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Title: BS IEC 61097-9 Global maritime distress and safety system (GMDSS)

Part 9: Shipborne transmitters and receivers for use in the MF and HF bands suitable for telephony, digital selective calling (DSC) and reception of Maritime Safety Information and Search and Rescue related information # Operational and performance requi

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Introduction

This draft standard is based on national and international discussions. Your comments on this draft are invited and will assist in the preparation of the consequent standard.

For international standards, comments will be reviewed by the relevant UK national committee before sending the consensus UK vote and comments to the international committee, which will then decide appropriate action. If the international standard is approved, it is usual for the text to be published as a British Standard.

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Date: xx/xx/20xx	Document: ISO/DIS xxxx
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1	2	(3)	4	5	(6)	7
MB	Clause No./ Subclause No./Annex (e.g. 3.1)	Paragraph/Figure/ Table/Note	Type of comment	Commend (justification for change) by the MB	Proposed change by the MB	Secretariat observations on each comment submitted
	3.1	Definition 1	ed	Definition is ambiguous and needs clarifying.	Amend to read '...so that the mains connector to which no connection...'	
	6.4	Paragraph 2	te	The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK.	Delete reference to UV photometer.	



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IEC TC 80 : MARITIME NAVIGATION AND RADIOCOMMUNICATION EQUIPMENT AND SYSTEMS	
SECRETARIAT: United Kingdom	SECRETARY: Mr Kim Fisher
OF INTEREST TO THE FOLLOWING COMMITTEES:	PROPOSED HORIZONTAL STANDARD: ☐ Other TC/SCs are requested to indicate their interest, if any, in this CD to the secretary.
FUNCTIONS CONCERNED: ☐ EMC ☐ ENVIRONMENT ☐ QUALITY ASSURANCE ☐ SAFETY	

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TITLE:

Global maritime distress and safety system (GMDSS) – Part 9: Shipborne transmitters and receivers for use in the MF and HF bands suitable for telephony, digital selective calling (DSC) and reception of Maritime Safety Information and Search and Rescue related information – Operational and performance requirements, methods of testing and required test results

NOTE FROM TC/SC OFFICERS:

This document has been prepared following a meeting of MT 19 held in September 2022.

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

GLOBAL MARITIME DISTRESS AND SAFETY SYSTEM (GMDSS) –**Part 9: Shipborne transmitters and receivers for use in the MF and HF bands suitable for telephony, digital selective calling (DSC) and reception of Maritime Safety Information and Search and Rescue related information – Operational and performance requirements, methods of testing and required test results**

FOREWORD

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IEC 61097-9 has been prepared by IEC technical committee 80: Maritime navigation and radiocommunication equipment and systems. It is an International Standard.

This second edition cancels and replaces the first edition published in 1997. This edition constitutes a technical revision.

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

- a) ...;
- b)

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

Draft	Report on voting
XX/XX/FDIS	XX/XX/RVD

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

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/standardsdev/publications.

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.

GLOBAL MARITIME DISTRESS AND SAFETY SYSTEM (GMDSS) –

Part 9: Shipborne transmitters and receivers for use in the MF and HF bands suitable for telephony, digital selective calling (DSC) and reception of Maritime Safety Information and Search and Rescue related information – Operational and performance requirements, methods of testing and required test results

1 Scope

This part of IEC 61097 specifies the minimum operational and performance requirements and methods of testing with required test results for transmitters and receivers capable of voice communication and digital selective calling for the GMDSS operating in either the medium frequency band only or in medium and high frequency bands allocated in the ITU Radio Regulations to the Maritime Mobile Service, as required by Chapter IV of SOLAS 1974 as amended. It is based on IMO resolution MSC.512(105) and takes account of Recommendation ITU-R M.493 for digital selective calling including the automatic connection system.

It also takes account of the general requirements given in IMO resolution A.694(17) and is associated with IEC 60945. When a requirement in this standard is different from IEC 60945, the requirement of this standard shall take precedence. It further takes account, as appropriate, of requirements for the presentation of navigation-related information on shipborne navigational displays given in IMO resolution MSC.191(79) as amended and is associated with IEC 62288, and the requirements of IMO resolution MSC.302(87) for Bridge Alert Management and is associated with IEC 62923-1 and IEC 62923-2.

This document also specifies the reception of maritime safety information and search and rescue related information by HF based on IMO resolution MSC.508(105).

NOTE All text of this document the wording of which is identical to that in IMO Resolutions and to that in the relevant ITU-R Recommendations is printed in *italics* and is prefixed by references in brackets.

