the frequency of sending is displayed or available to the operator•,
j) the option to send a distress relay is available,
k) the option to send a distress alert acknowledgement is NOT available,
l) the option to send a distress relay acknowledgement is NOT available,
m) the option to activate/place the procedure on hold is available,
n) the option to terminate the procedure is available,
o) HF: the option to change the frequency of subsequent communication is available,
p) it is indicated on the EUT that the event is waiting for an acknowledgement,
q) the history of at least the received DSC messages reveals that the following have been received: HF: alert 0, alert ack 0, relay 0, relay ack 0; MF/VHF: alert 0, alert ack 0, relay 0, relay ack 0, and on HF, that the 4 MHz band has been used•,
r) the elapsed time, stage, and operator options are visible at top level,
s) one can speak to the EUT from the TE,
t) one can speak to the TE from the EUT•.

C.7.2.7 Sending a distress relay tests

C.7.2.7.1 Purpose

This test checks that the automated procedure composes the distress relay correctly and presents the correct information and selection options when the operator chooses to send a relay.

C.7.2.7.2 Method of tests and required results

Reset the EUT to standby•. From the TE, send a distress alert attempt with "nature of distress" as sinking. On HF, use the multi frequency method including the 2 MHz, 8 MHz, and 12 MHz bands. Silence the alarms on the EUT• and wait until all the alerts of the distress alert attempt are sent. Place the TE back in standby. On the EUT, select the option to send a distress relay•. Verify that:

a) a warning is displayed that it is too soon to send a relay if three minutes have not elapsed,

b) after selecting the option, the default addressing mode is individual and default MMSI is invalid,•

c) the option to use all ships (VHF) or area (MF/HF) addressing is available,

d) the operator is unable to edit the distress information except the comms mode on HF,

e) the individually addressed relay is unable to be sent with no MMSI entry,•

f) HF: the default frequency band is that of the current subsequent communications (8 MHz),

g) HF: the currently used frequency bands are indicated (2, 8, and 12)•,

h) HF: the operator is able to select from among any of the six frequency bands•.

Select either area (MF/HF) or all ships (VHF) addressing• and send the relay•. Verify that:

i) a warning is displayed stating one shall try to send the relay to a coast station,

j) send anyways• and the received distress procedure is started on the TE,

k) the distress information and DSC message type displayed on the TE is correct,

l) HF: the relay is received on the frequency selected by the EUT,

m) one can speak to the EUT from the TE,

n) one can speak to the TE from the EUT•.

There is a big difference between "invalid" and "unknown" MMSI. "Unknown" is an acceptable value by Recommendation ITU-R M.493 (coded by five 126's) but it shall never be transmitted in this case. The software shall recognise the default entry as unacceptable to send and shall not allow the sending until an acceptable 9-digit value is entered.

C.7.2.8 Sending a distress alert acknowledgment tests

C.7.2.8.1 Purpose

This test checks that the automated procedure composes the distress alert acknowledgement correctly, and when the operator chooses to send a distress alert acknowledgment the only selection option available is the HF band of the acknowledgment.

C.7.2.8.2 Method of tests and required results

Reset the EUT to standby•. From the TE, send the default distress alert attempt. Silence the alarms on the EUT• and wait until all the alerts of the distress alert attempt are sent. On the EUT, select the option to send a distress alert acknowledgment•. Verify that:

a) a warning is displayed that it is too soon to send a distress alert acknowledgment if five minutes have not elapsed, and/or

b) a warning is displayed that the acknowledgment shall only be sent by coast stations,

c) VHF: after selecting the option, the acknowledgment is sent•,

d) HF: after selecting the option, the operator is unable to change any parameters of the acknowledgment•,

e) HF: the default frequency band is that of the current subsequent communications (8 MHz),

f) HF: the currently used frequency bands are indicated (all 6),

g) HF: the operator is able to select from among any of the six frequency bands•,

Send the distress alert acknowledgement (HF: on 16 MHz)•. Verify that:

h) the sending distress procedure is acknowledged on the TE,

i) the distress alert acknowledgment is received on the frequency selected by the EUT,

j) the EUT indicates that the event has been acknowledged,

k) one can speak to the EUT from the TE,

l) one can speak to the TE from the EUT•,

m) a warning is given that the event has already been acknowledged when trying to send a relay•,

n) a warning is given that the event has been acknowledged when trying to resend the distress ack•.

C.7.2.9 Sending a distress relay individual acknowledgment tests

C.7.2.9.1 Purpose

This test checks that the automated procedure composes the distress relay acknowledgement correctly and when the operator chooses to send a distress relay acknowledgment.

C.7.2.9.2 Method of test and required results

Reset the EUT to standby•. From the TE, send an individual distress relay to the EUT. On HF, use the 8 MHz band. Silence the alarm on the EUT•. On the EUT, select the option to send a distress relay acknowledgment•. Verify that:

a) VHF: after choosing to continue, the acknowledgment is sent•,

b) HF: after choosing to continue, the operator is unable to change any parameters of the acknowledgment•,

c) HF: the default frequency band is that of the current subsequent communications (4 MHz),

d) HF: the currently used frequency band is indicated,

e) HF: the operator is able to select from among any of the six frequency bands•.

Send the relay acknowledgement on 8 MHz•. Verify that:

f) the procedure is acknowledged on the TE,

g) the relay acknowledgement is received on the frequency selected by the EUT,

h) it is indicated on the EUT that the event has been acknowledged•,

i) one can speak to the EUT from the TE•,

j) one can speak to the TE from the EUT•,

k) a warning is given that the event has already been acknowledged when trying to send a relay•,

l) a warning is given that the event has been acknowledged when trying to resend the relay acknowledgment•.

C.7.2.10 Alarm restrictions (MF/HF only) tests

C.7.2.10.1 Purpose

This test checks that distress DSC messages that satisfy certain criteria do not sound an alarm that shall be manually silenced. These criteria are when the vessel in distress is further than 500 NM from the receiving station and between 70° South and 70° North.

C.7.2.10.2 Method of tests and required results

Reset the EUT to standby•. Configure the TE to be further than 500 NM from the EUT. From the TE, send a distress alert attempt with "nature of distress" as sinking. On HF, use the single frequency method on the 8 MHz band. Verify that:

a) the received distress procedure starts on the EUT,

b) the two tone alarm sounds but self-terminates,

c) the means to silence the alarm is displayed,

d) the distress information and distance to the vessel in distress is displayed/available and correct,

e) one can speak to the EUT from the TE,

f) one can speak to the TE from the EUT•.

Reset the EUT to standby•. Configure the TE to be further than 500 nm from the EUT but north of 70° North or south of 70° South. From the TE, send a distress alert attempt with "nature of distress" as "flooding". On HF, use the single frequency method on the 12 MHz band. Verify that:

g) the received distress procedure starts on the EUT,

h) the two tone alarm sounds,

i) the reason for and means to silence the alarm is displayed,

j) the alarm can only be silenced manually,

k) the distress information and distance to the vessel in distress is displayed/available and correct,

l) one can speak to the EUT from the TE,

m) one can speak to the TE from the EUT•.

Reset the EUT to standby•. From the TE, send a distress alert attempt with "nature of distress" as "abandoning ship" but no position information. On HF, use the single frequency method on the 6 MHz band. Verify that:

n) the received distress procedure starts on the EUT,

o) the two tone alarm sounds,

p) the means to silence the alarm is displayed,

q) the distress information is displayed/available and correct,

r) the distance is unknown,

s) one can speak to the EUT from the TE,

t) one can speak to the TE from the EUT•.

C.7.2.11 Remote controlling receiving distress procedure tests

C.7.2.11.1 Purpose

This test checks that it is possible to control the receiving distress automated procedure from a remote controller using the sentences described in Annex N.

C.7.2.11.2 Method of tests and required results

The test is executed via the remote interface following the guidelines in B.8.4. The test sequence shall be tailored to the current configuration of the EUT.

Any operator options selected by the test personnel and entered via the remote interface or HMI in combination shall work seamless.

C.8 Sending non-distress automated procedure

C.8.1 Sending non-distress automated procedure requirements

C.8.1.1 Procedure

The sending non-distress automated procedure results when the operator selects to transmit a DSC message that does not contain the distress information. It also results when an

acknowledgement to a sending non-distress automated procedure that has been prematurely terminated is received ("an acknowledgement one quit waiting for").

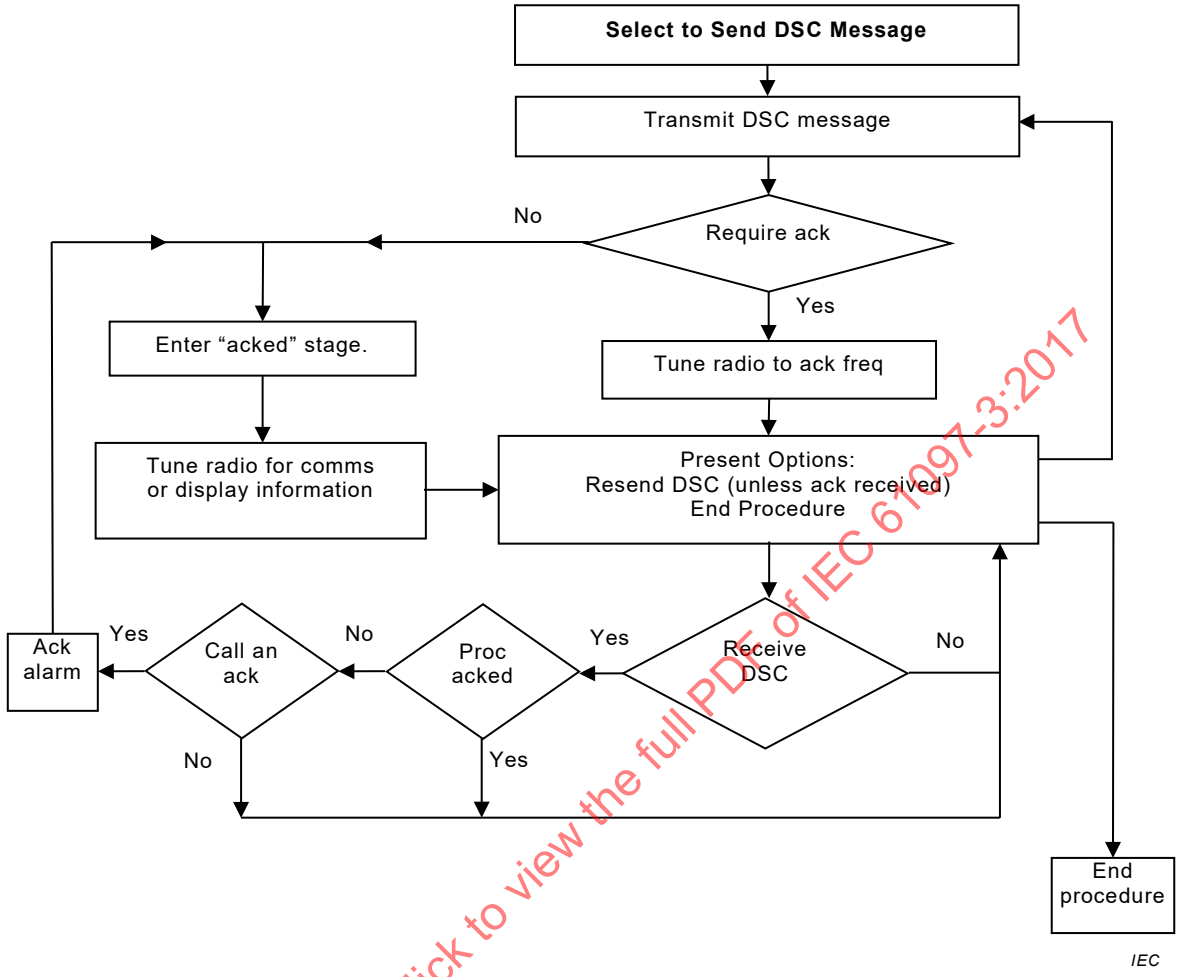


Figure C.3 – Sending non-distress automated procedure

C.8.1.2 Tasks

The EUT shall follow the sending distress automated procedure as shown in Figure C.3 complying with the automated procedures as defined in Recommendation ITU-R M.493-14:2015, Annex 4.

The sending non-distress automated procedure shall handle the following events:

a) prior to acknowledgement:
   1) the transmission of the composed/selected DSC message,
   2) if the DSC message demands no acknowledgment, setting the procedure to acknowledged,
   3) if the DSC message demands an acknowledgement:
      i) on HF, tuning the general receiver to the frequency of the DSC acknowledgement if required,
      ii) waiting for the acknowledgement and alarming when received,
      iii) allocating any received DSC message not pertinent to the procedure to their appropriate procedure or initiating their own procedure on hold,
      iv) providing the valid operator options which are:

- resend the initial DSC message,
- activate or place the procedure on hold,
- terminate the procedure.

b) upon reception of the acknowledgement or being set to acknowledged:

1) tuning the general receiver and transmitter to the frequency of subsequent communication or displaying the requested information,
2) ignoring any received DSC message pertinent to the procedure since it is a duplicate,
3) allocating any received DSC message not pertinent to the procedure to the appropriate procedure or initiating their own procedure on hold, and
4) providing the valid operator options which are:
   - resend the initial DSC message if it requires no acknowledgement,
   - activate or place the procedure on hold,
   - terminate the procedure.

C.8.1.3 Display

During the sending non-distress automated procedure, the EUT shall display or make available to the operator the following items and/or information:

a) the fact one is engaged in sending a non-distress DSC message,
b) the elapsed time since sending the initial DSC message (prior to acknowledgement),
c) the elapsed time since being acknowledged (once acknowledged or considered acknowledged),
d) the information content of the initial DSC message sent which is:
   1) the type of DSC message (description),
   2) the priority of the DSC message,
   3) the destination,
   4) the means of subsequent communication or purpose,
   5) the frequencies of subsequent communication if any,
   6) on HF, the frequency of the sent DSC message,
   7) whether or not the DSC message requires an acknowledgement.
e) if acknowledged, the information content of the acknowledgement which is:
   1) the type of acknowledgment (description),
   2) the priority of the DSC acknowledgement,
   3) the sender,
   4) to whom the DSC acknowledgement was sent,
   5) the means of subsequent communication or the requested information,
   6) if appropriate, the mode/frequency change or unable to comply and reason,
   7) the frequencies of subsequent communication if any,
   8) on HF, the frequency of the acknowledgement.
f) the valid operator options, and
g) the sub-stages of the procedure which are
   1) waiting for free channel,
   2) transmitting,
   3) waiting for acknowledgement,
   4) linked for communications,

5) procedure done (no more to do).

At top level, the elapsed time, the stage of the automated procedure, and operator options shall be displayed.

C.8.1.4 Handling received DSC messages

DSC messages pertinent to the station but not the procedure shall be allocated to the appropriate automated procedure or initiate their own automated procedure on hold.

DSC messages that are pertinent to the procedure are acknowledgements to the initial DSC message.

C.8.1.5 Alarms

The reception of the first acknowledgement pertinent to the procedure shall sound the appropriate acknowledgement alarm as specified in Tables H.1 and H.2.

Any subsequent acknowledgement may be ignored as only individually addressed non-distress DSC messages have acknowledgements.

C.8.1.6 Automated tuning

On HF, DSC messages using the duplex DSC channels requiring acknowledgements shall tune the general receiver to the anticipated frequency of the DSC acknowledgement.

If the DSC message requires subsequent communications, the general receiver and transmitter shall be tuned to the frequencies given in the acknowledgement upon reception of the "able to comply" acknowledgement.

If the acknowledgement received is "unable to comply", the radio shall not tune to the originally proposed channel or frequency.

If the acknowledgement received is "able to comply" but proposes a new working frequency that is not available, the radio shall not tune to the proposed frequency, but inform the operator that he has to make a new call request to the called station.

If no acknowledgement is required, the transmitter shall be tuned to the frequency of subsequent communications given by the initial DSC message.

C.8.1.7 Delayed acknowledgements

If an acknowledgement to a sending non-distress automated procedure is received after the procedure has been prematurely terminated, the automated procedure shall initiate itself recreating the initial DSC message based upon the acknowledgement. The procedure shall inform the operator that "an acknowledgement we quit waiting for" has been received. If the acknowledging station changed the frequency or communication mode, the original values will not be known but shall be assumed to be that present in the acknowledgement. If the acknowledging station responded with "unable to comply", all the original communication information will be unknown in which case the initial DSC message shall be assumed to have been radiotelephone on any legal frequency.

C.8.1.8 Termination

Termination is done manually or by the automated timeout. At least ten seconds prior to automated termination, a visual and discrete aural warning shall be displayed with the option to stop the automatic termination.

C.8.1.9 Warnings

The procedure shall provide warnings for those reasons provided in Recommendation ITU-R M.493-14:2015, Annex 4. The operator shall have the option to go back to the stage of the procedure where the action was taken that caused the warning.

C.8.2 Sending non-distress automated procedure tests

NOTE Tests and set ups marked with a raised circle (•) are actions that an operator will most likely have to perform in real life. Thus, these items are expected to be easy to perform. The test personnel are to report any difficulties or frustrations in performing these actions.

C.8.2.1 Sending non-distress procedure sequence with "able to comply" tests

C.8.2.1.1 Purpose

This test checks the typical cycle of sending a DSC message, waiting for the acknowledgment, receiving an "able to comply" acknowledgement, and establishing the communication link.

C.8.2.1.2 Method of test and required results

Set the EUT• and TE in standby and be sure that the automatic acknowledgement feature of the TE is turned off in order to have time to inspect the EUT. Configure the TE with a ship station MMSI. From the EUT, send a DSC message of priority routine requesting radio telephone addressed to the TE•. On HF, send the DSC message on the 16 MHz priority frequency (16 804,5 kHz) using simplex channel 1 (16 582,0 kHz); on VHF, select channel 6•. Verify that:

a) the EUT indicates that it is transmitting,
b) the information content of the initial DSC message is displayed or available on the EUT,
c) upon completion of the transmission, the EUT states that it is waiting for an acknowledgement,
d) the time since sending the initial DSC message is displayed,
e) the option to resend the initial DSC message is available,
f) the option to activate/place the procedure on hold is available,
g) the option to terminate the procedure is available,
h) the received non-distress DSC procedure is started on the TE,
i) HF: the DSC message is received on 16 804,5 kHz on the TE,
j) the information content displayed on the TE corresponds to that displayed on the EUT,
k) the elapsed time, stage, and operator options are visible at top level on the EUT.

Acknowledge the DSC message from the TE with "able to comply". Verify that:

l) the routine acknowledgement alarm sounds on the EUT,
m) the reason for and means to silence the alarm is displayed on the EUT,
n) the time since being acknowledged is displayed,
o) the information content of the acknowledgement is displayed or available• on the EUT,
p) the EUT indicates that it has been acknowledged or that communications are ready,
q) the option to resend the initial DSC message is no longer available on the EUT,
r) the option to activate/place the procedure on hold is available,
s) the option to terminate the procedure is available,
t) the time since acknowledgement, stage, and operator options are visible at top level,
u) one can speak to the TE from the EUT•,
v) one can speak to the EUT from the TE.

C.8.2.2 Sending non-distress procedure sequence with "comply with frequency change" tests

C.8.2.2.1 Purpose

This test checks the ability of the EUT procedure to handle an acknowledgement requesting a frequency change.

C.8.2.2.2 Method of test and required results

Set the EUT• and TE in standby and be sure that the automatic acknowledgement feature of the TE is turned off in order to be able to change the frequency of subsequent communications. Configure the TE with a ship station MMSI. From the EUT, send a DSC message with priority safety requesting radio telephone addressed to the TE•. On HF, send the DSC message on the 12 MHz priority frequency (12 577,0 kHz) using simplex channel 1 (12 353,0 kHz) and on VHF select channel 6•. Silence the alarm on the TE. When it is time to send the acknowledgment from the TE, select the option to comply with a mode and/or frequency change. Compose the change as follows: on HF, change the frequency of the subsequent communications to simplex channel 2 in the 12 MHz band (12 356,0 kHz), and on VHF change it to channel 71. Verify that:

a) the EUT indicates that it is transmitting,
b) the information content of the initial DSC message is displayed or available• on the EUT,
c) upon completion of the transmission, the EUT states that it is waiting for an acknowledgement,
d) the time since sending the initial DSC message is displayed,
e) the option to resend the initial DSC message is available,
f) the option to activate/place the procedure on hold is available,
g) the option to terminate the procedure is available,
h) the received non-distress DSC procedure is started on the TE,
i) HF: the DSC message is received on 12 577,0 kHz on the TE,
j) the information content displayed on the TE corresponds to that displayed on the EUT.

Send the acknowledgment specified above from the TE. Verify that:

k) the elapsed time, stage, and operator options are visible at top level on the EUT,
l) the safety acknowledgement alarm sounds on the EUT,
m) the reason for and means to silence the alarm is displayed on the EUT,
n) the alarm can only be silenced manually•,
o) the time since being acknowledged is displayed,
p) the information content of the acknowledgement is displayed or available• on the EUT,
q) the EUT indicates that a change in communications has been suggested (accept if necessary)•,
r) the EUT indicates that it has been acknowledged or that communications are ready,
s) the option to resend the initial DSC message is no longer available on the EUT,
t) the option to activate/place the procedure on hold is available,
u) the option to terminate the procedure is available,
v) one can speak to the TE from the EUT•,
w) one can speak to the EUT from the TE.

C.8.2.3 Sending non-distress procedure sequence with "unable to comply" tests

C.8.2.3.1 Purpose

This test checks the ability of the EUT procedure to handle an "unable to comply" acknowledgement.

C.8.2.3.2 Method of test and required results

Set the EUT• and TE in standby and be sure that the automatic acknowledgement feature of the TE is turned off in order to allow the "unable to comply" acknowledgment option. Configure the TE with a ship station MMSI. From the EUT, send a DSC message with priority urgency requesting radio telephone addressed to the TE•. On HF, send the DSC message on the 4 MHz priority frequency (4 207,5 kHz) using simplex channel 1 (4 146,0 kHz), and on VHF select channel 6•. Verify that:

a) the EUT indicates that it is transmitting,
b) the information content of the initial DSC message is displayed or available• on the EUT,
c) upon completion of the transmission, the EUT states that it is waiting for an acknowledgment,
d) the time since sending the initial DSC message is displayed,
e) the option to resend the initial DSC message is available,
f) a "too soon" warning is displayed when trying to resend• before 5 min, (Don't resend)
g) the option to activate/place the procedure on hold is available,
h) the option to terminate the procedure is available,
i) the received non-distress DSC message procedure is started on the TE,
j) HF: the DSC message is received on 4 207,5 kHz on the TE,
k) the information content displayed on the TE corresponds to that displayed on the EUT,
l) the elapsed time, stage, and operator options are visible at top level on the EUT.

Acknowledge the DSC message from the TE with "unable to comply" with reason "busy". Verify that:

m) the urgency acknowledgement alarm sounds on the EUT,
n) the reason for and means to silence the alarm is displayed on the EUT,
o) the time since being acknowledged is displayed,
p) the alarm can only be silenced manually•,
q) the information content of the acknowledgement is displayed or available• on the EUT,
r) the EUT indicates that the vessel is unable to comply since they are "busy"•,
s) the EUT indicates that there is nothing more to do,
t) the option to resend the initial DSC message is no longer available on the EUT,
u) the option to activate/place the procedure on hold is available,
v) the option to terminate the procedure is available.

C.8.2.4 Automated timeout and received acknowledgement after quitting sending non-distress procedure tests

C.8.2.4.1 Purpose

This test checks the automated timeout feature and the ability of the automated procedure to restart and recover itself when the acknowledgment is received after the procedure has timed out.

NOTE The EUT is able to retrieve all the necessary information to initiate the procedure from the acknowledgment, thus it is not necessary to store any information.

C.8.2.4.2 Method of test and required results

Set the EUT• and TE in standby and be sure that the automatic acknowledgement feature of the TE is turned off. Set the automated timeout of sending non-distress procedures on the EUT to some small value•. Note that some manufacturers may provide more sophisticated timeout options in the equipment setup as well as more sophisticated operation options to control the automated timeout and respond to any warnings. These tests only address the minimum requirement of at least a 10 s aural and visual warning and stopping the timeout. After the entire set of tests is completed, reset the timeout to the factory default of 15 min on the EUT•. Configure the TE with a ship station MMSI. From the EUT, send a DSC message of priority routine requesting radio telephone addressed to the TE•. On HF, send the DSC message on the 2 MHz priority frequency (2 187,5 kHz) using MF channel (2 182,0 kHz) on VHF select channel 6•. After transmission, silence the alarm on the TE. Verify that:

a) the EUT indicates that it is waiting for a reply,

b) a visual and aural warning appears at least 10 s before termination with the option to stop the termination,

c) the EUT returns to standby when the time elapses.

Acknowledge the EUT from the TE with "able to comply". Verify that:

d) the routine acknowledgement alarm sounds on the EUT,

e) the reason for and means to silence the alarm is displayed on the EUT,

f) the EUT indicates that this DSC message is an ack one quit waiting for or equivalent,

g) the information content of the acknowledgement is displayed or available on the EUT,

h) the EUT indicates that it has been acknowledged or that communications are ready,

i) the option to resend an "initial DSC message" is unavailable on the EUT,

j) the option to activate/place the procedure on hold is available,

k) the option to terminate the procedure is available,

l) the time since acknowledgement, stage, and operator options are visible at top level,

m) one can speak to the TE from the EUT•,

n) one can speak to the EUT from the TE.

C.8.2.5 Tuning of the general receiver during sending non distress procedure tests (HF only)

C.8.2.5.1 Purpose

This test checks the ability of the automated procedure to tune the general receiver to the anticipated frequency of the DSC acknowledgement when using duplex DSC channels.

C.8.2.5.2 Method of test and required results

Set the EUT• and TE in standby and be sure that the automatic acknowledgement feature of the TE is turned off. Configure the TE with a coast station MMSI. From the EUT, send a DSC message of priority routine requesting radio telephone addressed to the TE (see Note)•. Send the DSC message on the DSC duplex 8 MHz national channel (8 415,0 kHz ship TX, 8 436,5 kHz ship RX)•. Since the DSC message is to a coast station, the frequencies of subsequent communication are decided by the coast station.

NOTE 1 Since the TE is most likely a ship station scanning controller, the scanning general receiver on the TE will need to be configured to handle the short 20 bit dot pattern preamble. To accomplish this task, pause the general receiver of the TE on one channel and make sure its receive-frequency is 8 415,0 KHz.

Send the DSC message from the EUT•. Upon reception of the DSC message on the TE, silence the alarm and select to acknowledge with a mode and/or frequency change. Select duplex channel 1 in the 8 MHz band and send the acknowledgement.

NOTE 2 If communications are established, the tuning is correct.

Verify that:

a) the routine acknowledgement alarm sounds on the EUT,
b) the means to silence the alarm is displayed on the EUT,
c) the time since being acknowledged is displayed,
d) the information content of the acknowledgement is displayed or available• on the EUT,
e) the EUT indicates that a change in communications has been suggested (accept if necessary)•
f) the EUT indicates that it has been acknowledged or that communications are ready,
g) the option to resend the initial DSC message is no longer available on the EUT,
h) the option to activate/place the procedure on hold is available,
i) the option to terminate the procedure is available,
j) the time since acknowledgement, stage, and operator options are visible at top level,
k) one can speak to the TE from the EUT•,
l) one can speak to the EUT from the TE.

C.8.2.6 Remote initiation and control of sending non-DSC automated procedure tests

C.8.2.6.1 Purpose

This test checks that it is possible to initiate and control the non-DSC automated procedure from a remote controller using the sentences described in Annex N.

C.8.2.6.2 Method of test and required results

The test is executed via the remote interface following the guidelines in B.8.5. The test sequence shall be tailored to the current configuration of the EUT.

Any operator options selected by the test personnel and entered via the remote interface or HMI in combination shall work seamless.

C.9 Receiving non-distress automated procedure

C.9.1 Receiving non-distress automated procedure requirements

C.9.1.1 Procedure

The received non-distress automated procedure results when a DSC message is received that does not contain the distress information and is not an acknowledgement.

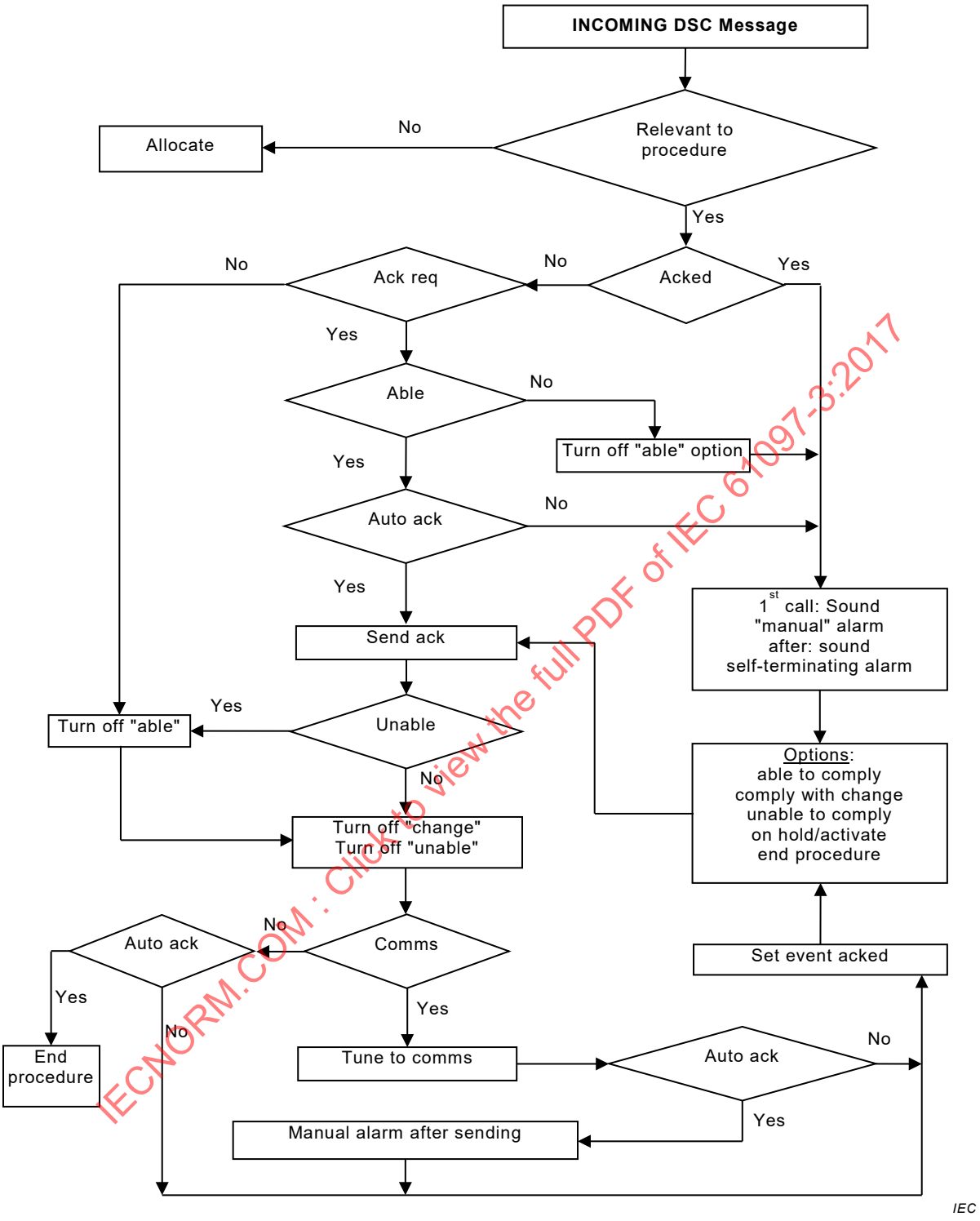


Figure C.4 – Receiving non-distress procedure

C.9.1.2 Tasks

The EUT shall follow the received distress automated procedure as shown in Figure C.4 complying with the automated procedures as defined in Recommendation ITU-R M.493-14:2015, Annex 4.

The received distress automated procedure shall handle the following events:

a) sound the appropriate alarms at the appropriate times for DSC messages pertinent to the procedure,

b) allocate DSC messages pertinent to the station but not the procedure to the appropriate automated procedure or initiate their own automated procedure on hold,

c) denote the procedure as acknowledged if the DSC message requires no acknowledgement,

d) provide and compose the acknowledgement options as dictated by the initial DSC message,

e) on HF, tune the transmitter to the appropriate DSC frequency for any selected acknowledgement if an acknowledgement is required,

f) tune the general receiver and transmitter to the frequencies of subsequent communications when and if required,

g) provide the operator with the option to:

   1) prior to acknowledgment

      i) comply if able,

      ii) comply with mode or frequency change if there are communications,

      iii) unable to comply,

      iv) activate or place the procedure on hold,

      v) end the procedure,

   2) after acknowledgement or being considered acknowledged,

      i) resend the acknowledgment (after sending the first acknowledgment),

      ii) ability to activate or place the procedure on hold,

      iii) end the procedure.

C.9.1.3 Display

During the received non-distress automated procedure, the EUT shall display or make available to the operator the following items and/or information:

a) the fact one is engaged in receiving a non-distress DSC message,

b) the elapsed time since the procedure started (prior to acknowledgment),

c) the elapsed time since acknowledgement (after acknowledgment),

d) indicate whether the procedure is on hold or is active,

e) at least a 10 s warning before any automated change in communications frequencies are invoked in case engaged in traffic;

f) the information content of the received DSC message;

- the priority (category),
- the sender,
- to whom the DSC message was sent (format and MMSI or area),
- means of subsequent communication or the requested or sent information,
- frequencies and mode of subsequent communication (if any),
- on HF, the frequency of the DSC message,
- whether or not the DSC message requires an acknowledgement.

g) the information content of any acknowledgment sent:

- the priority,
- the destination,
- the communication mode and frequencies, or "unable to comply" and reason, or info,

- on HF, the frequency of the acknowledgment.

h) displaying the valid user options, and

i) the sub-stages of the procedure which are:
   - waiting to send acknowledgement,
   - transmitting,
   - acknowledged
   - waiting for a free channel.

At top level, the elapsed time, the stage of the automated procedure, and operator options shall be displayed.

C.9.1.4 Handling received DSC messages

DSC messages pertinent to the station but not the procedure shall be allocated to the appropriate automated procedure or initiate their own automated procedure on hold.

DSC messages that are pertinent to the procedure are repeats of the initial DSC message.

C.9.1.5 Alarms

When auto acknowledging position, poll, and test DSC messages, no alarm shall sound.

When auto acknowledging individually addressed DSC messages requesting subsequent communications, an alarm shall sound and be terminated as specified in Tables H.1 and H.2, but the alarm shall be delayed until after transmission of the acknowledgement.

When auto acknowledging is not involved, an alarm shall sound and be terminated as specified in Tables H.1 and H.2.

All repeat initial DSC messages shall sound the self-terminating alarm.

C.9.1.6 Automated tuning

DSC messages requiring acknowledgements shall determine the frequency of the DSC acknowledgement based upon the frequency of the received DSC message. If the channel of the DSC message cannot be determined, the acknowledgment shall be sent on the same frequency as the original DSC message was received (HF only).

If the DSC message requires subsequent communications, the general receiver and transmitter shall be tuned to the frequencies of the subsequent communications given in the acknowledgement if acknowledgments are requested. Otherwise, the general receiver shall be tuned to the frequency of subsequent communication given by the initial DSC message.

a) the operator shall have a 10 s warning prior to any tuning if the new subsequent frequency is different from the current;

b) the operator shall be able to pause the tuning or accept the tuning.

c) If automatic channel or frequency change has been switched off, the radio shall remain on the current channel or frequency and prompt the user to accept the channel change. There shall be no change until manually accepted.

C.9.1.7 Acknowledgments

Acknowledgment options shall only be provided if the initial DSC message requests an acknowledgement and the acknowledgment option is possible. For example, the "able to comply" option is not possible for an individually addressed DSC message requesting

telephony but providing no subsequent communication frequency information. Only the "comply with mode/frequency change" and "unable to comply" options are possible.

In the case of a received individual call requesting telephony, the radio shall be capable of identifying if the requested working frequency identified in the call is available in the equipment.

a) If this frequency is available, the radio shall display the call details and compose an "able to comply" acknowledgement which shall only be transmitted manually. Switching to the frequency identified shall only be performed after a manual "able to comply" acknowledgement has been transmitted.

b) If this frequency is not available, the radio shall display the call details and compose an "unable to comply" acknowledgement with 104 as the first telecommand and 108 as the second telecommand. This acknowledgement may be transmitted automatically.

The "able to comply" option shall only require a single action by the operator to respond. The operator shall not be required to compose any elements of this acknowledgement.

The "comply with mode/frequency change" option shall require that the operator be able to enter/select frequencies and/or channels and on HF between voice and data modes before sending. The operator shall not be required to compose any other elements of this acknowledgement.

The "unable to comply" option shall require that the operator select one of the 10 reasons (telecommand 2 symbols) specified in Recommendation ITU-R M.493 for being unable to comply (default "no reason given") before sending. In the case of a position request, the option shall only require a single action by the operator to send, and the procedure shall indicate non compliance by filling the position and time information with the no information character.

If an acknowledgement is resent by the operator, it shall be identical to the first acknowledgment. It shall not be possible to further edit the content.

C.9.1.8 Termination

When auto acknowledging position, poll, and test DSC messages, the procedure shall self-terminate after sending the acknowledgement.

When sending an "unable to comply" acknowledgement, the procedure shall terminate after completing the transmission.

In all other cases, termination is done manually or by the automated timeout. At least ten seconds prior to automated termination, a visual and discrete aural warning shall be displayed with the option to stop the automatic termination.

If the procedure is terminated manually by the user, then integrated equipment may revert to the channel or frequency that was previously selected before the DSC procedure.

C.9.1.9 Warnings

The procedure shall provide warnings for those reasons provided in Annex H. The operator shall have the option to go back to the stage of the procedure where the action was taken that caused the warning.

C.9.2 Receiving non-distress automated procedure tests

NOTE Tests and set ups marked with a raised circle (•) are actions that an operator will most likely have to perform in real life. Thus, these items are expected to be easy to perform. The test personnel are to report any difficulties or frustrations in performing these actions.

C.9.2.1 The received non-distress automated procedure with "able to comply" tests

C.9.2.1.1 Purpose

This test checks the sequence of receiving an individually addressed DSC message, manually acknowledging with "able to comply", and establishing the communication link.

C.9.2.1.2 Method of test and required results

Set the EUT• and TE into standby. The auto acknowledging feature for individually addressed DSC messages of routine priority shall be turned off•. Configure the TE with a ship station MMSI. From the TE, send a DSC message of routine priority requesting radio telephone addressed to the EUT. On HF, send the DSC message on the 16 MHz priority frequency (16 804,5 kHz). For the working frequencies, use HF simplex channel 1 (16 582,0 kHz) or VHF channel 6. Verify that:

a) the EUT sounds the routine alarm,
b) the reason for and means to silence the alarm is displayed on the EUT,
c) the information content of the received DSC message is displayed or available• on the EUT,
d) the time since receiving the initial DSC message is displayed,
e) the information content received by the EUT corresponds to that sent by the TE,
f) the EUT states that it is waiting for the operator to respond/select an acknowledgment,
g) the "able to comply" acknowledgment option is available,
h) the "able to comply with mode/frequency change" acknowledgment option is available,
i) the "unable to comply" acknowledgment option is available,
j) the option to terminate the procedure is available,
k) the elapsed time, stage, and operator options are visible at top level.

Acknowledge the DSC message from the EUT with "able to comply"•. Verify that:

l) the EUT indicates that it is transmitting,
m) the time since sending the acknowledgment is displayed,
n) the information content of the sent acknowledgment is displayed or available• on the EUT,
o) the option to resend only the identical acknowledgement is available,
p) the EUT indicates that communications are ready,
q) the option to terminate the procedure is available,
r) the information content received by the TE corresponds to that sent by the EUT,
s) the time since acknowledgment, stage, and operator options are visible at top level,
t) one can speak to the EUT from the TE,
u) one can speak to the TE from the EUT•.

C.9.2.2 Received non-distress automated procedure with "comply with frequency change" tests

C.9.2.2.1 Purpose

This test checks the automated timeout and the ability of the procedure to identify a situation where a frequency change is required in the acknowledgement and thus any auto acknowledging is overridden and the "able to comply" option is unavailable.

C.9.2.2.2 Method of test and required results

Set the EUT• and TE in standby and be sure that the automatic acknowledgement feature of the EUT is turned on•. Set the automated timeout of received non-distress procedures on the EUT to some value long enough to complete all the tests prior to examining the timeout•. Note that some manufacturers may provide more sophisticated timeout options in the equipment setup as well as more sophisticated operation options to control the automated timeout and respond to any warnings. These tests only address the minimum requirement of at least a 10 s aural and visual warning and stopping the timeout. After the entire set of tests is completed, reset the timeout to the factory default of 15 min•. Configure the TE with a ship station MMSI. From the TE, send a DSC message of priority safety requesting radio telephone addressed to the EUT but let the destination station decide the working frequencies/channel. On HF, send the DSC message on the 12 MHz priority frequency (12 577,0 kHz). Verify that:

a) the EUT sounds the safety alarm,

b) the reason for and means to silence the alarm is displayed on the EUT,

c) the alarm can only be silenced manually•,

d) the information content of the received DSC message is displayed or available• on the EUT,

e) the time since receiving the initial DSC message is displayed,

f) the information content received by the EUT corresponds to that sent by the TE,

g) the EUT states that it is waiting for the operator to respond/select an acknowledgment,

h) the "able to comply" acknowledgment option is NOT available,

i) the "able to comply with mode/frequency change" acknowledgment option is available,

j) the "unable to comply" acknowledgment option is available,

k) the option to terminate the procedure is available,

l) the elapsed time, stage, and operator options are visible at top level.

Select the "comply with mode/frequency change" option•. Verify that:

m) the operator can select/enter a new frequency or channel•,

n) on HF, the operator can select/enter a new communication mode,•

o) options in m) an n) are the only editing of the acknowledgement the operator can perform. VHF units do not have to have the option to change the communication mode.

Send the acknowledgement using: (HF) simplex channel 1 (12 353,0 kHz) or (VHF) channel 6•. Verify that:

p) the EUT indicates that it is transmitting,

q) the time since sending the acknowledgment is displayed,

r) the information content of the sent acknowledgment is displayed or available• on the EUT,

s) the option to resend only the identical acknowledgement is available,

t) the EUT indicates that communications are ready,

u) the option to terminate the procedure is available,

v) the information content received by the TE corresponds to that sent by the EUT,

w) the time since acknowledgement, stage, and operator options are visible at top level,

x) one can speak to the EUT from the TE,

y) one can speak to the TE from the EUT•.

z) a visual and aural warning appears at least 10 s before termination with the option to stop the termination.

aa) the EUT returns to standby when the time elapses.

C.9.2.3 Received non-distress automated procedure with "unable to comply" and automated timeouts tests

C.9.2.3.1 Purpose

This tests checks the ability of the procedure to send an "unable to comply" acknowledgement.

C.9.2.3.2 Method of test and required results

Set the EUT• and TE in standby and be sure that the automatic acknowledgement feature of the EUT is turned on•. Configure the TE with a ship station MMSI. From the TE, send a DSC message of priority urgency requesting radio telephone addressed to the EUT but let the destination station decide the working frequencies/channel. On HF, send the DSC message on the 4 MHz priority frequency (4 207,5 kHz). Verify that:

a) the EUT sounds the urgency alarm,

b) the reason for and means to silence the alarm is displayed on the EUT,

c) the alarm can only be silenced manually,•

d) the information content of the received DSC message is displayed or available• on the EUT,

e) the time since receiving the initial DSC message is displayed,

f) the information content received by the EUT corresponds to that sent by the TE,

g) the EUT states that it is waiting for the operator to respond/select an acknowledgment,

h) the "able to comply" acknowledgment option is NOT available,

i) the "able to comply with mode/frequency change" acknowledgment option is available,

j) the "unable to comply" acknowledgment option is available,

k) the option to terminate the procedure is available,

l) the elapsed time, stage, and operator options are visible at top level.

Select the "unable to comply" option•. Verify that:

m) the only operator option is to select one of the ten Recommendation ITU-R M.493 reasons for being unable to comply,

n) the ten reasons are "no reason", "congestion at station", "busy", "queue", "station barred", "no operator available", "equipment disabled", "unable to use proposed channel", "unable to use proposed mode".

Select the reason "busy" and send the acknowledgement•. Verify that:

o) the EUT indicates that it is transmitting,

p) upon completion of the transmission, the procedure terminates,

q) the information content received by the TE corresponds to that sent by the EUT.