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 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 62923-1, *Maritime navigation and radiocommunication equipment and systems – Bridge alert management – Part 1: Operational and performance requirements, methods of testing and required test results*

IEC 62923-2, *Maritime navigation and radiocommunication equipment and systems – Bridge alert management – Part 2: Alert and cluster identifiers and other additional features*

IMO Resolution MSC.512(105), *Performance standards for shipborne MF and MF/HF radio installations capable of voice communication, digital selective calling and reception of Maritime Safety information and Search and Rescue related information*

IMO Resolution MSC.508(105), *Performance standards for the reception of maritime safety information and Search and Rescue related information by MF (NAVTEX) and HF*

Recommendation ITU-R M.493-15:2019, *Digital selective-calling system for use in the maritime mobile service*

Recommendation ITU-R M.540-2:1990, *Operational and technical characteristics for an automated direct-printing telegraph system for promulgation of navigational and meteorological warnings and urgent information to ships*

Recommendation ITU-R M.625-4:2012, *Direct-printing telegraph equipment employing automatic identification in the maritime mobile service*

Recommendation ITU-R M.688, *Technical characteristics for a high frequency direct-printing telegraph system for promulgation of high seas and NAVTEX-type maritime safety information*

3 Terms and 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

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

87 **3.1.6**
88 **default**
89 value selected or action taken by the equipment software in the absence of any operator input

90 **3.1.7**
91 **distress alert**
92 single distress DSC message with the format symbol 112

93 **3.1.8**
94 **distress alert attempt**
95 set of distress alerts sent by a vessel when in distress

96 **3.1.9**
97 **distress DSC message**
98 DSC message or acknowledgement containing the distress information

99 **3.1.10**
100 **distress event**
101 unique distress situation identified by three parameters of the distress information

102 Note 1 to entry. The parameters are the MMSI of the vessel in distress and the nature of distress, and the mode of
103 subsequent communication.

104 **3.1.11**
105 **distress information**
106 symbols within a DSC message describing a distress situation consisting of the MMSI of the
107 vessel in distress, the nature of distress, the position of the vessel in distress, the UTC time of
108 that position, and the mode of subsequent communication

109 **3.1.12**
110 **Dx/Rx**
111 notation used to describe the time diversity structure of DSC messages symbols within a DSC
112 message

113 **3.1.13**
114 **engaged**
115 indication that the equipment is busy handling an automated procedure

116 **3.1.14**
117 **factory default**
118 default value that is set by the manufacturer such that the field or behaviour is defined prior to
119 any operator intervention

120 **3.1.15**
121 **general receiver**
122 receiver used for the reception of all subsequent communications and on HF the reception of
123 DSC acknowledgements on the duplex DSC channels

124 **3.1.16**
125 **identical**
126 set of information characters where all pairs of corresponding information characters are equal
127 or, if a pair of corresponding information characters is not equal, one of the pair is in error

3.1.17**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

3.1.18**initial DSC message**

DSC message that starts an automated procedure

3.1.19**non-distress DSC message**

DSC messages or acknowledgments that do not contain the distress information

3.1.20**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.

3.1.21**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

3.1.22**operator options**

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

3.1.23**parallel event handling**

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

3.1.24**pertinent to the station**

any DSC message that would start an automated procedure if the equipment were in standby

3.1.25**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.

3.1.26**snooping**

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

3.1.27**standby**

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

3.1.28**symbol**

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

3.1.29**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)

3.1.30**watch receiver**

separate receiver in DSC radios that continuously monitors the DSC distress frequencies on MF/HF, 2 187,5 kHz on MF

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

3.1.31**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**

ACS	automatic connection system
AGC	automatic gain control
BAM	bridge alert management
BER	bit error rate
CCRS	consistent common reference system
DROBOSE	distress relay on behalf of someone else
DSC	digital selective calling
e.m.f.	electromotive force
ECC	error check character
EPFS	electronic position fixing system
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
RF	radio frequency
RMS	root mean square
SER	symbol error rate
SINAD	signal + noise + distortion/ noise + distortion
TE	test equipment

4 Performance requirements**4.1****General**

(See 10.1.4)

(MSC.512(105)/A1) The MF or MF/HF radiotelephone, digital selective calling (DSC) and reception of maritime safety information (MSI) and search and rescue (SAR) related information installation carried to meet any of the requirements of SOLAS regulations 1/7, 10 or 11, in

218 *addition to meeting the requirements of the Radio Regulations, the relevant ITU-R*
219 *Recommendations and the general requirements set out in resolutions A.694(17) as specified*
220 *in IEC 60945 and MSC.191(79 as amended as specified in IEC 62288 shall comply with the*
221 *following minimum requirements.*