C.9.2.4 Selection of the DSC acknowledgement frequency (HF only) tests

C.9.2.4.1 Purpose

This test checks the ability of the procedure to automatically tune the transmitter to the correct DSC frequency for the transmission of the acknowledgement.

C.9.2.4.2 Method of test and required results

Make sure the automatic acknowledgement option on the EUT is on•. Set both the EUT• and TE in standby. Configure the TE as a coast station. Compose a routine individual DSC message addressed to the EUT requesting telephone. Select the working frequencies to be the duplex 8 MHz channel 1 (8 195,0 kHz ship TX, 8 719,0 kHz ship RX). Send the DSC

message from the TE on the DSC duplex 8 MHz national channel (8 415,0 kHz ship TX, 8 436,5 kHz ship RX). Verify that:

a) the EUT automatically sends the acknowledgment,
b) the EUT indicates that it is waiting for a free channel and then transmitting,
c) the EUT sounds the routine (not routine-acknowledgment) alarm,
d) the reason for and means to silence the alarm is displayed on the EUT,
e) the information content of the received DSC message is displayed or available• on the EUT,
f) the information content received by the EUT corresponds to that sent by the TE,
g) the information content of the sent acknowledgement is displayed or available• on the EUT,
h) the information content received by the TE corresponds to that sent by the EUT,
i) the time since acknowledgement is displayed,
j) the option to resend only the identical acknowledgement is available,
k) the EUT indicates that communications are ready,
l) the option to terminate the procedure is available,
m) one can speak to the EUT from the TE,
n) one can speak to the TE from the EUT.•

NOTE If communications are established, the tuning is correct.

C.9.2.5 Remote controlling receiving non-distress procedure tests

C.9.2.5.1 Purpose

This test checks that it is possible to control the receiving non-distress automated procedure from a remote controller using the sentences described in Annex N.

C.9.2.5.2 Method of test and required results

The test is executed via the remote interface following the guidelines in B.8.6. The test sequence shall be tailored to the current configuration of the EUT.

Any operator options selected by the test personnel and entered via the remote interface or HMI in combination shall work seamless.

C.10 Communications automated procedure

C.10.1 Communications automated procedure requirements

C.10.1.1 Procedure

The communications automated procedure results when the operator engages in communications established by non DSC means. The procedure is initiated when the operator chooses to monitor a channel for non DSC traffic or non DSC traffic is initiated by the reception of an appropriate signal. (Note that the details in design of the automated procedure might depend upon the type of non DSC traffic being monitored. For example, the non DSC traffic may be initiated by the reception of an NBDP signal).

The critical purpose of this simple procedure is to assure that received DSC messages do not interrupt ongoing communications in the same manner that they do not disrupt any of the ongoing automated procedures handling DSC messages.

C.10.1.2 Tasks

The communications automated procedure shall handle the following events:

a) received DSC messages pertinent to the station shall be allocated to the appropriate automated procedure or initiate their own automated procedure on hold,

b) tuning the general receiver and transmitter to the frequencies of communication,

c) providing the operator with the option to:

- terminate the procedure,
- toggle between activating and placing the procedure on hold,
- provide any other options necessary for the traffic mode being handled.

C.10.1.3 Display

During the communications automated procedure, the EUT shall display or make available to the operator the following items and/or information:

a) the fact one is engaged in a communications procedure,

b) indication of whether the procedure is on hold or is active,

c) the frequencies and or channels of communication,

d) the operator options,

e) the station MMSI,

f) the latest known position of the vessel and the origin of the position (manual, automatic, etc.),

g) the UTC time of that position.

C.10.1.4 Handling received DSC messages

All received DSC messages pertinent to the station shall be allocated to the appropriate automated procedure or initiate their own automated procedure on hold.

C.10.1.5 Tuning of the general receiver and transmitter

The procedure shall automatically tune the general receiver and transmitter to the frequencies of the selected channel.

C.10.1.6 Termination

The procedure may either be terminated manually or via an automatic timeout.

C.10.2 Communications automated procedure tests

NOTE Tests and set ups marked with a raised circle (•) are actions that an operator will most likely have to perform in real life. Thus, these items are expected to be easy to perform. The test personnel are to report any difficulties or frustrations in performing these actions.

C.10.2.1 Communications automated procedure setup tests

C.10.2.1.1 Purpose

This tests checks that the communications automated procedure is correctly initiated.

C.10.2.1.2 Method of test and required results

Set both the EUT• and TE in standby. From the EUT, select the option to make a phone call (by non DSC means) on any appropriate channel•. Do the same on TE. Verify that:

a) the EUT indicates that it is monitoring a communications channel,

b) the frequencies and channels of the communication are displayed,

c) the option to terminate the procedure is available,

d) one can speak to the EUT from the TE,

e) one can speak to the TE from the EUT.•

NOTE If communications are established, the tuning is correct.

C.10.2.2 Remote controlling communication automated procedure tests

C.10.2.2.1 Purpose

This test checks that it is possible to control the communication automated procedure from a remote controller using the sentences described in Annex N.

C.10.2.2.2 Method of test and required results

The test is executed via the remote interface following the guidelines in B.8.7. The test sequence shall be tailored to the current configuration of the EUT.

Any operator options selected by the test personnel and entered via the remote interface or HMI in combination shall work seamless.

C.11 Multiple automated procedures and parallel event handling

C.11.1 Multiple automated procedures and parallel event handling requirements

C.11.1.1 Procedure

Subclause C.11 describes the handling of received DSC messages that are pertinent to the station while the EUT is engaged.

C.11.1.2 Tasks

If the EUT is engaged in handling an automated procedure (except for an unacknowledged sending distress automated procedure), received DSC messages that are pertinent to the station but not the currently active automated procedure:

a) are allocated to an existing automated procedure on hold, or

b) shall initiate their own automated procedure on hold.

Only one automated procedure can be active at a time (since there is only one transmitter and general receiver in addition to the watch receiver), thus any action to activate an automated procedure on hold places the currently active automated procedure on hold.

Automated procedures on hold shall behave identical to active procedures except they do not have control of the transmitter and general receiverm thus:

a) the only operator options which are available are those that do not require use of the transmitter or general receiver such as to terminate or activate the automated procedure,

b) any subsequent tunings of the transmitter and general receiver that would occur if the procedure were active upon reception of a DSC message appropriate to the procedure shall not occur until the procedure is activated by the operator,

c) the display of automated procedures on hold may be represented by an appropriately named list, labelled icons, or equivalent in order to minimize space requirements,

d) all other features, including handling of the alarms and full display of information at the request of the operator, remain.

The operator shall be able to activate any automated procedure on hold by a single action (a button press or selection) unless the currently active procedure is transmitting,

If the only remaining automated procedures present on the equipment are inactive or on hold, and there are automated procedures handling test, polling, or position requests and these procedures are setup to auto acknowledge, the equipment shall successively perform the auto acknowledgement and terminate these procedures.

The EUT shall provide sufficient memory or capacity to be able to handle a minimum of seven simultaneous automated procedures with a reserve of one. If the equipment can handle more than the required minimum, the equipment shall provide a setup option where the operator can set the value to seven (or any other value the equipment is capable of handling). This option is only required for equipment that can handle more than the minimum. When the equipment maximum is exceeded by one and the reserve procedure is started, the equipment shall generate a warning stating that an automated procedure needs to be terminated or equivalent, though this new procedure and all the previous automated procedures shall still function normally. At this time, the operator shall be prevented from starting any automated procedure except for the sending one's own distress. If the operator does not elect to terminate an automated procedure, the reception of an additional automated procedure shall result in the automatic termination of an existing automated procedure.

The automatic and immediate termination of an automated procedure shall be based upon age and priority.

C.11.2 Multiple automated procedures and parallel event handling tests

NOTE Tests and set ups marked with a raised circle (•) are actions that an operator will most likely have to perform in real life. Thus, these items are expected to be easy to perform. The test personnel are to report any difficulties or frustrations in performing these actions.

C.11.2.1 General

These tests check that received DSC messages pertinent to the station while the station is engaged in handling an automated procedure properly establish automated procedures on hold. The first part of the testing shall involve sending subsequent DSC messages from the TE while the EUT is engaged in one of the five automated procedures. The second part of the testing shall involve testing multiple automated procedures.

In the following tests, the test personnel shall be asked to verify that the proper automated procedure is started and on hold. This test is verified if:

a) the alarm appropriate to the initiated procedure is sounded,

b) the reason for and means to silence the alarm is displayed,

c) the information concerning the received DSC message is appropriately displayed,

d) the sub stage of the procedure is displayed,

e) the elapsed time is appropriately displayed,

f) there is a clear indication that automated procedure is on hold, and

g) the operator options to activate and terminate the automated procedure are available.

For the tests conducted in C.11.2.2, C.11.2.3, C.11.2.4, and C.11.2.5, the following DSC messages in Table C.3 shall be used.

NOTE Some of these DSC messages are not allowed in this document. These DSC messages are included in order to test backward compatibility.

Table C.3 – DSC messages to send from the EUT

(a)	A DSC message of priority routine individually addressed to the EUT.
(b)	A test DSC message individually addressed to the EUT.
(c)	A DSC message of priority "urgency" individually addressed to the EUT.
(d)	An all ships DSC message with priority "safety". [a]
(e)	An DSC message of priority "distress" individually addressed to the EUT.[b]
(f)	A group DSC message with priority "safety" [b]
(g)	An area DSC message with the priority "urgency".[c]
(h)	A position request addressed to the EUT.
(i)	A medical transports DSC message.
(j)	A DROBOSE addressed to an area or all ships (describing a different distress event when testing distress automated procedures).
(k)	A DROBOSE addressed to the EUT.
(l)	A distress alert (upon completion of the transmission, terminate the procedure on the TE).

[a] All ships DSC messages not allowed by Recommendation ITU-R M.493 on HF except for distress alert and relay acknowledgements.

[b] Group addressing shall have priority routine and the distress priority is only for distress DSC messages in Recommendation ITU-R M.493.

[c] Area addressing not allowed in Recommendation ITU-R M.493 on VHF.

C.11.2.2 Parallel procedures during the communications procedure tests

C.11.2.2.1 Purpose

This test checks that reception of DSC messages that are pertinent to the station while the station is engaged in the communications automated procedure do not disturb the communications and that the received DSC message properly initiates its own automated procedure on hold.

C.11.2.2.2 Method of test and required results

This test consists of setting up a communications procedure between the EUT and TE and then using the TE as if it were another station to send a DSC message to the EUT starting a second automated procedure. The tests are to assure the new automated procedure and the communications automated procedure operate properly on the EUT. The new procedure is then terminated. This exercise is conducted 12 times, once for each of the DSC messages listed in Table C.3.

Set the auto acknowledgement option to on for test, poll, and individual DSC messages on both the EUT• and TE.

From standby, set the EUT• and TE into a communications procedure.

On the TE, place the communications procedure on hold.

A DSC message as enumerated in the list given in Table C.3 shall then be sent from the TE. All addressing shall be chosen such that the DSC message is pertinent to the EUT. On HF, send the DSC message on a priority frequency.

Once the transmission has finished on the TE, make the communications procedure on the TE active (take off hold or activate). (After the TE sends the distress alert, the communications procedure may be terminated. In that case, it will be necessary to restart the communications procedure on the TE to do the last two verifications in the grid below).

Verify that:

	a	b	c	d	e	f	g	h	i	j	k	l
the automated procedure on the EUT that handles the received DSC message from Table C.3 is started and on hold,												
the operator is able to make the new procedure active and the communication procedure goes on hold,•												
the operator is able to acknowledge the TE from the EUT•												
the operator is able to make the communications procedure active and the “new” procedure goes on hold,•												
one can speak to the EUT from the TE,												
one can speak to the TE from the EUT,•												

Terminate the procedures on the TE and EUT•.

NOTE DSC messages a in Table C.3 generate a received non-distress procedure. DSC messages j in Table C.3 generate a received distress procedure. Message b auto acknowledges when made active.

C.11.2.3 Parallel procedures during the received non-distress procedure tests

C.11.2.3.1 Purpose

This test checks that reception of DSC messages that are pertinent to the station while the station is engaged in a received non-distress automated procedure do not disturb the received non-distress automated procedure and that the received DSC message properly initiates its own automated procedure on hold.

C.11.2.3.2 Method of test and required results

This test consists of setting up a received non-distress automated procedure on the EUT by sending a non-distress DSC message from the TE and then using the TE as if it were another station to send a second DSC message to the EUT starting a second automated procedure. The tests are to assure the new automated procedure and the original received non-distress automated procedure operate properly on the EUT. The new automated procedure is then terminated. This exercise is conducted 12 times, once for each of the DSC messages listed in Table C.3.

1) Set the auto acknowledgement option to off for test, poll, and individual DSC messages on the EUT•.
2) Place the EUT and TE in standby.
3) On the TE, compose an individually addressed DSC message addressed to the EUT with priority "safety". Select a subsequent communication channel or frequency of your choice.
4) On the TE, send the composed DSC message; this will start the received non-distress automated procedure on the EUT. Refer to this procedure as the “original” procedure.
5) Silence the alarm on the EUT• but do not acknowledge the DSC message at this time.
6) On the TE, compose a DSC message as enumerated in the list given in Table C.3 with addressing pertinent to the EUT. Select a subsequent communications channel or frequency that is different than those of step 3. (For DSC messages b and h from Table C.3, there are no subsequent communications).
7) On the TE, send the composed DSC message.

Verify that:

	a	b	c	d	e	f	g	h	i	j	k	l
the automated procedure that handles the received DSC message from Table C.3 is started and on hold,												
the operator is able to make the new procedure active and the original procedure goes on hold,•												
the operator is able to make the original procedure active and the “new” procedure goes on hold,•												
NOTE DSC messages agenerate a received non-distress procedure. DSC messages j in generate a received distress procedure.												

On the EUT from the original procedure acknowledge the DSC message with “able to comply"•. Verify that:

	a	b	c	d	e	f	g	h	i	j	k	l
the ‘safety’ acknowledgment alarm sounds on the TE,												
the information content of the sent acknowledgement is displayed or available• on the EUT,												
the information content of the sent acknowledgement on the TE corresponds to that of the EUT,												
the EUT indicates that it has been acknowledged or communications are ready,												
the time since acknowledgement is displayed,												
one can speak to the EUT from the TE,												
one can speak to the TE from the EUT.•												

Terminate both procedures.

C.11.2.4 Parallel procedures during sending non-distress procedure tests

C.11.2.4.1 Purpose

This test checks that reception of DSC messages that are pertinent to the station while the station is engaged in a sent non-distress automated procedure do not disturb the sent non-distress automated procedure and that the received DSC message properly initiates its own automated procedure on hold.

C.11.2.4.2 Method of test and required results

This test consists of setting up a sending non-distress automated procedure on the EUT by sending a non-distress DSC message to the TE and then using the TE as if it were another station to send a second DSC message to the EUT starting a second automated procedure. The test is to assure that the new automated procedure and the original sending non distress automated procedure operate properly on the EUT. The new automated procedure is then terminated. This exercise is conducted 12 times, once for each of the DSC messages listed in Table C.3. Auto acknowledging shall be turned off.

1) From standby, setup the TE to be able to receive DSC messages not pertinent to the station (snooping) since it shall play the role of two stations.
2) From standby, place the EUT in a sending non-distress automated procedure to set up subsequent communications by sending an individual DSC message of priority "safety" addressed to any ship station but the TE•. Refer to this procedure as the "original" procedure.
3) A "snooped" automated procedure shall start on the TE. Do not acknowledge the snooped DSC message at this time but place the snooped procedure handling the exchange with the EUT on hold.

4) A DSC message as enumerated in the list of Table C.3 shall then be sent from the TE. All addressing shall be chosen such that the DSC message is pertinent to the EUT.

Verify that:

	a	b	c	d	e	f	g	h	i	j	k	l
the automated procedure that handles the received DSC message from Table C.3 is started and on hold,												
the operator is able to make the new procedure active and the original procedure goes on hold,•												
the operator is able to make the original procedure active and the "new" procedure goes on hold,•												
NOTE DSC messages agenerate a received non-distress procedure. DSC messages jgenerate a received distress procedure.												

Continue with the original procedure on the EUT. Acknowledge the EUT from the TE with "able to comply" from the 'snooping' procedure. Verify that:

	a	b	c	d	e	f	g	h	i	j	k	l
the 'safety' acknowledgment alarm sounds on the EUT,												
the reason for and means to silence the alarm is displayed,												
the information content of the acknowledgement is displayed or available• on the EUT,												
the EUT indicates that it has been acknowledged,												
one can speak to the EUT from the TE,												
one can speak to the TE from the EUT.•												

Terminate both procedures.

C.11.2.5 Parallel procedures during the received distress procedure tests

C.11.2.5.1 Purpose

This test checks that reception of DSC messages that are pertinent to the station while the station is engaged in a received distress automated procedure do not disturb the received distress automated procedure and that the received DSC message properly initiates its own automated procedure on hold.

C.11.2.5.2 Method of test and required results

This test consists of setting up a received distress automated procedure on the EUT by sending a DROBOSE from the TE and then using the TE as if it were another station to send a second DSC message to the EUT starting a second automated procedure. The tests are to assure the new automated procedure and the original received distress automated procedure operate properly on the EUT. The new automated procedure is then terminated. This exercise is conducted 12 times, once for each of the DSC messages listed in Table C.3.

Place the EUT in a received distress automated procedure by sending a DROBOSE addressed to an area (MF/HF) or all ships (VHF) from the TE. A received distress automated procedure shall start on the EUT and the TE. Put the procedure on the TE on hold and send the DSC message enumerated in Table C.3 from the TE. All addressing shall be chosen such that the DSC message is pertinent to the EUT. Verify that:

	a	b	c	d	e	f	g	h	i	j	k	l
the automated procedure that handles the received DSC message from Table C.3 is started and on hold,												
the operator is able to make the new procedure active and the original procedure goes on hold,•												
the operator is able to make the original procedure active and the "new" procedure goes on hold,•												
NOTE DSC messages agenerate a received non-distress procedure. DSC messages j generate a received distress procedure.												

Continue with the original received distress procedure on the EUT. Verify that:

	a	b	c	d	e	f	g	h	i	j	k	l
the operator is able to send a relay addressed to an area (MF/HF) or all ships (VHF) from the EUT,•												
the relay is correctly received on the TE,												
upon sending an all ships relay ack from the TE the relay ack alarm sounds on the EUT,												
the reason for and means to silence the alarm is displayed,												
the information content of the acknowledgement is displayed or made available• on the EUT,												
the EUT indicates that it has been acknowledged,												
one can speak to the EUT from the TE,												
one can speak to the TE from the EUT.•												

Terminate both procedures.

C.11.2.6 Parallel procedures during the sending distress automated procedure prior to receiving the distress alert acknowledgment tests

C.11.2.6.1 Purpose

These tests check that if the received DSC message is not the distress alert acknowledgment to this distress event that it is not brought to the attention of the operator. Note that this behaviour is unique to the sending distress automated procedure, and that this behaviour only occurs prior to the procedure receiving its first acknowledgment.

C.11.2.6.2 Method of test and required results

Send a default distress alert attempt from the EUT•. A set of DSC messages shall be sent from the TE that are pertinent to the station represented by the EUT while the EUT is engaged in the sending distress automated procedure. Thus any regions specified by DSC messages addressed to an area shall be specified to encompass the EUT. Verify that none of the DSC messages listed in Table C.4 start an automated procedure or affect the sending distress automated procedure (the elapsed time countdown, automatic resending of the alert, tuning of the general receiver and transmitter, etc.).

Table C.4 – DSC messages

(1)	An individually addressed DSC message of priority urgency.
(2)	An area (MF/HF) or all ships (VHF) DSC message of priority urgency.
(3)	A distress alert.
(4)	A distress relay with different distress information than the procedure.
(5)	A distress relay with the same distress information as the procedure.
(6)	A distress acknowledgement with different distress information than the procedure.

Verify that all the DSC messages transmitted from the TE are recorded in the log on the EUT•.

C.11.2.7 Parallel procedures during the sending distress automated procedure after receiving the distress alert acknowledgment tests

C.11.2.7.1 Purpose

This test checks that reception of DSC messages that are pertinent to the station while the station is engaged in an acknowledged sent distress automated procedure do not disturb the sent distress automated procedure and that the received DSC message properly initiates its own automated procedure on hold.

C.11.2.7.2 Method of test and required results

This test consists of setting up a sending distress automated procedure on the EUT, acknowledging it from the TE, and sending DSC messages from the TE that are pertinent to the station but not the procedure. The six DSC messages to be sent from the TE are enumerated in Table C.5.

Table C.5 – DSC messages

(1)	A DSC message of priority routine individually addressed to the EUT.
(2)	A distress relay concerning a new distress event addressed to multiple stations.
(3)	A DSC message of priority urgency individually addressed to the EUT.
(4)	A DSC message of priority urgency addressed to an area (MF/HF) or all ships (VHF).
(5)	A test DSC message (priority safety) addressed to the EUT.
(6)	A distress alert.

For each of the cases of Table C.5:

1) send the default distress alert from the EUT• and acknowledge the distress from the TE by sending a distress alert acknowledgement;
2) place the received distress procedure on the TE on hold;
3) send the enumerated DSC message from the TE. All addressing shall be chosen such that the DSC message is pertinent to the EUT. A set of questions regarding the response of the EUT shall then be answered.

Verify that:

	1	2	3	4	5	6
the automated procedure that handles the received DSC message from the table is started and on hold,						
the operator is able to make the new procedure active and the original procedure goes on hold,•						
the operator is able to make the original procedure active and the “new” procedure goes on hold.•						

Activate the received distress procedure on the TE. Verify that:

	1	2	3	4	5	6
the operator is able to talk to the TE from the EUT.•						
the operator is able to talk to the EUT from the TE.						

For message number 6 of Table C.5, send a distress relay on behalf of someone else from the TE with the same distress information displayed on the EUT. This action can be necessary to restart a received distress automated procedure on the TE. Set the communication frequencies to that of the EUT.