222 *(MSC.512(105)/A2.1) The installation which may consist of more than one piece of equipment*
223 *shall be capable of operating on single-frequency channels or on single- and two-frequency*
224 *channels.*

225 *(MSC.512(105)/A2.2) The equipment shall provide for the following categories of calling using*
226 *both voice and DSC:*

- 227 *1 distress, urgency and safety;*
- 228 *2 general radiocommunications; and*
- 229 *3 ship operational requirements.*

230 *(MSC.512(105)/A2.3) The equipment shall provide capabilities for the reception and processing*
231 *of MSI and SAR related information.*

232 *(MSC.512(105)/A2.4) The equipment shall comprise at least:*

- 233 *.1 a transmitter/receiver, including antenna(e);*
- 234 *.2 an integral main control unit and/or one or more separate control units, or control functions*
235 *in an integrated communication system, with the possibility of separate slave control units;*
- 236 *.3 a microphone with a press-to-transmit switch, which may be combined with a telephone in a*
237 *handset;*
- 238 *.4 an internal or external loudspeaker;*
- 239 *.5 an integral or separate capability for reception and presentation of MSI and SAR related*
240 *information;*
- 241 *.6 an integral or separate DSC facility;*
- 242 *.7 a dedicated DSC watchkeeping facility to maintain a continuous watch on distress channels.*
243 *Where a scanning receiver is employed to watch more than one DSC channel, all selected*
244 *channels shall be scanned within two seconds and the dwell time on each channel shall be*
245 *adequate to allow detection of the dot pattern which precedes each DSC call. The scan shall*
246 *only stop on detection of a 100 baud dot pattern; and*
- 247 *.8 an integral or separate facility to establish a connection between stations of the maritime*
248 *mobile service by simple means using DSC conforming to Recommendation ITU-R M.493.*

249 **4.2 Power supplies**

250 *(See 10.1.4)*

251 *(MSC.512(105)/A3.1) The MF or MF/HF radio installation shall be powered from the ship's main*
252 *source of electrical energy. In addition, it shall be possible to operate the installation from an*
253 *alternative source of electrical energy including a reserve source of energy.*

254 *(MSC.512(105)/A3.2) If it is necessary to delay the application of voltage to any part of the*
255 *transmitter after switching on, this delay shall be provided automatically.*

256 *(MSC.512(105)/A3.3) If the transmitter or receiver or both include parts which are required to*
257 *be heated in order to operate correctly, for example crystal ovens, the power supplies to the*
258 *heating circuits shall be so arranged that they can remain operative when other supplies to or*
259 *within the equipment are switched off. If a special switch for the heating circuits is provided, its*
260 *functions shall be clearly indicated; it shall normally be in the "on" position and be protected*
261 *against inadvertent operation. The correct operating temperature shall be reached within a*
262 *period of five minutes after the application of power.*

4.3 Control and indicators

4.3.1 Operational controls

(See 10.1.4)

(MSC.512(105)/A4.1.1) *It shall be possible to initiate distress alerts and conduct distress and safety communications from the position, or in the vicinity of the position, from which the ship is normally navigated.*

(MSC.512(105)/A4.1.2) *The equipment shall provide a standard interface to enable the selections of frequencies and setting of MMSI to be called from a remote control unit (e.g. INS) by using standardized interfaces (see 4.4).*

(MSC.512(105)/A4.1.3) *The equipment shall provide functionality to establish connection with other stations of the mobile maritime service by simple means using DSC the "Automatic Connection System" conforming to Recommendation ITU-R M.493.*

(MSC.512(105)/A4.1.4) *The equipment shall provide visual and audible indication of any distress alert or alerts received on board at the position from which the ship is normally navigated, which may be different from the position of the primary control of the equipment.*

4.3.2 Transmitter controls

(See 10.1.4)

(MSC.512(105)/A4.2.1) *Provision shall be made for indicating the antenna current or power delivered to the antenna. Failure of the indicating system shall not interrupt the antenna circuit.*

(MSC.512(105)/A4.2.2) *Manually tuned equipment shall be fitted with a sufficient number of indicators to permit accurate and rapid tuning.*

(MSC.512(105)/A4.2.3) *Operation of the transmit/receive control shall not cause unwanted emissions.*

(MSC.512(105)/A4.2.4) *All adjustment and controls necessary for switching the transmitter to operate on 2 182 kHz and 2 187,5 kHz shall be clearly marked, in order that these operations may be performed readily.*

4.3.3 Receiver controls

(See 10.1.4)

(MSC.512(105)/A4.3) *The receiver shall be provided with automatic gain control.*

4.3.4 DSC controls and indicators

(See 10.1.4)

(MSC.512(105)/A4.4.1) *It shall be possible to initiate and make distress and safety calls from the position from which the ship is normally navigated. The means for initiating a distress call shall be as prescribed in 4.5.*

(MSC.512(105)/A4.4.2) *Initiation of DSC distress calls shall take precedence over any other operation of the facility.*

(MSC.512(105)/A4.4.3) *Self-identification data shall be stored in the DSC unit. It shall not be possible for the user to easily change these data (See 4.8).*

(MSC.512(105)/A4.4.4) *Means shall be provided to enable routine testing of the DSC facilities without radiation of RF signals.*

304 (MSC.512(105)/A4.4.5) *Provision shall be made for alerts with specific audible signals*
305 *and visual indications to indicate receipt of a distress or urgency call or a call having a distress*
306 *category. It shall not be possible to disable this alert. Provision shall be made to ensure that it*
307 *can be reset only manually (See D.3).*

308 The user manual shall include instructions for routine testing for the DSC.

309 **4.4 Interfaces**

310 (See 10.1.4)

311 (MSC.512(105)/A5.1) *Where the equipment is part of an integrated communication system*
312 *(ICS), integrated navigation system (INS), integrated bridge system (IBS) or connected to a*
313 *navigation system, this shall not impair any of the GMDSS functions of the system or the*
314 *equipment itself.*

315 (MSC.512(105)/A5.2) *Equipment shall provide an interface for bridge alert management (BAM)*
316 *in accordance with resolution MSC.302(87) on Performance standards for bridge alert*
317 *management.*

318 (MSC.512(105)/A5.3) *The equipment shall provide an interface to report a ship identifier and*
319 *location data from a received distress alert, MSI or SAR related information to a navigation*
320 *display system in order to enable a graphical display and possible linking to available target*
321 *information.*

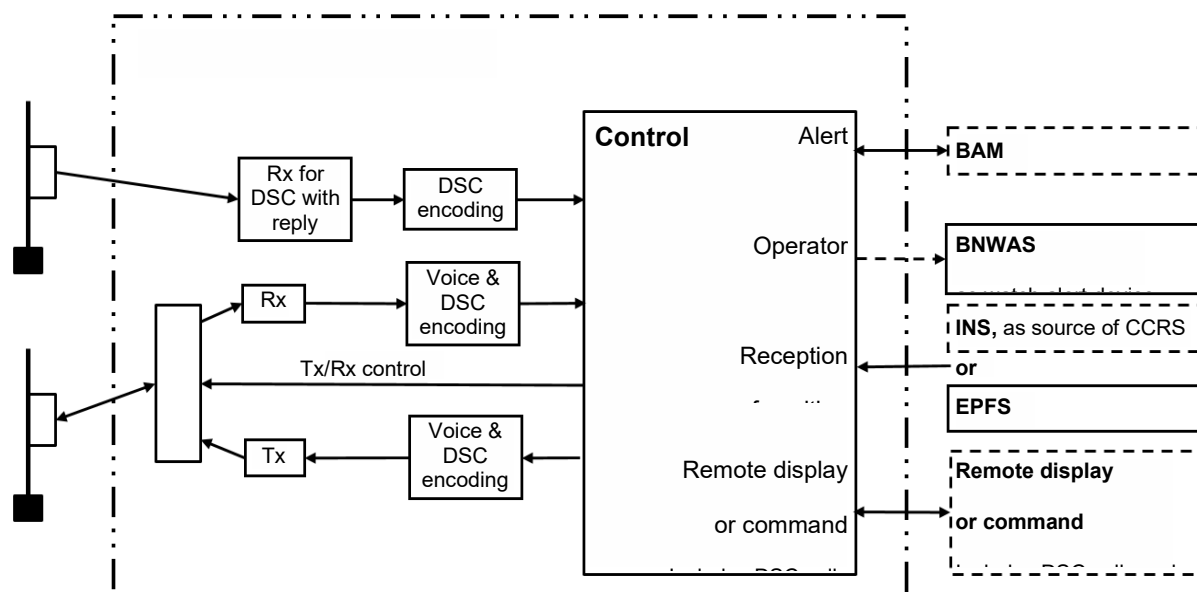
322 (MSC.512(105)/A5.4) *All interfaces provided for communication with other navigation and*
323 *communication equipment shall comply with the relevant international standards.*

324 (MSC.512(105)/A6.1) *Human-machine interface (HMI) shall provide all functions necessary to*
325 *carry out all communication procedures including those required by the GMDSS.*

326 (MSC.512(105)/A6.2) *Visual indications and visual presentations of text and graphics of the*
327 *system shall conform to resolution MSC.191(79) as amended as specified in IEC 62288.*

328 Data interfaces shall be compatible with at least one of IEC 61162-1, IEC 61162-2 and
329 IEC 61162-450. The manufacturer shall specify which alternative of IEC 61162 each physical
330 interface supports.