C.11.2.8 Handling of multiple automated procedures tests

C.11.2.8.1 Purpose

This test checks that the EUT (1) handles multiple automated procedures, (2) properly responds to reaching and exceeding the maximum number of automated procedures, and (3) that the automated procedure handling a test, poll, or position request that is set to auto-acknowledge does not auto-acknowledge until all other automated procedures are on hold. This test involves placing the EUT in a received distress automated procedure concerning distress event "A" and then sending the DSC messages in Table C.6 from the TE. The test personnel shall check that each of these automated procedures behaves correctly and that the EUT correctly handles the situations when the equipment maximum is exceeded. Then the test personnel shall be asked to make selected automated procedures active on the EUT and perform various actions (such as acknowledging). Even though there will be several procedures running, it shall not be difficult to find the procedure that corresponds to the DSC messages sent in Table C.6.

C.11.2.8.2 Method of test and required results

C.11.2.8.2.1 General

Be sure that the auto-acknowledgement option on the EUT is on for the test and polling DSC messages and is off for the position request•. Set the EUT’s automatic timeout for the automated procedures to no timeout•. If the equipment supports more than seven simultaneous automated procedures, set up the equipment such that the maximum number is seven•□ The DSC messages to be sent from the TE are listed in Table C.6.

Strictly follow the sequence of events in Table C.6 in order to assure proper behaviour.

Table C.6 – DSC messages to send from the TE

(a)	A DSC message of priority routine individually addressed to the EUT.
(b)	A position request individually addressed to the EUT.
(c)	A DSC message of priority "urgency" individually addressed to the EUT.
(d)	An all ships DSC message with priority "safety". [a]
(e)	A distress on behalf of someone else individually addressed to the EUT concerning a different event B.
(f)	A test DSC message addressed to the EUT
(g)	A polling request addressed to the EUT.
(h)	A distress on behalf of someone else addressed to an area or all ships concerning a different event C.
(i)	A distress on behalf of someone else addressed to an area or all ships concerning the event C but after changing the MMSI of the TE (to simulate another station reporting the same event C).
(j)	A distress on behalf of someone else addressed to the EUT concerning event C, but after changing the position of the vessel in distress.
[a]	All ships messages are not allowed by Recommendation ITU-R M.493 on HF except for distress alert and relay acknowledgements.

C.11.2.8.2.2 Stage one

Set the TE and EUT into standby. Place the EUT in a received distress automated procedure by sending a DROBOSE with distress information "sinking" addressed to an area (MF/HF) or all ships (VHF) from the TE. This distress event will be referred to as event A. A received distress automated procedure shall start on the EUT and the TE. Put the procedure on the TE on hold. Then:

For each DSC message enumerated in Table C.6:

1) address the message such that it is pertinent to the EUT,
2) send the DSC message from the TE as instructed below where the TE shall have the same own MMSI for all messages except message (i),
3) on MF/HF, use one of the six distress frequencies for all DSC messages regardless of the priority,
4) do not "handle" any of the automated procedures on the EUT, unless specifically instructed to do so below, except for the silencing of the alarms and cancelling of any messages.

From the TE, send the routine message (a). Verify that the automated procedure is started and on hold and does not automatically acknowledge.

From the TE, send position request (b). Verify that the automated procedure is started and on hold and does not automatically acknowledge.

From the TE, send priority message (c). Verify that the automated procedure is started and on hold and does not automatically acknowledge.

From the TE, send all ships message (d). Verify that the automated procedure is started and on hold.

NOTE 1 DSC messages (a) to (d) and (f) to (g) in Table C.6 generate a received non-distress procedure. DSC messages (e) and (h) to (j) in Table C.6 generate a received distress procedure.

From the TE, send the DSC message (e). Verify that the automated procedure is started and on hold and does not automatically acknowledge.

From the TE, send the test message (f). Verify that the automated procedure from Table C.6 is started and on hold and does not automatically acknowledge:

a) that a warning is displayed stating that an automated procedure needs to be terminated or equivalent,

b) that the EUT prevents the operator from starting• a comms procedure,

c) that the EUT prevents the operator from sending• a DROBOSE with distress information different than that of event "A",

d) that the EUT prevents the operator from sending• a non-distress DSC message,

e) that the operator is able to send• a distress alert (this test may require restarting the entire sequence at which time this test shall not be repeated since all procedures may be terminated).

From the TE, send the polling request (g). Verify that the automated procedure handling the position request of message (b) is automatically terminated•.

From the TE, send the DROBOSE (h) concerning distress event C. Verify that the automated procedure handling the test of message (f) is automatically terminated•.

NOTE 2 The terminated procedure in this case has the highest kill score and is therefore the procedure that is automatically terminated when the procedure buffer overflows.

On the EUT, place the original automated procedure handling distress event "A" on hold•. Verify that the procedure handling the polling request is automatically acknowledged and self-terminates•.

On the EUT, make the automated procedure handling distress event "A" active• and on the TE with different position of the vessel in distress, send the DROBOSE (i) concerning distress event "C". Verify that the DSC message (i) is handled by the procedure generated by DSC message (h) sounding only the self-terminating alarm.

From the TE, send the individual DROBOSE (j) concerning distress event "C". Verify that:

f) the automated procedure handling message (j) is started and on hold,

g) the total number of automated procedures on the EUT is 7,

h) the original received distress automated procedure is active on the EUT.

C.11.2.8.2.3 Stage two

Upon completion of the transmission of the messages in Table C.6, there will be seven automated procedures on the EUT, where the automated procedure handling distress event "A" is active. Verify that:

a) each one of the procedures can be made active while all the remaining procedures are placed on hold,•

b) the automated procedure handling DSC message (a) can be acknowledged with "able to comply",•

c) the TE receives the acknowledgement,

d) the EUT can speak to the TE upon activating the procedure on the TE,•

e) the TE can speak to the EUT,

f) the automated procedure handling DSC message (c) can be acknowledged ,•

g) the TE receives the acknowledgement,

h) the EUT can speak• to the TE upon activating the procedure on the TE,

i) the TE can speak to the EUT,

j) the automated procedure handling DSC message (e) can be acknowledged with an individual relay acknowledgement,•

k) the TE receives the acknowledgement,

l) the EUT can speak• to the TE upon activating the procedure on the TE,

m) the TE can speak to the EUT,

n) the automated procedure handling DSC message (j) can be acknowledged with an individual relay ack,•

o) the TE receives the acknowledgement,

p) the EUT can speak• to the TE upon activating the procedure on the TE,

q) the TE can speak to the EUT,

r) the relay acknowledgment can be sent from the automated procedure handling the distress event B,•

s) the TE receives the acknowledgement,

t) the EUT can speak• to the TE upon activating the procedure on the TE,

u) the TE can speak to the EUT,

v) the automated procedures corresponding to (a) and (c) – (j) can be terminated as well as the automated procedure handling distress event "A"•.

C.11.2.9 Remote controlling of multiple automated procedure tests

C.11.2.9.1 Purpose

This test checks that it is possible to control multiple automated procedure from a remote controller using the sentences described in Annex N.

C.11.2.9.2 Method of test and required results

The test is executed via the remote interface following the guidelines in B.8.8. The test sequence shall be tailored to the current configuration of the EUT.

Any operator options selected by the test personnel and entered via the remote interface or HMI in combination shall work seamless.

C.12 Error handling in the automated procedures

C.12.1 Error handling requirements

C.12.1.1 General

C.12 describes the handling of received DSC messages that contain errors in any of the information characters except the format, address (the destination MMSI, group MMSI or area), and end of sequence characters which shall be received correctly in order for the message to be accepted.

NOTE For the purposes of these tests, "performing comparison error correction" between identical sets of information characters means that if one of a corresponding pair of information characters is in error, the information character in error is replaced by the information character that is not in error. A given information character is received in the DX and RX positions of the DSC message from which a final set of information characters is determined.

A DSC message shall initiate or be handled by an automated procedure if the format test passes, the destination address, and end of sequence information characters are able to be determined error free.

If an automated procedure is initiated by the reception of a DSC message that contains critical errors, the aural alarm shall self-terminate.

When an automated procedure initiated with critical errors first receives a subsequent message without critical errors or the procedure is first able to correct the critical errors by combining received messages, the normal initiating alarm shall sound.

A received DSC message shall be considered pertinent to an automated procedure if the received information characters are identical to the set of information characters normally used to identify pertinence.

In no case shall the reception of an identical DSC message introduce more errors into the information characters (and their display) that are used to identify the procedure.

Automated procedures shall indicate all displayed information characters that are in error. Individual elements of any MMSIs and any position information that are in error shall be indicated by a special symbol (manufacturer defined) at the place of the error.

C.12.1.2 Distress automated procedures

A DSC message with errors in the ECC or information characters is considered a non-distress DSC message by an automated procedure unless:

a) the format character is distress (112) which makes the message a distress alert, or

b) the format character is all ships and the number of information characters excluding the enhanced position extension is 23, or

c) the format character is area, group, or individual and the number of information characters excluding the enhanced position extension is 28 which makes the message a relay, and

d) if (b) is true and the telecommand 1 parameter is received in error and the end of sequence character is no acknowledgement requested, the DSC message shall be assumed to be a relay (it could be a distress alert acknowledgment), and an error in DSC message type shall be indicated.

A distress procedure handling an individually addressed distress relay shall not allow the sending of the acknowledgment if any one of the digits in the sender MMSI is in error.

Received distress automated procedures shall not allow the sending of any further distress DSC messages as long as any one of the current distress information characters remains in error. In that case, the automated procedure shall only offer the operator the option of composing and sending a distress relay on behalf of someone else (the operator is then free to enter a best estimate of what the distress information shall be based upon the received distress information).

A distress automated procedure shall assume radio telephone if the communications parameter is received in error. The distress automated procedure shall indicate to the operator that it is making the assumption due to the error.

For a distress automated procedure to be considered acknowledged by a received distress DSC acknowledgment:

a) the MMSI (or unknown) of the vessel in distress shall be received error free,

b) if the acknowledgment is on MF/HF, the distress communications parameter shall also be received error free,

c) if the MMSI of the vessel in distress is unknown, all the parameters of the distress information shall also be received error free.

d) a distress automated procedure shall correct receive errors by performing comparison error correction in the following manner:

   1) if the entire set of received information characters is identical to the previously received set of information characters, comparison error correction shall be performed on the entire set of information characters,

2) if only the set of received distress information characters is identical to the distress information determined from the reception of previous DSC messages, comparison error correction shall only be performed on the set of distress information characters,

3) if the new message has the enhanced position information characters comparison error, correction shall be performed on the enhanced position information characters, and if the enhanced position information characters are absent in the current set of distress information characters, the current set shall be updated with the new set of enhanced position information characters,

4) if only the received distress event information characters are identical, comparison error correction shall only be performed on the distress event information characters.

C.12.1.3 Non-distress automated procedures

A non-distress automated procedure shall not tune to the frequencies of subsequent communication if the DSC message is addressed to a group, an area or all ships if the telecommand1 (MF/HF only) and/or frequency information characters are received in error.

A non-distress automated procedure shall not allow the acknowledgment of a non-distress DSC message that has errors in either the category, sender MMSI, or telecommand 1 information characters.

A non-distress automated procedure shall not be acknowledged by a non-distress DSC acknowledgement that has errors in any one of the sender MMSI, telecommand 1, or frequency information characters.

C.12.2 Error handling tests

C.12.2.1 General

Error testing involves composing DSC messages that have intentional errors in order to simulate receive errors that arise from noise. Errors in the information characters are simulated by editing the 10-bit DSC words such that the 3-bit zero count is inconsistent with the 7-bit symbol in both the DX and RX words. All that is necessary is to change any single bit of the word. If the symbol, zero count, or word are not editable in bit form, the same effect can be achieved by incrementing or decrementing the 7-bit symbol OR 3-bit zero count or 10-bit word by one.

C.12.2.2 Errors in received distress DSC messages

C.12.2.2.1 Purpose

This test checks how the EUT responds to received distress DSC messages that have errors. The key items are to make sure that relays and acknowledgements that would normally be based on the received DSC message are not allowed until the critical errors are corrected and that any alarms triggered by the reception of messages with critical errors are self-terminating.

C.12.2.2.2 Method of test and required results

Set both the EUT• and TE in standby. On the TE, compose a DROBOSE with the following distress information: the position and time of position is that of the TE, the means of subsequent communication is radio telephone, enter any valid nature of distress, and any valid ship MMSI for the vessel in distress. Address the DROBOSE to an area (MF/HF) or all ships (VHF) and select the MF/HF frequency of the DSC message to be 2 187,5 kHz. Bring up the option to edit the composed words of the DSC message. Edit the message such that the DX and RX positions of the first word of the MMSI of the vessel in distress are in error (make the 3-bit zero count disagree with the 7-bit symbol value). Transmit the edited DSC message and verify that:

a) the two-tone alarm sounds and self-terminates,

b) the operator is made aware of the fact the received DSC message has (critical) errors,

c) the MMSI of the vessel in distress is displayed with error indicators in the first two digits•,

d) the operator is unable to send a distress relay acknowledgement•,

e) the operator is unable to send a distress relay•,

f) the operator is able to send a DROBOSE•,

g) one can speak to the EUT from the TE,•

h) one can speak to the TE from the EUT.•

Resend the identical DROBOSE with the edited error from the TE. Verify that the self-terminating alarm sounds.

On the TE, correct the error in the RX word and resend the DROBOSE. Verify that:

i) the two-tone alarm sounds,

j) the reason for and means to silence the alarm is displayed,

k) the alarm can only be silenced manually,

l) the MMSI of the vessel in distress is displayed and all 9 digits are correct,

m) the operator is unable to send a distress relay acknowledgement to an area (MF/HF) or all ships (VHF),

n) the operator is able to send a distress relay.

Change the MMSI of the TE, recompose the DROBOSE, make the same error, and transmit. Verify that:

o) the self-terminating alarm sounds,

p) the distress information is displayed error free.

Select the option on the TE to send a relay. Address the relay to the EUT and on HF change the frequency of the DSC transmission to 4 207,5 kHz. Edit the message such that the DX and RX positions of the nature in distress are in error (make the 3-bit zero count disagree with the 7-bit symbol value). Transmit the edited DSC message and verify that:

q) a new procedure is initiated to handle the individually addressed relay,

r) the two-tone alarm sounds and self-terminates,

s) the operator is made aware of the fact the received DSC message has (critical) errors,

t) the EUT is unable to acknowledge the sender and the reason why is displayed•,

u) the operator is unable to send any distress relay acknowledgement•,

v) the operator is unable to send a distress relay•,

w) the operator is able to send a DROBOSE•,

x) one can speak to the EUT from the TE,•

y) one can speak to the TE from the EUT.•

Reset the EUT and TE into standby. Recompose the original DROBOSE. Edit the message such that the DX and RX positions of the relay telecommand 1 value are in error (make the 3-bit zero count disagree with the 7-bit symbol value). Transmit the edited DSC message and verify that:

z) the two-tone alarm sounds,

aa) the reason for and means to silence the alarm is displayed,

bb) the alarm can only be silenced manually,

cc) the DSC message is nevertheless identified as a distress relay,

dd) the operator is able to send a distress relay acknowledgement to an area (MF/HF) or all ships (VHF),

ee) the operator is able to send a distress relay.

Select the option on the TE to send an all-ships distress relay acknowledgment and on HF change the frequency of the DSC transmission to 6 312,0 kHz. Edit the message such that the DX and RX positions of the relay telecommand 1 value are in error (make the 3-bit zero count disagree with the 7-bit symbol value). Transmit the edited DSC message and verify that:

ff) the distress acknowledgement alarm sounds,

gg) the reason for and means to silence the alarm is displayed,

hh) the alarm can only be silenced manually,

ii) the procedure on the EUT is recognized as acknowledged,

jj) HF only: the general receiver and transmitter is tuned to 6 215,0 kHz in the absence of operator intervention.

Set the EUT and TE into standby. Select the option on the TE to send a distress alert acknowledgment and on HF set the frequency of the DSC transmission to 12 577,0 kHz. Edit the message such that the DX and RX positions of the alert acknowledgement telecommand 1 value are in error (make the 3-bit zero count disagree with the 7-bit symbol value). Transmit the edited DSC message and verify that:

kk) the two-tone alarm sounds,

ll) the reason for and means to silence the alarm is displayed,

mm) the alarm can only be silenced manually,

nn) the received DSC message type is labelled a relay but that the DSC message type is in error,

oo) the operator is able to send a distress relay,•

pp) the operator is unable to send a distress relay acknowledgement,•

qq) one can speak to the EUT from the TE,•

rr) one can speak to the TE from the EUT.•

C.12.2.3 Errors in received non-distress DSC messages

C.12.2.3.1 Purpose

This test checks how the EUT responds to received non-distress DSC messages that have critical errors.

C.12.2.3.2 Method of test and required results

Set both the EUT• and TE in standby. On the TE, compose an individual DSC message of priority "urgency" addressed to the EUT requesting voice subsequent communication. Before transmitting the message, place a 3-bit error in the DX and RX positions of the first word of the self-ID MMSI. Transmit the edited DSC message and verify that:

a) the appropriate alarm sounds and self-terminates,

b) the operator is made aware of the fact the received DSC message has (critical) errors and cannot acknowledge,

c) the MMSI of the sender is displayed with error indicators in the first two digits•,

d) none of the acknowledgement options are available•.

Resend the identical message with the edited error from the TE. Verify that the self-terminating alarm sounds.

On the TE correct the error in the RX word and resend the DROBOSE. Verify that:

a) the appropriate alarm sounds,

b) the reason for and means to silence the alarm is displayed,

c) the alarm can only be silenced manually,

d) the MMSI of the sender is displayed and all 9 digits are correct,

e) all three acknowledgement options are available.

On the TE, reset the RX word to an error value, and transmit. Verify that:

a) the self-terminating alarm sounds,

b) the self-ID is displayed error free,

c) all three acknowledgement options are available,

d) the operator can acknowledge the TE with "able to comply".

Reset both the EUT• and TE in standby. On the TE, compose an individual DSC message of priority "urgency" addressed to the EUT requesting voice subsequent communication. Before transmitting the message. place a 3-bit error in the DX and RX positions of the first word of the frequency message. Transmit the edited DSC message and verify that:

a) the appropriate alarm sounds,

b) the reason for and means to silence the alarm is displayed,

c) the alarm can only be silenced manually,

d) the operator is made aware of the fact the there is an error in the subsequent communication frequency,

e) the "able to comply" acknowledgement option is NOT available,

f) the operator can acknowledge the TE suggesting a new frequency of subsequent communication,

g) the EUT can talk to the TE,

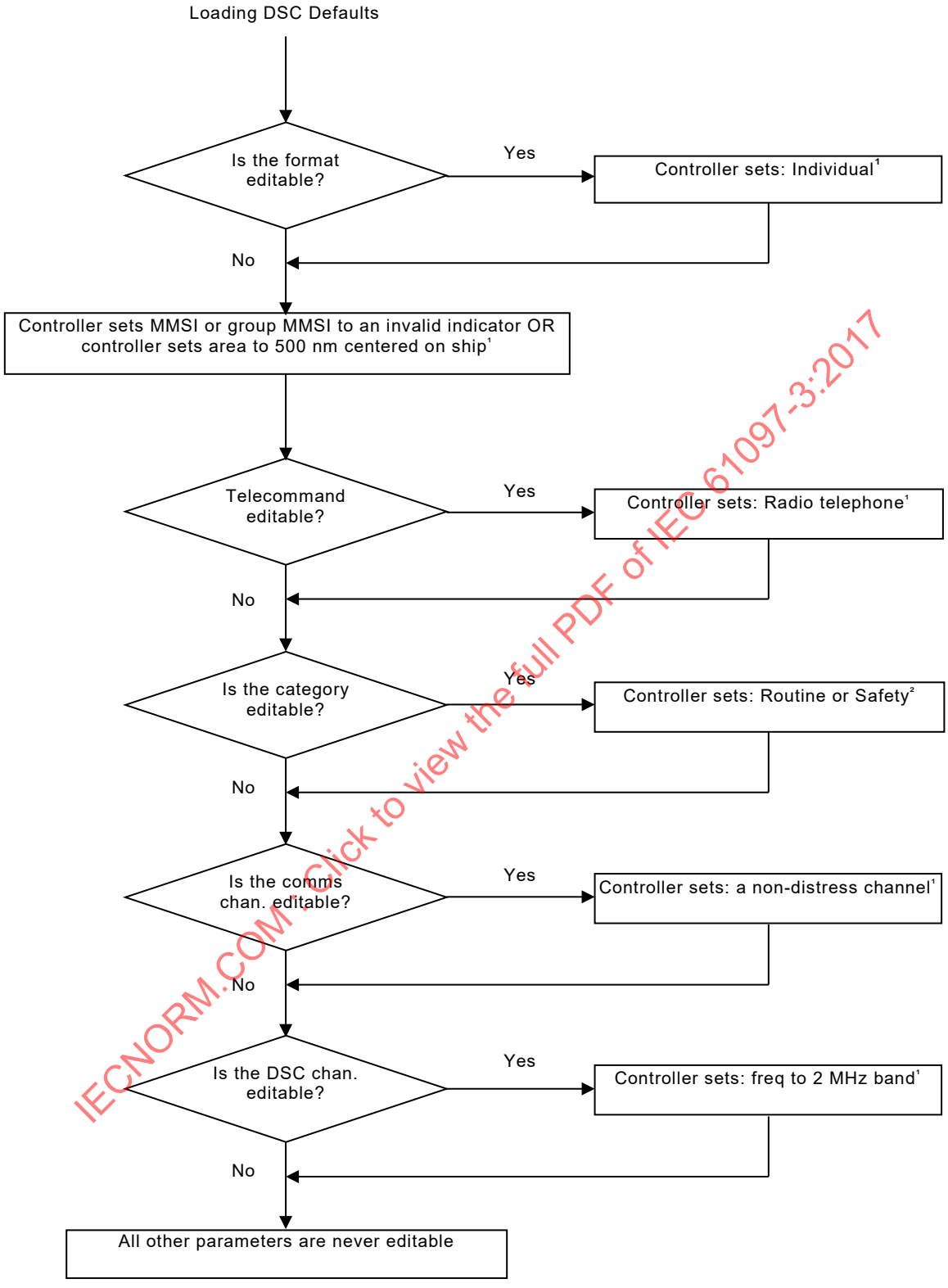
h) the TE can talk to the EUT.

Annex D
(normative)

DSC message composition

D.1 Default values

When default parameters are necessary, the factory default values shall be as shown in Figure D.1.



[1] Only if the parameter has not already been set by the operator.

[2] The default is "routine" if allowed (it is not allowed for area or all ships messages), otherwise the default is "safety". This default is to be reset (the most recently entered value shall be overwritten) when the operator selects the option to compose a non-distress DSC message at some later time.