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



NOTE

Solid line indicates mandatory part

IEC

Figure 1 – Interfaces of the equipment

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

The IEC 61162-1 sentences ZDA and at least one from GLL, GGA, NSR, RMC or GNS shall be recognised for providing UTC for automatic MSI reception by HF MSI receiver. See Table 1.

Additionally, for remote display and/or command purposes, the equipment shall be capable of transmitting and receiving the sentences DSC, DSE, [EPV], [NAK] and SFI (see Table 2 and Table 3).

The equipment shall also be capable of communicating with the sentences NRM and NRX as described in Annex I and with the electrical signal characteristics given in IEC 61162-1. The equipment shall also be capable of responding to query sentences as defined in IEC 61162-1 for the NRM and NRX sentences (see Table 2 and Table 3).

Optionally, if provided, the equipment may include an interface to report operator activity in order that the BNWAS can reset the dormant period (see Table 4). 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 5 and Table 6. BAM operation is described in Annex G.

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

Table 1 – Sentences received by the 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
ZDA	INS, as source of CCRS or EPFS	UTC	

Table 2 – Sentences transmitted by the equipment

Mnemonic	Interface (see Figure 1)	Name	Comment
DSC DSE	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]
[NAK]	[Remote display or command]	[Negative acknowledgement]	[Used to inform commander about refusal to set equipment property values]
SFI	Remote display or command	Scanning frequency information	Report setting of DSC
NRX ^a	Remote display or command	MSI received message	Reports received Maritime Safety Information
NRM ^a	Remote display or command	MSI receiver mask	Reports configuration masks that control which messages are stored, printed and sent to the INS port of the HF-MSI receiver
^a See Annex I			

Table 3 – Sentences received by the equipment

Mnemonic	Interface (see Figure 1)	Name	Comment
DSC DSE	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]
SFI	Remote display or command	Scanning frequency information	Used to set scanning frequencies of DSC
NRM ^a	Remote display or command	MSI receiver mask	Used to set configuration masks that control which messages are stored, printed and sent to the INS port of the HF-MSI receiver. Also used to request of currently stored messages
^a See Annex I			

Table 4 – Sentences transmitted by the 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 5 – Sentences transmitted by the 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 6 – Sentences received by the 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]

The talker identifier for MF/HF equipment shall be CT. The HF-MSI receiver may use talker identifier CR.

4.5 Distress controls

(See 10.1.4)

(MSC.512(105)/A2.5) 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 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.

(MSC.512(105)/A2.6) The dedicated distress button shall:

.1 be clearly identified, red in colour and marked "DISTRESS". Where a non-transparent protective lid or cover is used, it shall also be marked "DISTRESS"; and

.2 be protected against inadvertent operation. The required protection of the distress button shall 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. The distress button shall initiate a distress alert when kept pressed for at least three seconds. A flashing light and an intermittent acoustic signal shall start immediately. After the three seconds the transmission of the distress alert is initiated and the indication shall become steady and the acoustic signal shall stop. If the distress button is released before a distress alert is initiated, the light shall go out and the acoustic signal shall stop.

(MSC.512(105)/A2.7) The distress alert initiation shall require at least two independent actions. The lifting of the protective lid or cover is considered as the first action. Pressing the distress button as specified above is considered as the second independent action.

(MSC.512(105)/A2.8) *The equipment shall indicate the status of the distress alert transmission.*

(MSC.512(105)/A2.9) *It shall be possible to interrupt and initiate distress alerts at any time and to interrupt repetitive transmissions of distress messages. Such operation shall not interrupt the transmission of a distress alert or distress message in progress but shall prevent repetitive transmissions of a distress message.*

(MSC.512(105)/A2.10) *Valid GNSS position and timing data from either an internal or external source shall be available to the equipment at all times. The loss of position information shall generate a visible or audible indication.*

All adjustments and controls necessary for switching the transmitter and receiver to operate on the distress and safety channels applicable to the equipment shall be clearly marked in order that this operation can be performed easily.

4.6 Control panel priority

(See 10.1.4)

If the accessible controls are located on a separate control panel and if there are two or more control panels, one of the control panels shall have priority over the others. If there are two or more control panels, when any control panel is in use, this shall be clearly indicated on all of the other control panels.

4.7 Labels

(See 10.1.4)

Labels shall be in accordance with IEC 60945.

Those of the following distress frequencies:

DSC distress (kHz)	Telephony distress (kHz)
2 187,5	2 182,0
4 207,5	4 125,0
6 312,0	6 215,0
8 414,5	8 291,0
12 577,0	12 290,0
16 804,5	16 420,0

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.

4.8 Safety precautions

(See 10.1.4)

The information in user programmable memory devices shall be protected from interruptions in the power supply of up to at least 24 h duration. Any software required to facilitate operation in accordance with this standard shall be permanently installed within the equipment.

Key parameters relating to the equipment and any software necessary for its initial activation or reactivation shall be stored in solid state non-volatile memory. Facilities shall be provided to protect all operational software incorporated in the equipment. It shall not be possible during routine use for the operator to augment, amend or erase any software in the equipment required for operation in accordance with this standard.

Means shall be provided to monitor the operational software of the equipment automatically at appropriate regular intervals, and to activate an alert in the event of failure

4.9 Manuals

In addition to the requirements of IEC 60945:2002, the manufacturer shall make the declarations/provided information in the user/installation manual in Annex H.

5 Transmitter

5.1 Frequencies and classes of emission

(See Clause 11)

(MSC.512(105)/B1.1) For MF only equipment, the radiotelephone and DSC transmitter shall be capable of transmitting on all frequencies allocated in the bands between 1 605 kHz and 4 000 kHz, but at least the frequency 2 182 kHz for voice and the DSC frequency 2 187.5 kHz, as well as the DSC frequency 2 177 kHz used for routine calls shall be readily accessible to the operator.

(MSC.512(105)/B1.2) For MF/HF equipment the transmitter shall be capable of transmitting on all frequencies allocated to the maritime mobile service in the frequency band 1 605 kHz to 27 500 kHz. As a minimum, the following frequencies shall be readily accessible to the operator: the voice frequencies 2 182, 4 125, 6 215, 8 291, 12 290 and 16 420 kHz; and the DSC frequencies 2 187.5, 4 207.5, 6 312, 8 414.5, 12 577 and 16 804.5 kHz and the DSC routine calling frequencies in the 2 MHz, 4 MHz, 6 MHz, 8 MHz, 12 MHz and 16 MHz bands as defined by the ITU-R Radio Regulations.

(MSC.512(105)/B1.3) Radiotelephone frequencies are designated in terms of the carrier frequency; DSC frequencies are designated in terms of the assigned (centre) frequency. When DSC signals are transmitted using a transmitter in the J2B mode the (suppressed) carrier frequency shall be adjusted so as to have the DSC signal transmitted on the assigned frequency. The selected transmitter frequency shall be clearly identifiable on the control panel of the equipment.

(MSC.512(105)/B1.4) The transmitter shall be capable of transmitting upper side band using classes of emission J3E and either J2B or F1B. The modulation shall change automatically according to the designation of the frequency selected.

(MSC.512(105)/B1.4.1) When switching to the pre-set distress frequencies 2 182, 4 125, 6 215, 8 291, 12 290 and 16 420 kHz, the appropriate class of emission in accordance with the Radio Regulations shall be selected automatically.

(MSC.512(105)/B1.4.2) When switching to the assigned (centre) frequencies for DSC specified in paragraphs B1.1 and B1.2 above, classes of emission F1B or J2B shall be selected automatically.

(MSC.512(105)/B1.5) It shall be possible for the user to select transmission frequencies independent of any receiver setting. This does not preclude the use of transceivers.

(MSC.512(105)/B1.6) It shall be possible to change the transmitter quickly from operation on any frequency to operation on any other frequency, and in any event within a period not exceeding five seconds. The equipment shall not be able to transmit during channel switching operations.

(MSC.512(105)/B1.7) Means shall be provided to automatically control the modulation level to prevent over modulation.

5.2 Frequency accuracy and stability

(See 11.2)

(MSC.512(105)/B2) The transmitter frequency shall be provided with a frequency tolerance (+/- 10 Hz) which ensures reception of the voice and DSC signal.

5.3 Output power

(See 11.3)

(MSC.512(105)/B3.1) During normal modulation, the peak envelope power in the case of J3E emissions, or the mean power in the case of J2B or F1B emissions, shall be at least 60 W at any frequency within the specified frequency range.

NOTE 1 In some areas of the world a 60 W value is not adequate to ensure reliable communications. A value greater than 60 W can be required in these areas.