Figure D.1 – Loading DSC defaults

D.2 The default DROBOSE

Default parameters for DROBOSE are given in Table D.1.

Table D.1 – Default DROBOSE

Vessel in distress MMSI	Format[a]	*Nature*	Distress comms	Position	UTC time of position
Unknown	Individual	Undesignated	Phone	Unknown	Unknown
[a] The destination MMSI shall be some invalid indicator.					

The MMSI of the vessel in distress, format, nature, and position shall be reset when the operator selects the option to compose the DROBOSE at some later time.

D.3 Allowable non-distress DSC message parameters

The EUT shall provide the operator only with the ability to send non-distress DSC messages with the parameter combinations as given by Recommendation ITU-R M.493 For convenience, the allowable parameter combinations for the various message types for non-distress DSC messages are summarized in Table D.2.

Parameters in **bold** type are fixed for that DSC message type, and when composing that message type, the fixed parameters shall not be able to be edited by the operator.

Table D.2 – Allowable parameter combinations

Message type	Format[a]	Category	Telecommand	Freq message
Safety and Urgency	Individual Area[b], All-ships[c]	Safety, Urgency	Phone, HF: NBDP	Comms freq[e]
Individual routine	**Individual**	**Routine**	Phone, HF: NBDP	Comms freq[e]
Group call	**Group**	**Routine**	Phone, HF: NBDP	Comms freq[e]
Position request	**Individual**	**Safety**	**Position request**	**No info**
Test	**Individual**	**Safety**	**Test**	**No info**
Medical Transport[d]	**Area[2], All-ships[c]**	**Urgency**	Phone, HF: NBDP	Comms freq[e]
Neutral Craft[d]	**Area[2], All-ships[c]**	**Urgency**	Phone, HF: NBDP	Comms freq[e]

[a] The ability to enter/select an appropriate address for the individual, area, and group formats is also necessary.

[b] MF/HF only (except when VHF supports the enhanced geographic area extension)

[c] VHF only

[d] The Medical Transport and Neutral Craft DSC messages shall only be available as a setup option. In the factory defaults, these DSC messages shall not be available.

[e] On MF/HF, the communications options are the duplex and simplex radio phone and NBDP channels/frequencies. On VHF, the communication options are the applicable channels in Appendix 18 of the Radio Regulations:2016. A broadcast option is also permissible. For individually addressed DSC messages, there is also the option of letting the other station decide. When directed to a coast station, the EUT shall let the coast station decide the working frequencies. On MF/HF, the ship station shall provide position information in place of the frequency message. On VHF, the ship station may put the "no information" characters in the frequency message.

Annex E
(normative)

Radius-centre point conversion and rounding algorithm

E.1 Radius-centre point conversion

The Mercator box specification coded into the DSC message shall be the minimum sized box that encompasses the entire circle as illustrated in Figure E.1.

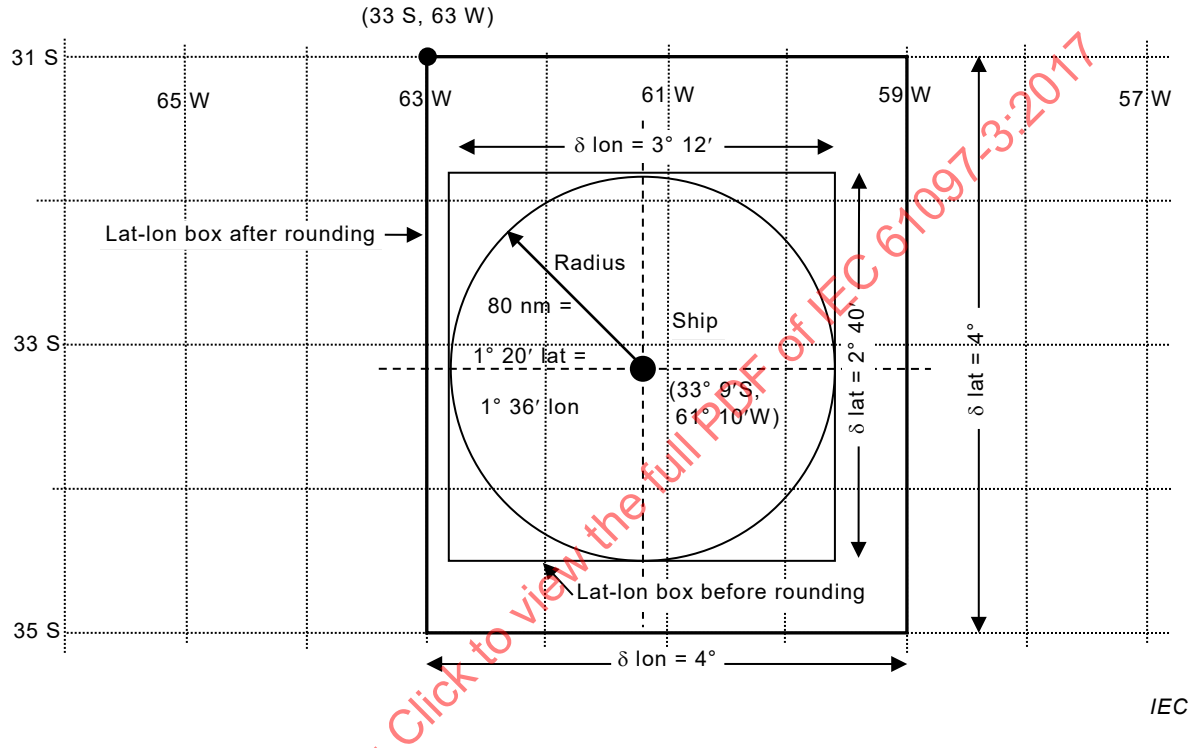


Figure E.1 – Circle-radius to lat-lon box

The centre point, radius to northwest corner point, latitude-longitude Mercator box conversion shall take the following steps. The situation shown in Figure E.1, a radius of 80 nautical miles cantered on the point (33º 9'S, 61º 10'W) is used as an example in the conversion algorithm below as an illustration.

a) Define the centre point as given by the latitude – longitude point (θ, λ): (33º 9'S, 61º 10'W).

b) The radius shall be converted to units of latitude φ: (80 nautical miles = 1º 20' latitude).

c) The equivalent value in units of longitude shall be given by: $\gamma = \varphi / \cos\theta$, where θ is the latitude of the centre point: 1º 36' longitude = 1º 20' latitude / cos(33º 9'). If the longitude exceeds 49º 00', the longitude shall be truncated to that value since the maximum box width in the DSC sentence is 99º.

d) The dimensions of the Mercator box before rounding shall be given by (2φ, 2γ): (2º 40', 3º 12').

e) The northwest corner point of the Mercator box before rounding shall be given by moving the centre point latitude north by the radius distance φ and the centre point longitude west by the radius distance γ: (33º 9'S + 1º 20'N, 61º 10'W + 1º 36'W) = (31º 49'S, 62º 46'W).

E.2 Rounding

If the enhanced geographic position expansion option is not used, the northwest corner point and Mercator box dimensions shall be rounded. The rounding shall take place as follows.

a) The northwest corner point latitude shall be moved northward to the nearest whole degree latitude, and the longitude shall be moved westward to the nearest whole degree longitude:31º 49'S becomes 31º S, a movement of 49'N and 62º 46'W becomes 63º W, a movement of 14'W.

b) The northward and westward movements needed to round the northwest corner point to whole degrees shall be added to the latitude height and longitude width of the Mercator box: (2º 40' + 49', 3º 12' + 14') = (3º 29', 3º 26').

c) The final dimensions of the Mercator box shall be rounded upward to the nearest whole degree: (4º, 4º).

E.3 Special cases for either form of area data entry

a) If the final northwest corner point via either entry method exceeds 90ºN, it shall be truncated to 90ºN, and the latitude height of the Mercator box shall be adjusted accordingly.

b) If the final southern extent of the Mercator box via either entry method exceeds 90ºS, the latitude height shall be truncated so that it reaches 90ºS.

c) If the final longitudinal dimension of the Mercator box exceeds 99º, the dimension shall be truncated to 99º.

d) If the final latitudinal dimension of the Mercator box exceeds 99º, the dimension shall be truncated to 99º.

Annex F
(normative)

Automated non-distress channel/frequency selection algorithm

F.1 General

Automated subsequent communications channel selection provides a default channel for the operator for non-distress DSC messages requiring subsequent communications based upon a simple algorithm. It shall be applied in the absence of any other specialized means of an automated communication setup, such as HF automatic link establishment (ALE).

F.2 VHF

Channel 16 shall not be used as a default for routine category DSC messages.

If the DSC message is directed toward a ship station, a simplex channel shall be used (for example channel 6).

DSC messages directed toward a coast station shall let the coast station decide (position or all 126's in the frequency parameters of the DSC message).

DSC messages directed to a group (area) or all ships shall use the broadcast mode (126's for the TX channel in the frequency parameters of the DSC message).

Due to the regional nature of VHF, the actual channel number for each vessel may be established as an operator set up option.

F.3 HF

On HF, one has several bands of simplex and duplex frequencies for both voice or analogue signals (3 000 Hz bandwidth) and data signals (500 Hz bandwidth).

The distress channels shall not be used for routine category DSC messages.

The band of the communication channel shall be in the band of the DSC message.

The set of 3 000 Hz analogue channels shall be chosen for voice communications.

The set of 500 Hz data (NBDP) channels shall be chosen for data modes such as NBDP.

DSC messages addressed to coast station destinations shall let the coast station decide (position in the frequency parameters of the DSC message).

DSC messages addressed to ship station destinations shall use the simplex set of channels.

DSC messages directed to a group or an area shall use the broadcast mode (126's for the TX frequency in the frequency parameters of the DSC message).

The automated channel/frequency selection shall be able to be overridden (which will be necessary to select a distress channel.

Annex G
(normative)

DSC message detection and decoding

Figure G.1 shows a schematic of the various tests and error checks that are required before the message is accepted. The "bit detector" is the output of the DSC modem and provides the source of the 0 and 1 bitstream computed from the received signal. A DSC "word" consists of 10 bits, a 7-bit "symbol" and a 3-bit "number of zeros in the symbol" or "zero-count" value. The sequence of the process is shown as (1), (2), (3).

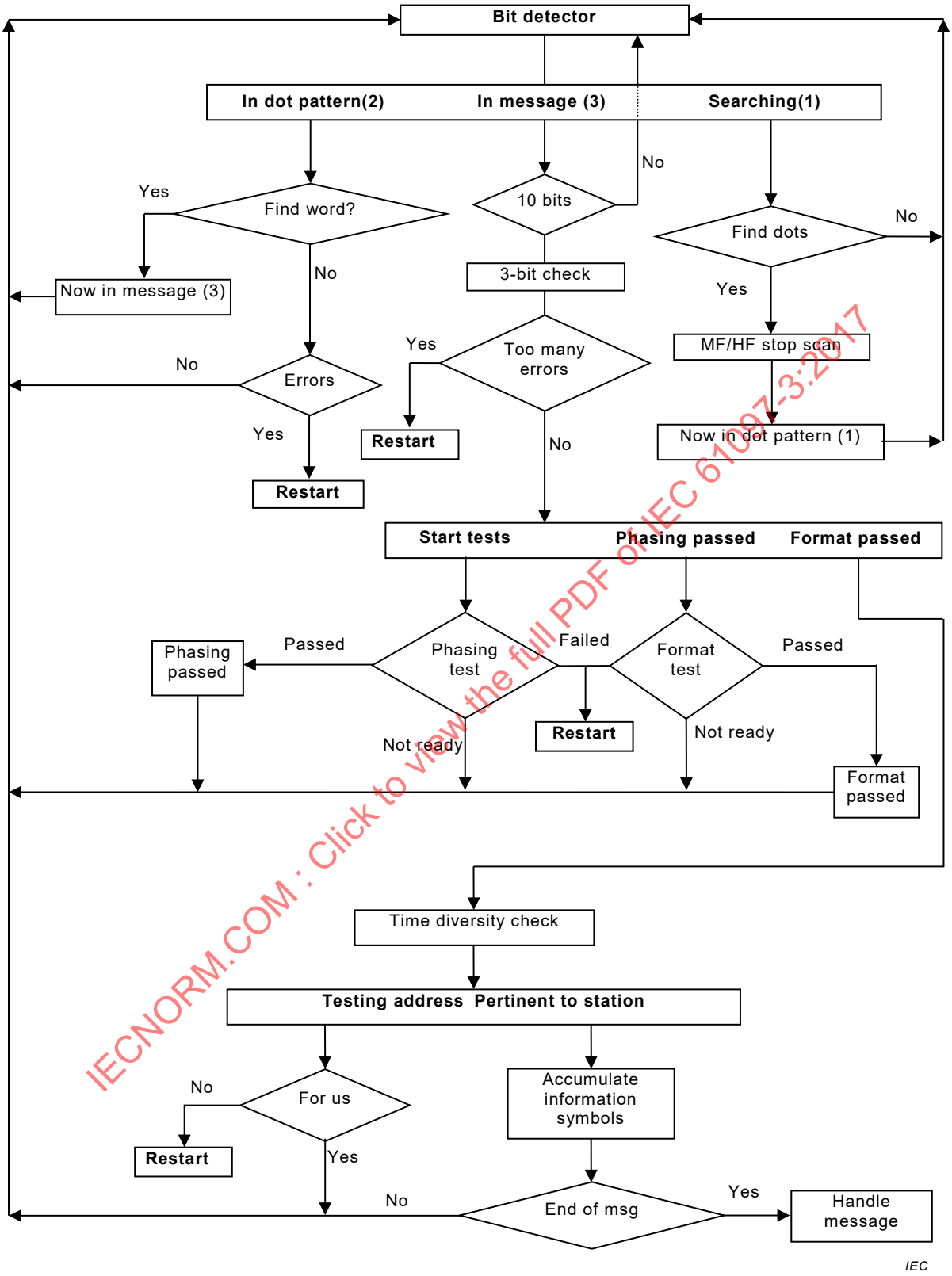


Figure G.1 – Tests and error checks

Annex H
(normative)

Audible annunciation and BAM alert signalling

H.1 Aural alert specifications

Table H.1 summarizes the aural alert characteristics required by the EUT. The "event" is the reason for the alert detected at EUT. The "sound" specifies the default audio character of the aural alert whose detailed characteristics are specified in Table H.2. The "BAM Alert" indicates if the event shall also result in signalling to the BAM and how. The "increase" specifies whether or not the aural alert shall increase in volume over the first 10 s. The "shutdown" specifies whether the alert shall be terminated manually (man), may be silenced automatically (auto), or automatically terminated if the situation causing the alert is corrected (corr). Manual silencing of aural alerts is always an option. The "when aural required" column specifies the conditions under which the aural alert is mandatory.

It is assumed in Table H.1 that any references to received DSC messages refer only to messages implicitly or explicitly addressed to the station.

Due to the categorization of BAM alerts as in Table H.1, the following assumptions are made:

- BAM alert priority Alarm or Warning are the only priorities that can be silenced temporarily from BAM, thus being the only alerts allowed to have continuous sounding audible alerts;
- BAM alerts with priority Caution shall be self-terminating (or be a very short sound using a repetition interval of at least 1 min) and shall not require manual shutdown.

Table H.1 – Audible characteristics

Event	Sound at EUT	BAM alert	Increase	Shutdown	When aural is required
Initiating a received distress automated procedure[a]	Distress alarm	Priority: Warning Category: A	Yes	Man	Only if within 500 NM of the vessel in distress or if from north of 70°N or south of 70°S otherwise aural alert self-terminates.
Acknowledging a received distress automated procedure[a]	Distress ack	Priority: Warning Category: A	No	Man	Only if within 500 NM of the vessel in distress or if from north of 70°N or south of 70°S otherwise aural alert self-terminates.
Acknowledging a sent distress automated procedure[a]	Distress ack	Does Not Apply	No	Man	Always.
RX DSC message not pertinent to unacknowledged sent distress automated procedure	Silence	Does Not Apply	Does not Apply	Does not Apply	DSC message is only logged; no alert of any type is required
Initiating a received urgency non distress automated procedure	Urgency alert	Priority: Warning Category: A	Yes	Man	Always when the priority of the non-distress DSC message is (distress[b]) or urgency
Acknowledging a sent urgency non distress automated procedure	Urgency ack alert	Does Not Apply	No	Man	Always when the priority of the non-distress DSC message is (distress[b]) or urgency
Initiating all other priority non distress automated procedures[a]	Routine alert	Priority Caution	Yes	Auto	When the priority of the non-distress DSC message is safety, routine, ships business, or unknown

Event	Sound at EUT	BAM alert	Increase	Shutdown	When aural is required
Acknowledging all other priority sent non distress automated procedures	Routine ack alert	Does not Apply	No	Auto	When the priority of the non-distress DSC message is safety, routine, ships business, or unknown
RX DSC message pertinent to an ongoing automated procedure	Self-terminating alert	Does not Apply	No	Auto	Always
Auto termination of procedures; too many procedures	Discrete	Does not Apply	No	Auto	Always
No own MMSI	Warning	Does not Apply	No	Auto	Only on equipment power up
Automatic positioning ceases	Warning[b]	Priority: caution	No	Man / corr	Only if configured for auto position updating and position data has not been received for 10 min or, in the case of turning on the EUT, no position data has been received more than 1 min.
Position older than 4 h	Warning	Does not Apply	No	Man	At all times the situation is satisfied.
Position older than 23,5 h	Warning	Does not Apply	No	Man	Only if older than 4 h alert has been silenced
Pressing the dedicated distress button	Count	Does not Apply	No	———	At all times the situation is satisfied.
Antenna tuner error or other detected antenna failure	Warning[b]	Priority: warning category: B	No	Man / corr	If facilities are supported in EUT
Transmission power error or otherwise inhibited transmission	Warning[b]	Priority: warning category: B	No	Man / corr	If facilities are supported in EUT

[a] Only when the event occurs due to the reception of a DSC message.

[b] Align sound pattern with BAM Warning, 2 short beeps, silence for next 5 min when active-unacknowledged (IEC 61924-2:2012, Table 6, and MSC 302(87):2010, 8.3 and 7.6).

H.2 Alerting with critical errors

If an automated procedure is initiated by a DSC message with critical errors (errors in the information symbols such that the procedure cannot take any action such as generating acknowledgements), the aural alert shall self-terminate. The sound of the alert shall be that it would have had if the DSC message were received without critical errors. The alert specified in Table H.1 (perhaps requiring manual termination or signalling towards BAM) shall be delayed until that time the reception of subsequent or repeat DSC messages allows the procedure to correct the critical errors.

H.3 Default aural alert sounds

The accuracy of the tones and durations specified in Table H.1 and Table H.2 are not critical since they are for the human ear and not electronic detection. Nevertheless, the error shall not be more than 5 % in frequency and time. The waveforms may be sinusoidal, square, triangular, sawtooth, or any other form as long as the fundamental tone is clearly recognizable.

The distree and urgency alerts of Table H.2 shall initially be of a power that is clearly distinguishable, but not interfere with, radiotelephone communications. If not manually

cancelled within 10 s, the power shall start to rise to a level of at least 80 dB(A) within the next 10 s at a distance of 1 m from the equipment.

The "count" alert of Table H.3 shall have a power level of at least 80 dB(A) at a distance of 1 m from the equipment.

All other aural alerts in Table H.3 shall be of a power (or of a final power when appropriate) that is clearly distinguishable, but not interfere with, radiotelephone communications.

The operator shall be unable to customize the distress, distress acknowledgment, urgency and urgency acknowledgement alerts of Table H.2 or use these alerts for other purposes. The alerts of Table H.3 are recommended as factory defaults; however, the manufacturer may implement their own sounds.

Table H.2 – Non configurable alert sounds

Fixed alert sounds[a]	Frequency Hz Tone 1	Frequency Hz Tone 2	Duration ms Tone 1	Duration ms Tone 2
Distress	2 200	1 300	250	250
Distress ack	2 200	1 300	500	500
Urgency	2 200	silence	250	250
Urgency ack	2 200	silence	500	500
[a] The two-tone, distress ack, urgency, and urgency ack alerts shall not be able to be customized.				

Table H.3 – Recommended alert sounds

Customisable alert sound	Frequency Hz Tone 1	Frequency Hz Tone 2	Duration ms Tone 1	Duration ms Tone 2
Routine, safety	350	300	1 000	500
Routine, safety ack	350	300	1 000	1 000
Warning	2 000	silence	250	500
Count	2 000	silence	500	500
Discrete	450	300	500	1 000
Self-terminating	500	360	50	50

Annex I
(normative)

Shipborne watchkeeping receivers

I.1 General and operational requirements

I.1.1 General

The equipment, in addition to meeting the requirements of the Radio Regulations, the relevant ITU recommendations, the IMO performance standards and general requirements set out in IMO resolution A.694(17) and detailed in IEC 60945, shall comply with the following requirements and with the technical requirements contained in this document (A.803/1, A.804/A.1, A.806/A.1).

I.1.2 Construction

The equipment shall be so constructed that it is capable of:

– keeping continuous watch on DSC channels (A.803/2.4.6, A.804/A.2.4.6, A.806/A.2.4.7);
– being operated readily and in accordance with the requirements of this document.

I.2 Technical requirements

I.2.1 Frequency bands and channels

I.2.1.1 Frequency bands

The equipment shall be capable of operating as a single-frequency receiver, as a multiple-frequency receiver and/or as a scanning receiver in one or more of the frequency bands:

a) VHF: 156,025 MHz to 162,025 MHz;
b) MF: 1 605 kHz to 4 000 kHz;
c) HF: 4 MHz to 27,5 MHz.

I.2.1.2 Methods of test and required results

Confirm by observation of the equipment and documentation that the equipment is designed as a single-frequency receiver for a) and b) of I.2.1.1, and for c) of I.2.1.1 as a multiple-frequency receiver or as a scanning receiver in one or more of the frequency bands.

I.2.1.3 Frequencies and channels

Watchkeeping receivers:

a) on VHF, the calling channel for distress, urgency and safety calling as well as for general communication calling is channel 70;
b) MF DSC frequency for distress, urgency and safety calling shall be single-frequency receivers for 2 187,5 kHz;
c) MF and MF/HF scanning receivers shall be designed for scanning of up to six frequencies for either DSC distress alerting only, or for DSC general communication calling only.