(MSC.512(105)/B3.2) If the rated output power exceeds 400 W in the MF band, provision should be made for reducing the output to 400 W or less.

NOTE 2 The Radio Regulations No.52.127 specify a 400 W maximum power for equipment operating in the MF band in region 1.

5.4 Transmitter input

(See 11.5)

For the transmission of voice signals, the transmitter shall have a microphone input, suitable to produce an output power level within –3 dB and –9 dB relative to full output power when a sound level of 94 dBA is applied to the microphone.

An input, earth free, of 600 Ω and 0 dBm shall be provided.

5.5 Permissible warming-up period

(See 11.2)

(MSC.512(105)/B4) The equipment shall be capable of operation within one minute after switching on.

5.6 Continuous operation

(See 11.14)

(MSC.512(105)/B5.1) The transmitter shall be capable of continuous voice operation at rated power without causing any reduction in performance or damage to the equipment.

(MSC.512(105)/B5.2) The transmitter shall have a visual indication that the transmitter is activated and shall provide a facility integrated in the power amplifier to limit the continuous transmission time to a maximum of five minutes.

5.7 Safety precautions

(See 11.15)

(MSC.512(105)/B7.1) The equipment shall be so designed and constructed that, when the transmitter is providing power to the antenna, 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.

(MSC.512(105)/B7.2) In case the standing wave ratio (SWR) becomes too high, the power of the transmitter can be automatically reduced without stopping the transmission and an appropriate alert shall be initiated.

5.8 Synthesizer lock

(See X.X)

It shall not be possible to transmit until any frequency synthesizer is locked.

6 Receiver

6.1 Frequencies and classes of emission

(See Clause 12, Clause 13)

(MSC.512(105)/C1.1) For MF equipment only, the receiver shall be capable of being tuned throughout the bands between 1 605 kHz and 4 000 kHz. The frequency for 2 182 kHz for voice and the DSC frequency 2 187.5 kHz as well as the DSC routine frequency 2 177 kHz shall be readily accessible to the operator.

(MSC.512(105)/C1.2) For MF/HF the receiver shall be capable of being tuned throughout the bands between 1 605 kHz and 27 500 kHz. As a minimum, the following frequencies shall be readily accessible to the operator: the carrier frequencies 2 182, 4 125, 6 215, 8 291, 12 290 and 16 420 kHz for radiotelephony; and the DSC frequencies 2 187.5, 4 207.5, 6 312, 8 414.5, 12 577 and 16 804.5 kHz and the DSC routine frequencies in the 2 MHz, 4 MHz, 6 MHz, 8 MHz, 12 MHz and 16 MHz bands as defined by the ITU-R Radio Regulations.

(MSC.512(105)/C1.3) Radiotelephone frequencies shall be designated in terms of the carrier frequency and DSC frequencies shall be designated in terms of the assigned (centre) frequency. The selected receiver frequency shall be clearly identifiable on the control panel of the equipment.

(MSC.512(105)/C1.4) The receiver shall be capable of receiving upper side-band signals as appropriate for classes of emission J3E, J2B and F1B.

(MSC.512(105)/C1.5) The class of emission shall be selectable by not more than one control.

(MSC.512(105)/C1.6) It shall be possible for the user to select reception frequencies independent of any transmitter setting. This does not preclude the use of transceivers.

(MSC.512(105)/C1.7) The receiver shall be capable of being tuned to different frequencies quickly, and in any event within a period not exceeding five seconds.

6.2 Frequency tolerance and accuracy

(See 12.2)

(MSC.512(105)/C2) The receiver frequency shall be provided with a frequency tolerance (+/- 10 Hz) which ensures reception of the voice and DSC signal.

6.3 Usable sensitivity

(See 12.5, 13.2 and 13.8)

(MSC.512(105)/C3) For classes of emission J3E and F1B the sensitivity of the receiver shall be equal to or better than 6 μ V e.m.f. at the receiver input for a signal-to-noise and distortion (SINAD) ratio of 20 dB. For DSC an output character error rate of 10^{-2} or less shall be obtained for a signal-to-noise ratio of 12 dB.

6.4 Receiver output

(See 12.1 and 12.6)

(MSC.512(105)/C4.1) For the reception of voice signals, the receiver shall be suitable for use with a loudspeaker and a telephone handset and shall be capable of providing power of at least 2 W to loudspeaker and at least 1 mW to the handset.

An output, earth free, of 600 Ω shall be provided.

Facilities shall be provided to enable the loudspeaker to be switched off when reception is by headphones or telephone handset. Automatic facilities shall be provided to turn off the loudspeaker during duplex operation, when provided.