I.2.1.4 Methods of test and required results

Confirm by equipment inspection that:

a) on VHF, the calling channel for distress, urgency and safety calling as well as for general communication calling is channel 70.

b) on MF DSC frequency for distress, urgency and safety calling, single-frequency receivers for 2 187,5 kHz are provided.

c) on MF and MF/HF scanning, receivers are designed for scanning of up to six frequencies for either DSC distress alerting only, or for DSC general communication calling only.

I.2.1.5 Mode of reception

I.2.1.5.1 Requirement

Equipment for reception of MF and HF DSC transmissions shall provide for classes of emission F1B or J2B.

Equipment for reception of VHF DSC transmissions shall provide for class of emission G2B.

I.2.1.5.2 Methods of test and required results

Confirm by measurement that the equipment is using, for reception of MF and HF DSC transmissions, the classes of emission F1B or J2B.

Confirm by measurement that the equipment is using, for reception of VHF DSC transmissions, the class of emission G2B.

I.2.1.6 Scanning receivers

I.2.1.6.1 Scanning sequence

I.2.1.6.1.1 Requirement

An MF/HF scanning receiver shall be able to complete a scanning sequence within 2 s.

I.2.1.6.1.2 Methods of test and required results

Confirm by measurement that an MF/HF scanning receiver completes the scanning sequence within 2 s.

I.2.1.6.2 Scanning frequencies

I.2.1.6.2.1 Requirement

Scanning watchkeeping receivers shall be dedicated to either scan DSC distress frequencies or to scan DSC frequencies for general communication. It shall not be possible to have both DSC distress frequencies and DSC frequencies for general communication in one scanning sequence.

I.2.1.6.2.2 Methods of test and required results

Confirm by document and equipment inspection that scanning watchkeeping receivers are dedicated to either scan DSC distress frequencies or to scan DSC frequencies for general communication. Confirm that it is not possible to have both DSC distress frequencies and DSC frequencies for general communication in one scanning sequence.

I.2.1.6.3 DSC distress frequencies

I.2.1.6.3.1 Requirement

Scanning watchkeeping receivers for MF/HF DSC distress frequencies shall scan the frequencies 2 187,5 kHz and 8 414,5 kHz and at least one other HF DSC distress frequency listed in Annex K up to a total of six frequencies in the scanning sequence.

I.2.1.6.3.2 Methods of test and required results

Confirm by equipment and document inspection that scanning watchkeeping receivers for MF/HF DSC distress frequencies are scanning the frequencies 2 187,5 kHz and 8 414,5 kHz and at least one other HF DSC distress frequency listed in Annex K up to a total of six frequencies in the scanning sequence.

I.2.1.6.4 DSC frequencies for general communication

I.2.1.6.4.1 Requirement

Scanning watch receivers for MF and HF DSC frequencies for general communication may scan any frequency up to a total of six frequencies in the scanning sequence.

I.2.1.6.4.2 Methods of test and required results

Confirm by equipment and document inspection that scanning watch receivers for MF and HF DSC frequencies for general communication may scan any frequency up to a total of six frequencies in the scanning sequence.

I.2.1.6.5 Frequency information

I.2.1.6.5.1 Requirement

The selected receiver frequencies shall be clearly identifiable. Means shall be provided for automatic transfer of information of the frequency or channel on which the scanning has stopped for use and display in an external installation. The interface for such transfer shall be in accordance with IEC 61162-1, IEC 61162-2 or IEC 61162-450.

I.2.1.6.5.2 Methods of test and required results

Confirm by equipment inspection that the selected receiver frequencies are clearly identifiable. Confirm further that means are provided for automatic transfer of information of the frequency or channel on which the scanning has stopped for use and display in an external installation and that the interface for such transfer is in accordance with the IEC 61162-1, IEC 61162-2 or IEC 61162-450.

I.3 MF and MF/HF watchkeeping receiver

I.3.1 Maximum usable sensitivity

I.3.1.1 Objective

To determine the maximum usable sensitivity as the minimum level of the signal (e.m.f.) at the nominal frequency of the receiver which, when applied to the receiver input with a standard test signal, will produce a specified SER.

I.3.1.2 Method of measurement

The arrangements for applying the test messages shall be in accordance with 4.2.11.1.

The wanted signal standard test signal STS-1 shall be applied using relevant frequencies as specified by 4.2.11.3:

– for MF, the input level shall be +5 dBμV under normal and +11 dBμV under extreme test conditions;

– for HF, the input level shall be 0 dBμV under normal and +6 dBμV under extreme test conditions.

The symbol error rate in the output shall be determined as described in 4.2.11.2.5.

The measurements shall be carried out under normal test conditions at nominal RF and at input frequencies ±10 Hz. Carry out the tests under extreme test conditions as specified by 4.2.7 at nominal RF..

I.3.1.3 Results required

The symbol error ratio shall be equal to or less than 10^{-2}.

I.3.2 Adjacent channel selectivity

I.3.2.1 Objective

To determine the capability to receive a wanted modulated signal without exceeding a specified message error rate due to the presence of an unwanted modulated signal in channels adjacent to that of the wanted signal.

I.3.2.2 Method of measurement

The arrangements for applying the test messages shall be in accordance with 4.2.11.1.

The wanted RF signal shall be standard test signal STS-1 using relevant frequencies as specified by 4.2.11.3.

The wanted signal input level shall be +20 dBμV.

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

The level of the unwanted signal shall be +60 dBμV.

The symbol error rate in the output shall be determined as described in 4.2.11.2.5.

I.3.2.3 Results required

The symbol error ratio shall be equal to or less than 10^{-2}.

I.3.3 Co-channel rejection

I.3.3.1 Objective

To determine the capability to receive a wanted modulated signal without exceeding a specified error rate due to the presence of an unwanted modulated signal, both signals being at the nominal frequency of the receiver.

I.3.3.2 Method of measurement

The arrangements for applying the test messages shall be in accordance with 4.2.11.1.

The wanted signal shall be standard test signal STS-1 using relevant frequencies as specified by 4.2.11.3.

The wanted signal input level shall be +20 dBμV.

The unwanted signal shall be unmodulated. The level of the unwanted signal shall be +14 dBμV. Both input signals shall be at the nominal frequency of the receiver.

The symbol error rate in the output shall be determined as described in 4.2.11.2.5.

I.3.3.3 Results required

The symbol error ratio shall be equal to or less than 10^{-2}.

I.3.4 RF intermodulation response

I.3.4.1 Objective

To determine the capability to reject intermodulation products originating from two or more (generally unwanted) signals at specified levels simultaneously present in a non-linear circuit.

I.3.4.2 Method of measurement

The arrangements for applying the test messages shall be in accordance with 4.2.11.1.

The wanted signal shall be standard test signal STS-1 using relevant frequencies as specified by 4.2.11.3.

The wanted signal input level shall be +20 dBμV.

The two unwanted signals shall be applied, both unmodulated and at the same level of +70 dBμV. Neither of the two signals shall be at a frequency nearer to the wanted signal than 30 kHz.

NOTE Frequency combinations capable of resulting in unwanted intermodulation products are given in Recommendation ITU-R SM.332.

The symbol error rate in the output shall be determined as described in 4.2.11.2.5.

I.3.4.3 Results required

The symbol error ratio shall be equal to or less than 10^{-2}.

I.3.5 Spurious response rejection

I.3.5.1 Objective

To measure the ability of the receiver to receive a wanted modulated signal at the nominal frequency without exceeding a specified error rate due to the presence of an unwanted signal at any other frequency band outside the passband of the receiver.

I.3.5.2 Method of measurement

The manufacturer shall provide the test house with the information regarding the equipment.

In general, a block diagram from which it appears what signal path architecture there has been chosen.

If the equipment is built using heterodyne principles, the following shall be stated:

- IF frequencies used;
- the local oscillator frequencies;
- filter arrangements ahead of the first mixer.

If the equipment uses analog to digital converter techniques the following shall be stated:

- whether the sampling is done directly on the RF frequency or on an IF frequency;
- the sampling frequency used for the conversion.

The arrangements for applying two test signals to the receiver input shall be according to 4.2.11.1. The AGC shall be in operation.

The wanted signal shall be at the nominal assigned frequency and shall use standard test signal STS-1.

The wanted signal shall be standard test signal STS-3 at an input level of +20 dBμV.

The unwanted signal level shall be +90 dBμV and shall be unmodulated.

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

The equipment shall be in compliance for the unwanted signal frequencies from 9 kHz to 2 GHz with the exception of the frequency band ±3 kHz from the nominal receiver frequency.

The equations below for calculation of spurious frequencies can be used as a guidance.

a) For equipment using super heterodyne principles

$$f_{\text{spurious}} = (1 - n)/\text{m} \times f_{\text{if}} - n/m \times f_{\text{receive}}$$

where

m and n are integers with values from –5 to +5.

Spurious frequency calculation should be applied to all frequency conversions (IF1, IF2, etc.).

b) For equipment using analog to digital converter techniques

$$f_{\text{spurious}} = f_{\text{receive}}\ /m - n/m \times f_{\text{sample clock}}$$

where

m and n are integers with values from –5 to +5.

For equipment where both heterodyne principles and digital techniques are used, both equations should be taken into consideration.

The symbol error rate in the output shall be determined as described in 4.2.11.2.5.

Measurements shall be made under normal test conditions.

I.3.5.3 Results required

The symbol error ratio shall be equal to or less than 10^{-2}.

I.3.6 Blocking immunity

I.3.6.1 Objective

Blocking immunity is defined as the receiver ability to discriminate between wanted signal and unwanted signals at frequencies from ±3 kHz to ±20 kHz from the nominal assigned frequency.

I.3.6.2 Method of measurement

The arrangements for applying two test signals to the receiver input shall be accordance with 4.2.11.1. The AGC shall be in operation.

The wanted signal standard test signal STS-1 shall be applied using relevant frequencies as specified by 4.2.11.3.

The level of the wanted signal shall be +20 dBμV.

The level of the unwanted signal shall then be +90 dBμV and shall be unmodulated and varied in frequency steps of 500 Hz.

The equipment shall be in compliance for frequencies from ±3 kHz to ±20 kHz from the nominal assigned frequency.

The symbol error ratio in the output shall be determined as described in 4.2.11.2.5.

I.3.6.3 Results required

The symbol error ratio shall be equal to or less than 10^{-2}.

I.3.7 Dynamic range

I.3.7.1 Objective

To determine the range from the maximum usable sensitivity to the maximum level of an input signal at which the error rate in the output of the receiver does not exceed a specified value.

I.3.7.2 Method of measurement

The arrangements for applying the test signals shall be in accordance with 4.2.11.1.

The wanted signal standard test signal STS-1 shall be applied using relevant frequencies as specified by 4.2.11.3.

The wanted input signal level shall be +80 dBμV.

The symbol error rate in the output shall be determined as described in 4.2.11.2.5.

I.3.7.3 Results required

The symbol error ratio shall be equal to or less than 10^{-2}.

I.3.8 Conducted spurious emissions into the antenna

I.3.8.1 Objective

All internally generated signals conducted to the antenna terminal and which may be radiated are noted as the conducted spurious emissions into the antenna, and shall not exceed 2 nW.

I.3.8.2 Method of measurement

The receiver antenna terminal shall be connected to a 50 Ω artificial antenna and the spurious emissions shall be measured, using a selective measuring instrument. The RMS value of any component of the spurious emission shall then be evaluated. The measurement shall be made over the frequency range from 9 kHz to 2 GHz. The bandwidth of the selective measuring instrument shall be:

– 200 Hz in the frequency range from 9 kHz to 150 kHz;
– 9 kHz to 10 kHz in the frequency range from 150 kHz to 30 MHz;
– 100 kHz to 120 kHz in the frequency range from 30 MHz to 1 GHz; and

– 1 MHz above 1 GHz.

The detector shall be a peak detector.

I.3.8.3 Results required

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

I.3.9 Protection of receiver antenna input circuits

I.3.9.1 Objective

To determine the ability of the receiver antenna input circuits to withstand large voltages for a specified time.

I.3.9.2 Method of measurement

The arrangements for applying the test signals shall be in accordance with 4.2.11.1. Confirm that the receiver does not suffer damage when an unmodulated radiofrequency signal at an input level of 30 V RMS for one frequency in each selectable frequency band in which the receiver is designed to operate is applied to its antenna input terminal for a period of 15 min. The signal shall then be removed and the EUT be subjected to a performance check.

I.3.9.3 Results required

The receiver shall not suffer damage and shall meet the requirement of the performance check.

I.3.10 Stop/start of scanning efficiency

I.3.10.1 Objective

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

I.3.10.2 Method of measurement

Two RF test signals with a level of +20 dBμV shall be applied to the receiver in accordance with 4.2.11.1. One of the RF signals shall have a nominal frequency corresponding to a frequency in the scanning sequence and be standard test signal STS-1 containing a single DSC distress call. The other RF signal shall have a nominal frequency corresponding to another frequency being scanned. It shall be standard test signal STS-1 containing DSC calls with a 20 bit dot pattern. The distress call sequences shall be repeated after a random interval of 2,5 s to 4,0 s. The receiver shall be set to scan the maximum number of frequencies for which it is designed. The number of transmitted calls shall be 200 and the symbol error rate shall be determined as described in 4.2.11.2.5.

I.3.10.3 Results required

The total number of received distress calls shall be equal to or exceed 95 % of distress calls transmitted.

I.4 VHF watchkeeping receiver

I.4.1 Maximum usable sensitivity

I.4.1.1 Objective

The calling sensitivity of the receiver is a defined RF-signal level at which the symbol error ratio will result in a decoded DSC message.

I.4.1.2 Method of measurement

The signals applied to the receiver input shall be connected in accordance with 4.2.11.1.

The wanted signal standard test signal STS-3 shall be applied using relevant frequencies as specified by 4.2.11.3.

The input level shall be 0 dBμV under normal test conditions and +6 dBμV under extreme test conditions.

The measurement shall then be repeated under extreme test conditions in accordance with 4.2.7.

The measurement shall be repeated under normal test conditions at the nominal carrier frequency ±1,5 kHz.

The symbol error rate in the output shall be determined in accordance with 4.2.11.2.5.

I.4.1.3 Results required

The symbol error ratio shall be equal to or less than 10^{-2}.

I.4.2 Adjacent channel selectivity

I.4.2.1 Objective

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.

I.4.2.2 Method of measurement

The signals applied to the receiver input shall be connected in accordance with 4.2.11.1.

The wanted signal standard test signal STS-3 shall be applied using relevant frequencies as specified by 4.2.11.3.

The level of the wanted signal shall be +3 dBμV.

The unwanted signal shall be modulated by 400 Hz with a deviation of ±3 kHz at the frequency +25 kHz relative to the nominal receiver frequency.

The input level of the unwanted signal shall be +73 dBμV.

The measurement shall be repeated with the unwanted signal tuned to the centre frequency of the lower adjacent channel.

The symbol error rate in the output shall be determined as described in 4.2.11.2.5.

I.4.2.3 Results required

The symbol error ratio shall be equal to or less than 10^{-2}.

I.4.3 Co-channel rejection ratio

I.4.3.1 Objective

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.

I.4.3.2 Method of measurement

The signals applied to the receiver input shall be connected in accordance with 4.2.11.1.

The wanted signal standard test signal STS-3 shall be applied using relevant frequencies as specified by 4.2.11.3.

The level of the wanted signal shall be +3 dBμV.

The unwanted signal shall be modulated by 400 Hz with a deviation of ±3 kHz at the nominal receiver frequency.

The level of the unwanted signal shall be -5 dBμV.

The symbol error rate in the output shall be determined as described in 4.2.11.2.5.

I.4.3.3 Results required

The symbol error ratio shall be equal to or less than 10^{-2}.

I.4.4 Intermodulation response

I.4.4.1 Objective

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.

I.4.4.2 Method of measurement

The signals applied to the receiver input shall be connected in accordance with 4.2.11.1.

The wanted signal standard test signal STS-3 shall be applied using relevant frequencies as specified by 4.2.11.3.

The level of the wanted signal shall be +3 dBμV.

The unwanted signals shall be applied, both at the same level. 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 input level of the unwanted signals shall be +68 dBμV.

The symbol error rate in the output shall be determined accordance with 4.2.11.2.5.

I.4.4.3 Results required

The symbol error ratio shall be equal to or less than 10^{-2}.

I.4.5 Spurious response rejection

I.4.5.1 Objective

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.

I.4.5.2 Method of measurement

The manufacturer shall provide the test house with the information regarding the equipment.

In general, a block diagram from which it appears what signal path architecture there has been chosen.

If the equipment is built using heterodyne principles, the following shall be stated:

- IF frequencies used;
- the local oscillator frequencies;
- filter arrangements ahead of the first mixer.

If the equipment uses analogue to digital converter techniques, the following shall be stated:

- whether the sampling is done directly on the RF frequency or on an IF frequency;
- the sampling frequency used for the conversion.

The arrangements for applying two test signals to the receiver input shall be according to 4.2.11.1.

The wanted signal standard test signal STS-3 shall be applied using relevant frequencies as specified by 4.2.11.3.

The level of the wanted signal shall be +3 dBμV.

The level of the unwanted signal shall then be +73 dBμV and shall be unmodulated.

The equipment shall be in compliance for frequencies from 9 kHz to 2 GHz with the exception of the receiver passband and the adjacent channels.

The equations below for calculation of spurious frequencies can be used as a guidance.

a) For equipment using super heterodyne principles

$$f_{\text{spurious}} = (1 - n)/m \times f_{\text{if}} - n/m \times f_{\text{receive}}$$

where

m and n are integers with values from –5 to +5.

Spurious frequency calculation should be applied to all frequency conversions (IF1, IF2, etc.).

b) For equipment using analog to digital converter techniques

$$f_{\text{spurious}} = f_{\text{receive}}\ /m - n/m \times f_{\text{sample clock}}$$

where

m and n are integers with values from –5 to +5.

c) For equipment where both heterodyne principles and digital techniques are used, both equations should be taken into consideration.

The symbol error rate in the output shall be determined accordance with 4.2.11.2.5.

I.4.5.3 Results required

The symbol error ratio shall be equal to or less than 10^{-2}.

I.4.6 Blocking immunity

I.4.6.1 Objective

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

I.4.6.2 Method of measurement

The arrangements for applying two test signals to the receiver input shall be in accordance with 4.2.11.1.

The wanted signal standard test signal STS-3 shall be applied using relevant frequencies as specified by 4.2.11.3.

The level of the wanted signal shall be +3 dBμV.

The level of the unwanted signal shall then be +93 dBμV and shall be unmodulated and varied in frequency steps of 500 Hz.

The equipment shall be in compliance for frequencies from ±1 MHz to ±10 MHz from the nominal assigned frequency.

The symbol error rate in the output shall be determined accordance with 4.2.11.2.5.

When a spurious response occurs, refer to I.4.5.

I.4.6.3 Results required

The symbol error ratio shall be equal to or less than 10^{-2}.

I.4.7 Dynamic range

I.4.7.1 Objective

The dynamic range of the equipment is the range from the minimum to the maximum level of a radio frequency input signal at which the symbol error rate.

I.4.7.2 Method of measurement

The signals applied to the receiver input shall be connected in accordance with 4.2.11.1.

The wanted signal standard test signal STS-3 shall be applied using relevant frequencies as specified by 4.2.11.3.

The level of the wanted signal shall be +80 dBμV.

The symbol error rate in the output shall be determined in accordance with 4.2.11.2.5.

I.4.7.3 Results required

The symbol error ratio shall be equal to or less than 10^{-2}.

I.4.8 Conducted spurious emissions conveyed to the antenna

I.4.8.1 General

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

I.4.8.2 Objective

The power of any conducted spurious emission, measured at the antenna terminals, shall not exceed 2,0 nW at any discrete frequency in the frequency range 9 kHz to 2 GHz.

I.4.8.3 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.

I.4.8.4 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.

Annex J
(normative)

Shipborne VHF radiotelephone transmitter and receiver

J.1 General and operational requirements

J.1.1 General

The equipment, in addition to meeting the requirements of the Radio Regulations, the relevant ITU recommendations, the IMO performance standards and general requirements set out in IMO resolution A.694(17) and detailed in IEC 60945, shall comply with the following requirements and with the technical requirements contained in this document (A.803/1).

J.1.2 Composition

The equipment shall comprise at least:

- a transmitter/receiver including antenna;
- an integral control unit;
- a microphone with a press to transmit switch, which may be combined with a telephone in a handset;
- an internal or external loudspeaker;
- an integral digital selective calling facility; and
- a dedicated DSC watchkeeping facility to maintain a continuous watch on channel 70.

The installation may also include additional receivers.

J.1.3 Frequency bands

The equipment shall be designated for operation on one or more channels selected from and in accordance with Appendix 18 of the Radio Regulations:2016, and Recommendation ITU-R M.1084-5, as covered in the footnotes to the Radio Regulations:2016, Appendix 18.

The equipment shall be capable of operating as follows:

- in the band 156,025 MHz to 157,425 MHz and the band 160,625 MHz to 162,025 MHz for transmitting and receiving as specified in appendix 18 to the Radio Regulations; and
- the equipment shall be so designed that the use of channel 70 for purpose other than DSC and AIS channels is prevented.

J.1.4 Multiple watch facilities

VHF radiotelephone equipment having multiple watch facilities shall comply with the following requirements:

- the equipment shall include a provision for the automatic scanning of a priority channel and one additional channel only;
- the priority channel is that channel which will be sampled even if there is a signal on the additional channel and on which the receiver will lock during the time a signal is detected;
- the additional channel is that channel which will be monitored during the periods the equipment is not sampling or receiving signals on the priority channel;
- provision shall be included to switch the scanning facility on and off by means of a manually operated control. In addition it shall be ensured that the receiver remains on the same channel as the transmitter for the entire duration of any communication with the ship;

- selection of the additional channel and, if provided, of the priority channel shall be possible at the operating position of the equipment. If the selection of the priority channel is not provided, the priority channel shall be channel 16;
- when the scanning facility is in operation, the channel number of both channels on which the equipment is operating shall be clearly indicated simultaneously;
- in a transceiver, transmission shall not be possible when the scanning facility is operating. When the scanning facility is switched off, both transmitter and receiver shall be tuned automatically to the selected additional channel;
- a transceiver shall be provided with a single manual control (e.g. push-button) in order to switch the equipment quickly for operation on the priority channel;
- at the operating position of a transceiver, the selected additional channel shall be clearly indicated as being the operational channel of this receiver.

J.2 Switching time

J.2.1 Requirement

Switching time to change frequency is the time from the receive and/or transmit condition at one frequency to another. This includes manual channel selection time, the time to press the press-to-transmit (p.t.t.) switch, and receiver/transmitter response time.

The time taken to change from transmit to receive conditions, and vice versa on the same channel is the total time of the time taken to switch the internal circuit plus receiver/transmitter response time.

Change of channel shall be capable of being made as rapidly as possible, but in any event within 5 s. The time taken to switch from the transmit to the receive condition, and vice versa, shall not exceed 0,3 s.

J.2.2 Method of measurement

The transmitter output shall be connected to an artificial antenna through a coupling device, and a storage oscilloscope shall be connected to the coupling device to monitor the output level of the transmitter. Initially, the EUT shall be set at transmit condition on channel A, depressing the p.t.t. switch. Then, the EUT shall be set to the transmit condition on channel B, after releasing the p.t.t. switch, changing the channel from A to B, and depressing the p.t.t. switch again. The period from the ending of transmission on channel A to the beginning of transmission on channel B shall be measured by the storage oscilloscope.

To measure the time from receive condition to transmit condition, the storage oscilloscope shall be triggered by the p.t.t. switch signal at the starting point of transmission. The period from the starting point to the point where the level of the transmitted signal reaches 90 % of the final level shall be measured.

In addition to the above measuring condition, to measure the time from transmit to receive conditions, the input of the storage oscilloscope shall be connected to the receiver output with the squelch facility switched off. The p.t.t. switch signal shall be used to trigger the storage oscilloscope at the end point of transmission. The period from the end point to the point where the level of received noise level reaches 90 % of the final average level shall be measured.

J.2.3 Results required

Switching time of frequency change shall be within 5 s, and the time of receive to transmit conditions, and vice versa, shall not exceed 0,3 s.

J.3 Transmitter

J.3.1 General

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

J.3.2 Frequency error

J.3.2.1 Objective

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

J.3.2.2 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 specified by 4.2.6 and 4.2.7.

J.3.2.3 Results required

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

J.3.3 Carrier power

J.3.3.1 Objective

The carrier power is the average power supplied to the artificial antenna during one radiofrequency cycle in the absence of modulation.

Maximum output power shall be the rated output power declared by the manufacturer.

J.3.3.2 Method of measurement

The transmitter shall be connected to an artificial antenna and the power delivered to this artificial antenna shall be measured. The measurements shall be carried out under normal test conditions and extreme test conditions as specified by 4.2.6 and 4.2.7.

J.3.3.3 Results required

J.3.3.3.1 General

The limits prescribed in J.3.3.3.2 and J.3.3.3.3 apply to channel 16, and to any channels of the International VHF maritime mobile band, as defined in Appendix 18 to the ITU Radio Regulations:2016.

J.3.3.3.2 Normal test conditions

Measured under normal test conditions with the output power set at maximum, the carrier power shall be between 6 W and 25 W, and shall not differ by more than 1,5 dB from the rated output power as declared by the manufacturer. The output power shall never however exceed 25 W.

Measured under normal test conditions with the output power set at minimum, the carrier power shall be between 0,1 W and 1 W.

J.3.3.3.3 Extreme test conditions

Measured under extreme test conditions with the output power set at maximum, the carrier power shall remain between 6 W and 25 W, and shall be within +2 dB and –3 dB of the rated output power as declared by the manufacturer. The output power shall never however exceed 25 W.

Measured under extreme test conditions with the output power set at minimum, the carrier power shall remain between 0,1 W and 1 W.

J.3.4 Frequency deviation

J.3.4.1 Maximum permissible frequency deviation

J.3.4.1.1 Objective

For the purpose of this document, the frequency deviation is the difference between the instantaneous frequency of the modulated radiofrequency signal and the carrier frequency. The frequency deviation shall correspond to 100 % modulation and shall approach ±5 kHz as nearly as practicable.

J.3.4.1.2 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. This test shall be carried out with the output power switch set at both maximum and minimum.

J.3.4.1.3 Results required

The maximum permissible frequency deviation shall be ±5 kHz.

J.3.4.2 Reduction of frequency deviation at modulation frequencies above 3 kHz

J.3.4.2.1 Objective

The upper limit of the audio frequency band shall not exceed 3 kHz.

J.3.4.2.2 Method of measurement

The transmitter shall be 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.

J.3.4.2.3 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.

J.3.5 Limitation characteristics of the modulator

J.3.5.1 Objective

This characteristic expresses the ability of the transmitter to be modulated near the maximum permissible deviation. The frequency deviation corresponding to 100 % modulation shall approach ±5 kHz as nearly as practicable.

J.3.5.2 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.

J.3.5.3 Results required

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

J.3.6 Sensitivity of modulator, including microphone

J.3.6.1 Objective

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

J.3.6.2 Method of measurement

An acoustic signal with a frequency of 1 kHz and sound level of 94 dBA shall be applied to the microphone. The resulting deviation shall be measured.

J.3.6.3 Results required

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

J.3.7 Audio frequency response

J.3.7.1 Objective

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

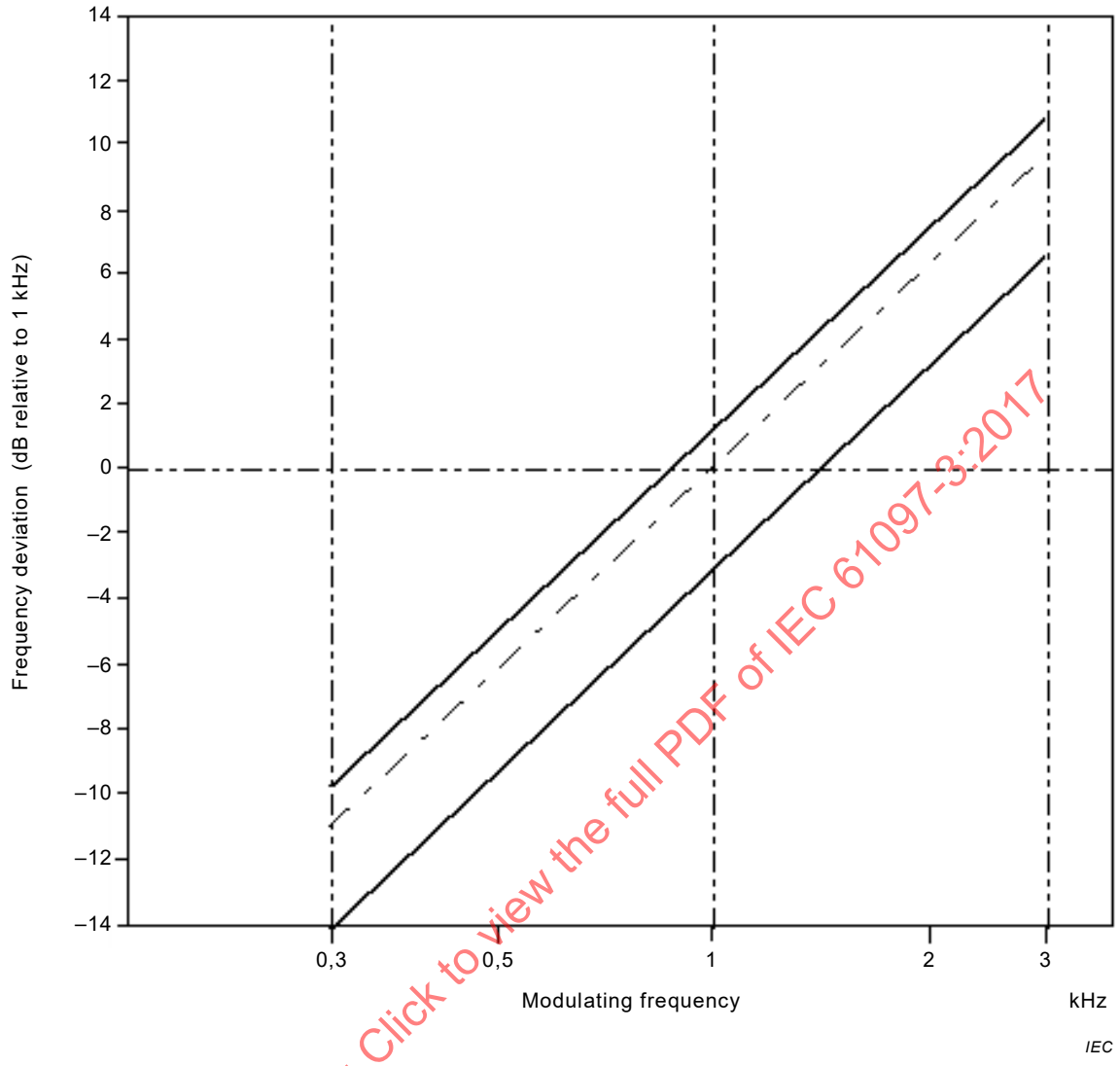


Figure J.1 – Modulation pre-emphasis curve (for a modulation index of 3, +1 dB –3 dB)

J.3.7.2 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.

J.3.7.3 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. See Figure J.1.

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

J.3.8 Audio frequency harmonic distortion of the emission

J.3.8.1 Objective

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

J.3.8.2 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 transmitter shall be modulated with audio tones at 300 Hz, 500 Hz and 1 kHz successively, with a constant modulation index of 3. The distortion of the audio frequency signal shall be measured in each case.

Under extreme test conditions, the transmitter shall be modulated with an audio tone at 1 kHz, with a modulation index of 3. The distortion of the audio frequency signal shall be measured.

J.3.8.3 Results required

The audio frequency harmonic distortion shall not exceed 10 %.

J.3.9 Adjacent channel power

J.3.9.1 Objective

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 centred 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.

J.3.9.2 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 RMS value indicator. Instead of the variable attenuator with the RMS value indicator, it is possible to use an RMS voltmeter calibrated in decibels. The technical characteristics of the power measuring receiver are given in Clause J.9.

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.

a) The transmitter shall be operated at the carrier power determined in J.3.3. 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.

J.3.9.3 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.

J.3.10 Conducted spurious emissions conveyed to the antenna

J.3.10.1 Objective

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.

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 3 of the Radio Regulations:2016.

J.3.10.2 Method of measurement

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

J.3.10.3 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.

J.3.11 Residual modulation of the transmitter

J.3.11.1 Objective

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

J.3.11.2 Method of measurement

The normal test modulation shall be applied to the transmitter. The radiofrequency 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 RMS voltmeter. The modulation shall then be switched off and the level of the residual audio frequency signal at the output shall be measured again.

J.3.11.3 Results required

The residual modulation shall not exceed –40 dB.

J.3.12 Transient frequency behaviour of the transmitter

J.3.12.1 Objective

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 radiofrequency output power is switched on and off.

Operation of the transmit/receive control shall not cause unwanted emissions.

J.3.12.2 Method of measurement

In order to define the method of measurement, the following definitions will apply:

- T_{on} the switch-on instant, defined as the instant when the output power, measured at the transmitter antenna port, exceeds 0,1 % of the nominal power;
- t_1 the period of time starting at t_{on} and ending 5 ms later;
- t_2 the period of time starting at the end of t_1 and ending 20 ms later;
- t_{off} the switch-off instant, defined as the instant when the output power, measured at the transmitter antenna port, falls below 0,1 % of the nominal power;
- t_3 the period of time ending at t_{off} and starting 5 ms earlier.

Arrangements for monitoring the transmitter output are shown in Figure J.2: the transmitter output is connected via a 50 Ω power attenuator to the first input of a combining network, and a test signal generator is connected to the second input.

The output of the combining network is connected to the RF input of a FM-demodulator. The arrangements shall be such that all ports are presented with a 50 Ω non-reactive termination.

The output of the FM-demodulator, representing the difference between the instantaneous frequency of the combined input and the nominal frequency of the test channel (the frequency difference fd), is connected to a storage oscilloscope for display.

A signal corresponding to the amplitude of the combined RF input to the FM-demodulator (the amplitude difference ad) has to be derived and connected to trigger the storage oscilloscope. Typically the storage oscilloscope is set to a sweep rate of 10 ms/division, and set to trigger at 1 division from the left edge of the display.

With the EUT transmitter inactive the test signal generator is set to the nominal frequency of the transmitter and modulated with a 1 kHz tone to a peak deviation of ±25 kHz. The level of the test signal is set to 30 dB below the level of the EUT transmitter in the combined signal. This level is then maintained throughout the measurement.

With the oscilloscope on free running trigger, adjustments can be made at this point to centre and calibrate the vertical scale in terms of frequency deviation, since the displayed 1 kHz sinewave of the demodulated test signal represents a peak-to-peak deviation of 50 kHz around the nominal channel frequency.

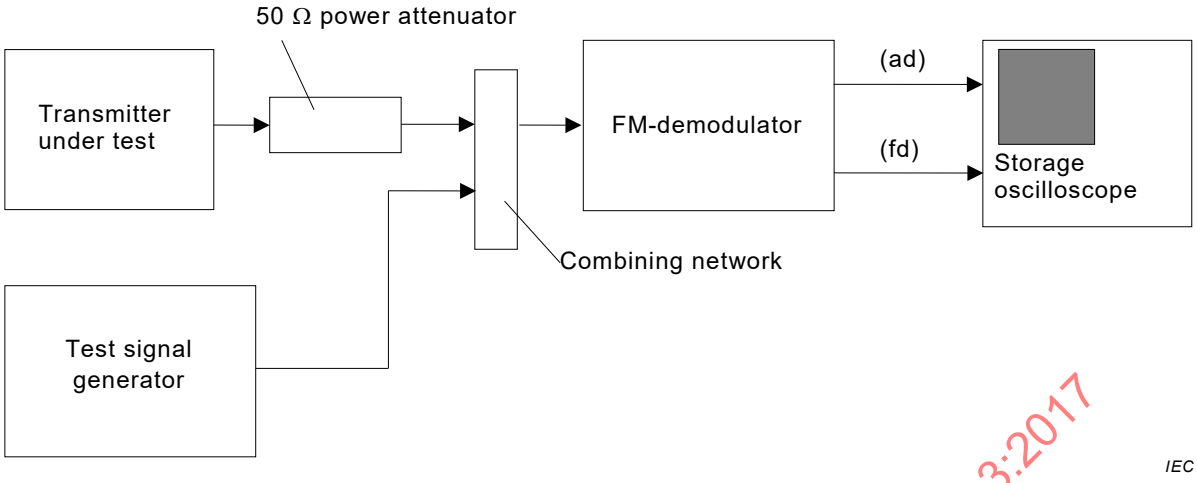


Figure J.2 – Transient frequency behaviour test configuration

J.3.12.3 Results required

During the periods t_1 and t_3, the frequency difference shall not exceed the value of 25 kHz.

During the period t_2, the frequency difference shall not exceed the value of 12,5 kHz.

After period t_2 and before period t_3, the frequency difference shall be within the limits of the transmitter frequency error of J.4.1.3.

J.3.13 Antenna VSWR integrity behaviour and monitor

J.3.13.1 Objective

The transmitter shall continue to operate under all VSWR conditions presented to the antenna connector. When the VSWR presented to the antenna connector exceeds 3:1, the EUT shall indicate an "antenna fault" condition. In this condition, the output power is not required to be the rated output power.

The EUT shall alarm when the VSWR is 3:1.

J.3.13.2 Method of measurement

Prevent the EUT from radiating with full power by mismatching the antenna for a VSWR of 3:1. During the mismatch the output power is not required to be the rated output power.

J.3.13.3 Results required

Verify that the EUT continues operating. Verify that a BAM alert 313 is sent.

J.4 Transmitter with integrated DSC encoder

J.4.1 Frequency error (carrier)

J.4.1.1 Objective

The frequency error is the difference between the measured carrier frequency and its nominal value.

J.4.1.2 Method of measurement

The transmitter frequency shall be set to channel 70.

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 specified in 4.2.6 and 4.2.7.

If the carrier frequency during DSC operation is derived using the same frequency reference as for telephony operation, the measurement needs only to be carried out at normal temperature.

J.4.1.3 Results required

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

J.4.2 Frequency error (demodulated signal)

J.4.2.1 Objective

The frequency error for the B and the Y state is the difference between the measured frequency from the demodulator and the nominal values.

J.4.2.2 Method of measurement

The transmitter shall be connected to the artificial antenna.

The transmitter frequency shall be set to channel 70.

The transmitter shall be set to transmit continuous B or Y state.

The measurement shall be carried out by measuring the demodulated output for both B and Y state.

The measurement shall be carried out under normal test conditions and extreme test conditions applied simultaneously.

J.4.2.3 Results required

The measured frequency from the demodulator at any time for the B state shall be 1 300 Hz ±10 Hz and for the Y state 2 100 Hz ±10 Hz.

J.4.3 Carrier power

J.4.3.1 Objective

The carrier power is the average power supplied to the artificial antenna during one radiofrequency cycle in the absence of modulation.

The rated output power is the carrier power declared by the manufacturer.

J.4.3.2 Method of measurement

The transmitter shall be connected to an artificial antenna and the power delivered to this artificial antenna shall be measured. The measurements shall be carried out under normal test conditions and extreme test conditions as specific by 4.2.6 and 4.2.7.

If transmitter circuits used for DSC operation is the same as for telephony operation the measurement needs only to be carried out at normal temperature.

J.4.3.3 Results required

J.4.3.3.1 Normal test conditions

The carrier power shall remain between 6 W and 25 W and be within ±1,5 dB of the rated power and not greater than 25 W.

J.4.3.3.2 Extreme test conditions

The carrier power shall remain between 6 W and 25 W and be within +2,0 dB and –3 dB of the rated power and not greater than 25 W.

J.4.4 Modulation index

J.4.4.1 Objective

The modulation index of the modulated signal is determined as the ratio between the frequency deviation and the frequency of the modulation signal.

J.4.4.2 Method of measurement

The equipment shall be set to transmit continuous B and then Y state signal.

The transmitter output is connected to a linear FM demodulator. The frequency deviation is measured and the modulation index is calculated for both B and Y state.

J.4.4.3 Results required

The modulation index shall be 2,0 with a relative tolerance of ± 10 %.

J.4.5 Modulation rate

J.4.5.1 Objective

The modulation rate is the bit stream speed measured in bit/s.

J.4.5.2 Method of measurement

The equipment shall be set to transmit continuous dot pattern.

The transmitter output is connected to a linear FM demodulator and the frequency is measured.

J.4.5.3 Results required

The frequency shall be 600 Hz ± 0,018 Hz corresponding to modulation rate of 1 200 bit/s ± 0,036 bit/s.

J.4.6 Residual modulation

J.4.6.1 Objective

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

J.4.6.2 Method of measurement

The transmitter output is connected to a linear FM demodulator with de-emphasis filter of first order. The filtered output is led on to the second linear FM demodulator. The output from the second demodulator is filtered out by second order low filter with cut off frequency of 3 kHz.

The RMS level of the filtered output signal from the second demodulator is measured during transmission of continuous dot pattern and continuous B or Y state respectively.

The ratio of the two RMS levels shall be determined.

J.4.6.3 Results required

The residual modulation shall be greater than –26 dB.

J.4.7 Modulator attack time

J.4.7.1 Objective

The modulator attack time is the time elapsed between keying the transmitter and the transmitter being correctly modulated.

J.4.7.2 Method of measurement

Arrangements for monitoring the transmitter output are shown in Figure J.3. The transmitter output is coupled by suitable means to a wideband FM-demodulator, and the transmitter RF signal is used for external trigger to a storage oscilloscope connected to the output of the FM-demodulator. The oscilloscope is set for single trigger mode.

The test shall be performed on channel 70.

A DSC call (for guidance see 4.2.11.2) shall be initiated and the measurement carried out.

The modulator attack time t_{att} is the elapsed time from when the RF carrier is present, until the demodulated 1 300 Hz / 2 100 Hz audio tones are present.

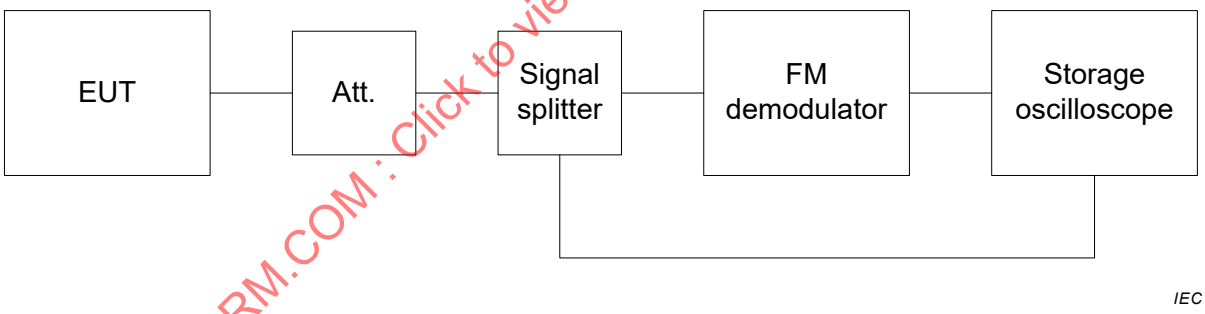


Figure J.3 – Modulator attack time test configuration

J.4.7.3 Results required

The settling time t_{att} shall be less than 90 ms.

J.4.8 Adjacent channel power

J.4.8.1 Objective

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 centred 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.

J.4.8.2 Method of measurement

Measurements shall be made on channel 70.

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 RMS value indicator. Instead of the variable attenuator with the RMS value indicator, it is possible to use an RMS voltmeter calibrated in decibels. The technical characteristics of the power measuring receiver are given in Clause J.9.

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

a) The transmitter shall be operated at the carrier power determined in J.3.3. 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.

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

J.4.8.3 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.

J.5 Receiver

J.5.1 General

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

J.5.2 Harmonic distortion and rated audio frequency output power

J.5.2.1 Objective

The harmonic distortion at the receiver output is defined as the ratio, expressed as a percentage, of the total RMS voltage of all the harmonic components of the modulation audio frequency to the total RMS voltage of the signal delivered by the receiver. The rated audio frequency 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 document are met.

J.5.2.2 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 audio frequency 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 audio frequency output power. The value of this load shall be stated by the manufacturer.

The test signal shall be modulated successively at 300 Hz, 500 Hz and 1 kHz with a constant modulation index of three. The harmonic distortion and audio frequency output power shall be measured at all the frequencies specified above.

J.5.2.3 Results required

The rated audio frequency output power shall be at least 2 W in the loudspeaker and 1 mW in the handset/earphone.

The harmonic distortion shall not exceed 10 %.

J.5.3 Audio frequency response

J.5.3.1 Objective

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

J.5.3.2 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 audio frequency power control of the receiver shall be set so as to produce a level equal to 50 % of the rated audio frequency output power (see J.5.2) when normal test modulation is applied in accordance with 4.2.9.3. 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.

J.5.3.3 Results required

The required limits are illustrated in Figure J.4. 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 audio frequency, decreasing by 6 dB/octave and passing through the measured point at 1 kHz.

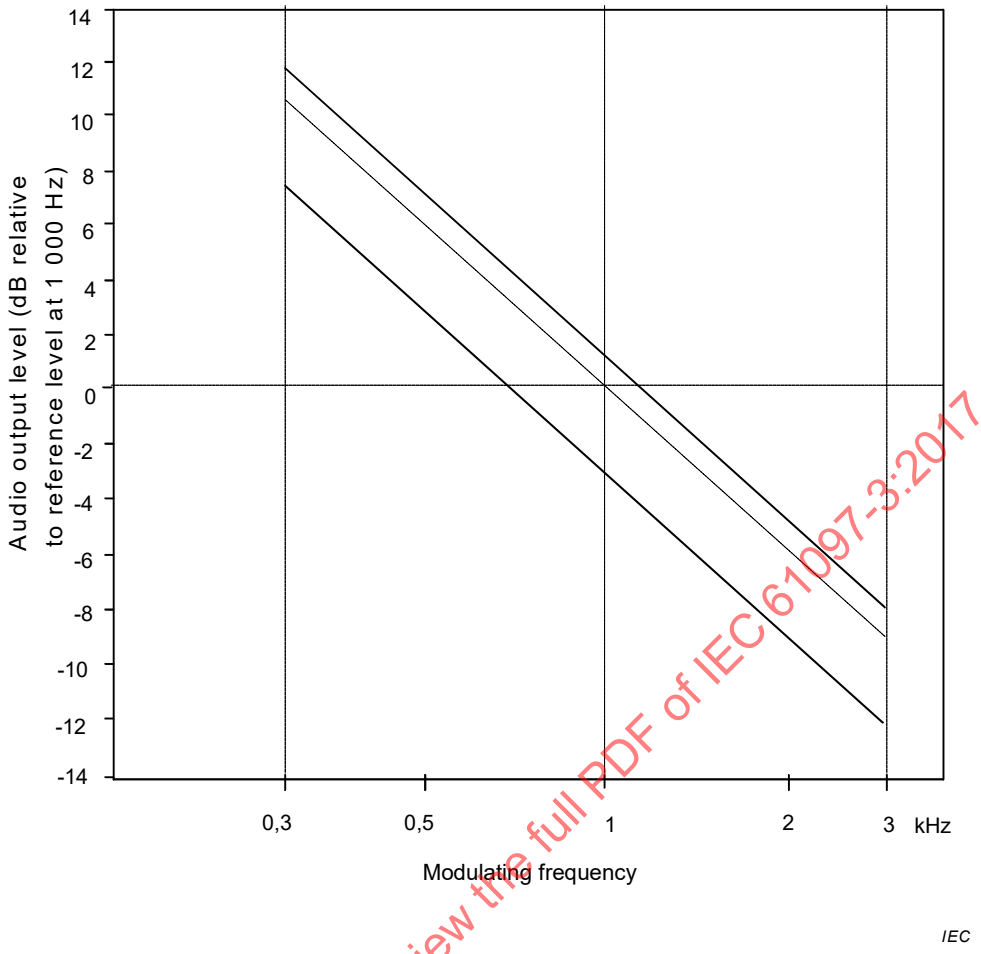


Figure J.4 – Receiver audio frequency response

J.5.4 Maximum usable sensitivity

J.5.4.1 Objective

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 audio frequency output power equal to 50 % of the rated output power and a SINAD ratio, psophometrically weighted, of 20 dB.

J.5.4.2 Method of measurement

Measurements shall be made on channel 16, and also on the highest frequency and lowest frequency.

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 audio frequency 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 audio frequency 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.

A receiver audio frequency 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.

J.5.4.3 Results required

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

J.5.5 Amplitude response of the receiver limiter

J.5.5.1 Objective

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

J.5.5.2 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 audio frequency 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 audio frequency output power level shall be measured again.

J.5.5.3 Results required

When the radiofrequency input level is varied as specified, the variation between the maximum and minimum value of the audio frequency output level shall not exceed 3 dB.

J.5.6 Co-channel rejection ratio

J.5.6.1 Objective

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.

J.5.6.2 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 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 J.5.4. The amplitude of the unwanted input signal shall then be adjusted until the SINAD ratio at the receiver audio frequency 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.

J.5.6.3 Results required

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

J.5.7 Adjacent channel selectivity

J.5.7.1 Objective

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.

J.5.7.2 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 J.5.4. The amplitude of the unwanted input signal shall then be adjusted until the SINAD ratio at the receiver audio frequency 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 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 60945, 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.

J.5.7.3 Results required

The adjacent channel selectivity shall not be less than 70 dB.

J.5.8 Spurious response rejection

J.5.8.1 Objective

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.

J.5.8.2 Method of measurement

J.5.8.2.1 Introduction to the method of measurement

To determine the frequencies at which spurious responses can occur, the following calculations shall be made:

a) calculation of the "limited frequency range".

   The "limited frequency range" is equal to:

   – The frequency of the local oscillator signal (f_{lo}) applied to the 1st mixer of the receiver ± the sum of the intermediate frequencies (f_{IF1}, … f_{IFn}) and a half the switching range (sr) of the receiver.

Hence:

– The "limited frequency range" = $f_{lo} \pm (f_{IF1} + f_{IF2} + ... + f_{IFn} + sr/2)$.

b) calculation of frequencies outside the "limited frequency range".

A calculation of the frequencies at which spurious responses can occur outside the range determined in (a) is made for the remainder of the frequency range of interest, as appropriate, see J.5.8.2.3.

The frequencies outside the "limited frequency range" are equal to:

– The harmonics of the frequency of the local oscillator signal (f_{lo}) applied to the 1st mixer of the receiver ± the numeric value of the 1st intermediate frequency (f_{IF1}) of the receiver.

Hence:

– The frequencies of these spurious responses = $nf_{lo} \pm f_{IF1}$ where "n" is an integer greater than or equal to 2.

For the calculations (a) and (b) above, the manufacturer shall state the frequency of the receiver, the frequency of the local oscillator signal (f_{lo}) applied to the 1st mixer of the receiver, the intermediate frequencies (f_{IF1}, f_{IF2} etc.) and the switching range (sr) of the receiver.

J.5.8.2.2 Method of search over the "limited frequency range"

The two input signals shall be connected to the receiver via a combining network as specified in 4.2.11.1.

The wanted test signal, at the nominal frequency of the receiver, with normal test modulation (see 4.2.9.3), at the measured maximum usable sensitivity, shall be applied to the receiver input connector via one input of the combining network.

The unwanted test signal, modulated with a frequency of 400 Hz at a deviation of ±5 kHz, at an e.m.f. of +86 dBμV, shall be applied to the receiver input connector via the second input of the combining network.

The frequency of the unwanted signal shall be varied incrementally over the "limited frequency range".

The incremental steps of the frequency of the unwanted signal shall be 5 kHz.

The frequency of any spurious response detected during the search shall be recorded for the use in measurements in accordance with J.5.8.2.3.

J.5.8.2.3 Method of measurement

The two input signals shall be connected to the receiver via a combining network as specified in 4.2.11.1.

The wanted test signal, at the nominal frequency of the receiver, with normal test modulation (see 4.2.9.3), at the measured maximum usable sensitivity, shall be applied to the receiver input connector via one input of the combining network.

The unwanted test signal, modulated with a frequency of 400 Hz at a deviation of 60 % of the maximum permissible frequency deviation of 5 kHz, at an e.m.f. of +86 dBμV, shall be applied to the receiver input connector via the second input of the combining network.

The measurement shall be performed at all spurious response frequencies found during the search over the "limited frequency range" (see J.5.3.2), and at frequencies calculated for the remainder of the spurious response frequencies in the frequency range 100 kHz to 2 GHz.

At each frequency at which a spurious response occurs, the input level shall be adjusted until the SINAD ratio, psophometrically weighted, is reduced to 14 dB.

The measure of the spurious response rejection is the ratio in dB of the level of the unwanted test signal to the level of the wanted test signal at the receiver input for which the specified reduction in SINAD ratio occurs.

The ratio shall be recorded as the spurious response rejection for each spurious response obtained.

J.5.8.3 Results required

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

J.5.9 Intermodulation response

J.5.9.1 Objective

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.

J.5.9.2 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 J.5.4. The amplitude of the two unwanted signals shall be maintained equal and shall be adjusted until the SINAD ratio at the receiver audio frequency 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.

J.5.9.3 Results required

The intermodulation response ratio shall not be less than 70 dB.

J.5.10 Blocking immunity

J.5.10.1 Objective

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

J.5.10.2 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 J.5.4.

The audio frequency 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 audio frequency output, psophometrically weighted, whichever occurs first.

This level expressed in dBμV shall be noted.

J.5.10.3 Results required

The blocking level for any frequency within the specified ranges shall be not less than +90 dBμV, except at frequencies on which spurious responses are found (see J.5.8).

J.5.11 Conducted spurious emissions conveyed to the antenna

J.5.11.1 Objective

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

J.5.11.2 Method of measurement

The receiver shall be connected to the artificial antenna as described in 4.2.11.1.

The level of spurious emissions shall be measured as the power level of any discrete signal appearing at the receiver input.

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

J.5.11.3 Results required

The power of conducted spurious emission on any discrete frequency shall not exceed 2 nW.

J.5.12 Receiver hum and noise level

J.5.12.1 Objective

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

J.5.12.2 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 audio frequency load shall be connected to the output terminal of the receiver. The audio frequency power control shall be set so as to produce the rated audio frequency output power defined in J.5.2.3.

The output signal shall be measured by means of an RMS voltmeter. The modulation shall then be switched off and the audio frequency output level shall be measured again.

J.5.12.3 Results required

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

J.5.13 Squelch operation

J.5.13.1 Objective

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

A squelch (mute) control shall be provided on the exterior of the equipment.

J.5.13.2 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 audio frequency load and the psophometric filtering network shall be connected to the output terminals of the receiver. The audio frequency power output control of the receiver shall be set so as to produce the rated audio frequency output power defined in J.5.2.3.

   The output signal shall be measured with an RMS voltmeter. The input signal shall then be suppressed, the squelch facility switched on and the audio frequency output 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 audio frequency 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 audio frequency output power is reached. The SINAD ratio and the input level shall then be measured.

c) Applicable only to equipment with 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 audio frequency 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 audio frequency output power.

J.5.13.3 Results required

Under the conditions specified in J.5.13.2 a), the audio frequency output power shall not exceed –40 dB relative to the rated audio frequency output power.

Under the conditions specified in J.5.13.2 b), the input signal level shall not exceed +6 dBμV and the SINAD ratio shall be at least 20 dB.

Under the conditions specified in J.5.13.2 c), the input signal level shall not exceed +6 dBμV when the control is set at maximum.

J.5.14 Squelch hysteresis

J.5.14.1 Objective

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

J.5.14.2 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.

J.5.14.3 Results required

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

J.5.15 Scanning characteristics of multiple watch facilities

J.5.15.1 Objective

The equipment shall include a provision for the automatic scanning of a priority channel and at least one additional channel.

The scanning period is the time between the start of two successive samplings of the priority channel in the absence of a signal on that channel. The dwell time on the priority channel is the time between the start and finish of any sampling of the priority channel in the absence of a signal on that channel. The dwell time on the additional channel is the time between the start and finish of any sampling of the additional channel.

J.5.15.2 Method of measurement

The equipment shall be adjusted to scan the priority channel and at least one additional channel. The squelch shall be operational and so adjusted that the receiver just mutes on both channels. A test signal at the carrier frequency equal to the nominal frequency of the additional channel of the receiver, modulated by the normal test modulation shall be connected to the receiver via a combining network.

A second test signal with a frequency equal to the nominal frequency of the priority channel having no modulation shall be connected to the receiver via the other input of the combining network. The level of the two signals shall be +12 dBμV. A storage oscilloscope shall be connected to the audio output.

Initially the output of the test signal on the priority channel shall be switched off. The scanning process shall be started and the output shall be observed on the oscilloscope. The gap between and the duration of the audio bursts shall be measured.

The test signal on the priority channel shall be switched on and scanning shall stop on the priority channel after the last burst and within the dwell time on the priority channel. The measurement shall be carried out where the additional channel is a simplex channel (single-frequency channel) and repeated where it is a duplex channel (two-frequency channel).

J.5.15.3 Results required

The scanning period shall not exceed 2 s, the dwell time on the priority channel shall not exceed 150 ms and the dwell time on the additional channel shall be between 850 ms and 2 s.

J.6 Receiver with integrated DSC decoder

DSC requirements for signalling on channel 70 shall comply with Annex I.

For equipment supporting DSC signalling on channels different from channel 70 (semi-automatic PSTN calling as defined in Recommendation ITU-R M.689), the main receiver shall comply with the calling sensitivity requirements from Annex I on at least one working channel.

J.7 Duplex operation

J.7.1 General

Where full-duplex or semi-duplex systems are in use, the performance of the equipment shall continue to comply with the requirements of this document.

If the equipment is designed for full-duplex operation, it shall be fitted with a duplex filter and the following additional measurements shall be carried out to ensure satisfactory duplex operation.

J.7.2 Acoustic feedback

J.7.2.1 Objective

Acoustic feedback is a phenomenon which is known as howling or singing, and it is caused when a feedback loop is formed in the full-duplex mode of operation.

In the transmit condition during full-duplex operation, only the telephone handset shall be in circuit. Care shall be taken to prevent harmful electrical or acoustic feedback, which could cause singing.

J.7.2.2 Method of measurement

By means of an operational check with the audio frequency output power control of the receiver at maximum.

J.7.2.3 Results required

Howling or singing shall not occur in the transmitting condition in the full-duplex mode of operation.

During the transmit condition in full-duplex mode of operation, an internal or external loudspeaker shall not be in circuit.

J.7.3 Receiver desensitization with simultaneous transmission and reception (full-duplex operation)

J.7.3.1 Objective

The desensitization is the degradation of the sensitivity of the receiver resulting from the transfer of power from the transmitter to the receiver due to coupling effects. It is expressed as the difference in decibels of the maximum usable sensitivity levels with simultaneous transmission and without.

J.7.3.2 Method of measurement

The antenna terminal of the equipment comprising the receiver, transmitter and duplex filter shall be connected through a coupling device to the artificial antenna. A signal with normal test modulation shall be connected to the coupling device so that it does not affect the impedance matching. The transmitter shall be brought into operation at the carrier output power as defined in J.3.2, modulated at 400 Hz with a deviation of ±3 kHz.

The receiver sensitivity shall then be measured in accordance with J.5.4. The output level of the signal generator shall be recorded in dBμV. The transmitter shall be switched off and

receiver sensitivity is again measured. The output level of the signal generator shall be recorded in dBμV.

J.7.3.3 Results required

The desensitization shall not exceed 3 dB.

The maximum usable sensitivity under conditions of simultaneous transmission and reception shall not exceed +6 dBμV e.m.f.

J.7.4 Receiver spurious response rejection

J.7.4.1 Objective

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.

J.7.4.2 Method of measurement

The receiver spurious response rejection shall be measured as specified in J.5.8 with the equipment arrangement described in J.5.8.2, except that the transmitter shall be unmodulated. The transmitter shall be operated at the carrier output power as defined in J.3.3.

J.7.4.3 Results required

Spurious response rejection ratio shall not be less than 70 dB at any frequency separated by more than 25 kHz from the nominal frequency of the receiver.

J.8 Electromagnetic compatibility

J.8.1 Conducted spurious emission

Conducted spurious emissions shall be determined as specified in IEC 60945 and comply to the limits contained therein.

J.8.2 Radiated spurious emission

Radiated spurious emissions shall be determined as specified in IEC 60945 and comply to the limits contained therein.

J.8.3 Immunity to electromagnetic environment

Tests for immunity to electromagnetic environment as applicable shall be performed as specified in IEC 60945.

J.9 Power measuring receiver specification

J.9.1 IF filter

The IF filter shall be within the limits specified in Figure J.5:

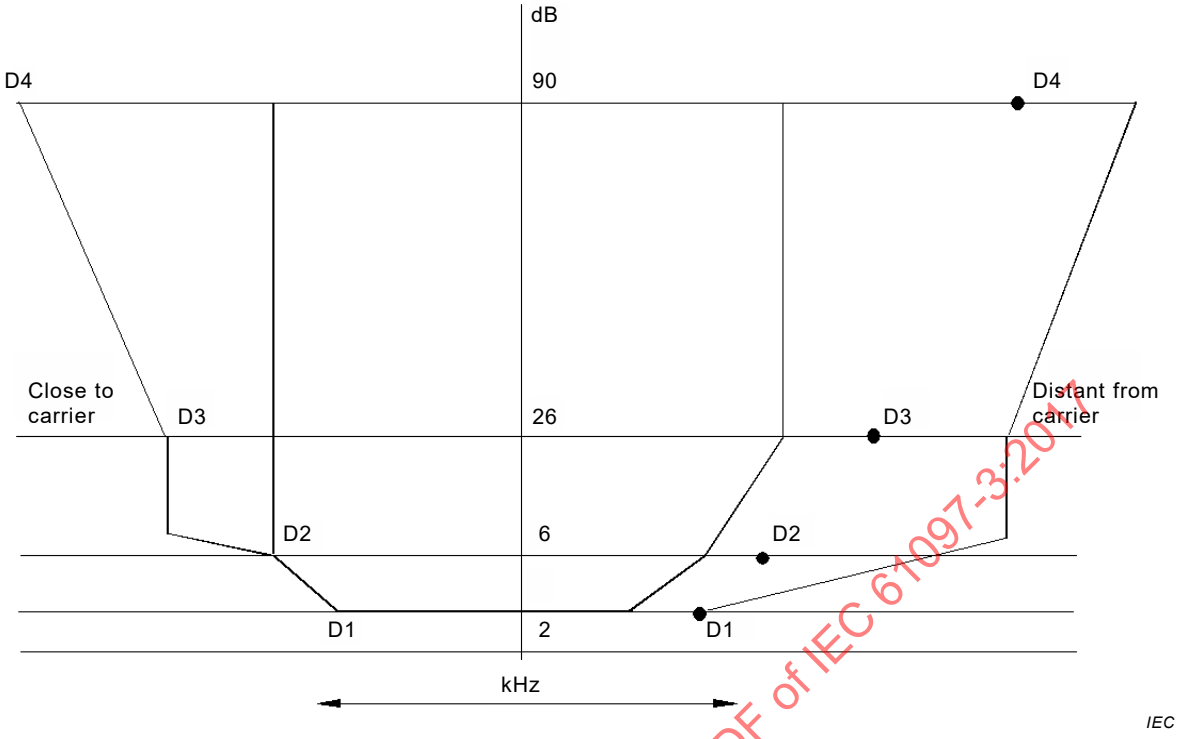


Figure J.5 – IF filter specification

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

Table J.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 tolerances in Tables J.2 and J.3.

Table J.2 – Attenuation points close to carrier

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

Table J.3 – Attenuation points distant from carrier

Tolerance 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.

J.9.2 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.

J.9.3 RMS value indicator

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

J.9.4 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 less than -90 dB.

Annex K
(normative)

Shipborne MF and HF transmitters and receivers

K.1 General and operational requirements

K.1.1 General

The MF or MF/HF radiotelephone, narrow band direct printing and digital selective calling installation, in addition to meeting the requirements of the Radio Regulations, shall comply with the following performance standards and with the general requirements as set out in Assembly Resolution A.694(17) as specified in IEC 60945.

The installation, which may consist of more than one piece of equipment, shall be capable of operating on single-frequency channels or on single- and two-frequency channels.

The equipment shall provide for the following categories of calling using both voice and digital selective calling (DSC):

- distress, urgency and safety;
- ship operational requirements; and
- public correspondence.

The equipment shall provide for the following categories of communications using voice and optionally narrow band direct printing (NBDP) for MF equipment and both for MF/HF equipment.

K.1.2 Composition

The equipment shall comprise at least:

- a transmitter/receiver, including antenna(e);
- an integral control unit and/or one or more separate control units;
- a microphone with a press to transmit switch, which may be combined with a telephone in a handset;
- an internal or external loudspeaker;
- an integral or separate narrow band direct printing facility for MF/HF equipment; and
- an integral or separate digital selective calling facility.

K.1.3 Frequency indication

Radiotelephone frequencies (J3E) shall be designated in terms of the carrier frequency; NBDP and DSC frequencies (F1B and J2B) shall be designated in terms of the assigned frequency, as defined in Appendix 17 of the Radio Regulations:2016, and shall be clearly identifiable on the control panel of the equipment. Independent choice and indication of transmitting and receiving frequencies shall be possible.

K.1.4 Control panel priority

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

K.1.5 Labels

Labels shall be in accordance with IEC 60945.

Those of the distress frequencies in Table K.1 applicable to the equipment shall be clearly indicated, either on the front panel of the equipment or on an instruction label supplied with the equipment.

Table K.1 – Distress frequencies

DSC (kHz)	Telephony (kHz)	NBDP (kHz)
2 187,5	2 182,0	2 174,5
4 207,5	4 125,0	4 177,5
6 312,0	6 215,0	6 268,0
8 414,5	8 291,0	8 376,5
12 577,0	12 290,0	12 520,0
16 804,5	16 420,0	16 695,0

K.1.6 Classes of emission

The equipment shall provide for the transmission and reception of upper side-band signals using the classes of emission as appropriate for the equipment:

- J3E: single side-band telephony with the carrier suppressed at least 40 dB below peak envelope power;
- F1B: frequency shift keying suitable for digital selective calling with a frequency shift of ±85 Hz (this may be achieved by use of a 1 700 Hz subcarrier; the class of modulation is then J2B).

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

K.1.7 Frequency bands

K.1.7.1 General

The equipment shall be capable of operating in either the MF frequency or in the MF and HF frequency bands.

K.1.7.2 MF frequency band

The equipment shall provide for the transmission and/or reception in the appropriate frequencies between 1 605 kHz and 4 000 kHz allocated in the Radio Regulations to the maritime mobile service.

K.1.7.3 HF frequency bands

The equipment shall provide for the transmission and/or reception in the appropriate frequencies in the bands between 4 MHz and 27,5 MHz allocated in the Radio Regulations to the maritime mobile service.