(MSC.512(105)/C4.2) An output, earth free, shall be provided for DSC signals if the corresponding facility is not integrated.

6.5 Permissible warming-up period

(See 12.2)

(MSC.512(105)/C5.1) The equipment shall be capable of operating within one minute after switching on.

6.6 Immunity to interference

(See 12.7, 12.8, 12.9, 12.10, 13.3, 13.4, 13.5 and 13.7)

(MSC.512(105)/C7.1) The immunity to interference of the receiver shall be such that the wanted signal is not seriously affected by unwanted signals.

6.7 Antenna static protection

(See 12.19 and 13.10)

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

6.8 Noise reducer

(See 10.3.1)

If a device is provided in the receiver to reduce the effects of impulsive noise, a switch shall be provided to disable its function.

6.9 Audio gain control and automatic gain control (AGC)

(See 12.15, 12.16 and 12.17)

The receiver shall be provided with a control of audio frequency gain and with an AGC.

7 Digital selective calling facility

7.1 DSC capabilities

(See 10.1.4)

(MSC.512(105)/D1.1) The facility shall conform to the provisions of the relevant ITU-R Recommendations pertaining to the DSC system (Recommendations ITU-R M.493 and ITU-R M.541).

(MSC.512(105)/D1.2) The DSC facility shall comprise:

.1 means to decode and encode DSC messages;

.2 means necessary for composing the DSC message;

.3 means to verify the prepared message before it is transmitted;

.4 means to display, the information contained in a received call in plain language;

.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 can 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 standards (see 4.4);

.6 means for the manual entry of position and the time at which the position information was determined shall be provided; and

.7 means to activate an alert when:

.1 no position data is received from the electronic position-fixing aid; or

.2 in the case of manual input, the position information is over four hours old.

Any position information not updated for more than 23.5 hours shall be erased.

7.2 Distress message storage

(MSC.512(105)/D2.1) Sufficient capacity shall be provided to enable at least 20 received distress messages to be stored in the DSC facility.

(MSC.512(105)/D2.2) These calls shall be marked as read when they are printed or displayed.

7.3 DSC characteristics

The technical description of DSC is given in Annex 1 of Recommendation ITU-R M.493-15.

The required operation of DSC is given in Annex A.

For bridge alert management requirements specific to DSC, see Annex G.

8 Facility for the reception of MSI

8.1 General

(See Annex E)

(MSC.512(105)/E) The facility can be an integral part or a separate part of the MF/HF-Radio. It shall conform to the Performance standards for the reception of maritime safety information and search and rescue related information by MF (NAVTEX) and HF (resolution MSC.508(105)).

(MSC.508(105)/A1.2) In addition to meeting the requirements of the Radio Regulations, the receiver for HF-MSI shall comply with Recommendation ITU-R M.688.

(MSC.508(105)/2.1) The facility shall comprise a [dedicated??] radio receiver, a signal processor and either:

.1 an integrated printing device; or

.2 a dedicated display device, printer output port and a non-volatile message memory; or

.3 a connection to an integrated navigation system and a non-volatile message memory.

(540/All.2) The equipment shall be capable of receiving messages in the collective B-mode of the direct printing system specified in ITU-R Recommendation M.625-4:2012, Annex I, 4.

8.2 Controls and indicators

(See E.4)

(MSC.508(105)/3) Details of the coverage areas and message categories which have been excluded by the operator from reception and/or display shall be readily available.

The settings for coverage areas and message categories shall be applied to all operating frequencies of the receiver.

(540/All.2.1) The B_1 characters identifying the different transmitter coverage areas and the B_2 characters identifying the different types of messages are defined by IMO and chosen from table I of ITU-R Recommendation M.625, combination numbers 1-26.

a) Ship equipment shall be capable of automatically rejecting unwanted information using character B_1 .

b) Ship equipment shall be capable of disabling print-out, transmission to the INS port or display of selected types of messages using character B_2 with the exception of messages with B_2 characters A, B, D and L.

c) If any facility is rejected (transmitter coverage area) or disabled (type of message) the extent of any such limitation shall be clearly indicated to the user.

(540/All.2.2) $B_3 B_4$ is a two-character serial number for each B_2 , starting with 01 except in special cases where the serial number 00 is used.

(540/All.3) The printer, display, message store or INS port output shall only be activated if the preamble $B_1 B_2 B_3 B_4$ is received without errors.

(540/All.4) Facilities shall be provided to avoid printing, storage or display of the same message several times on the same ship, when such a message has already been satisfactorily received.

(540/All.5) The necessary information for these measures shall be deduced from the sequence $B_1 B_2 B_3 B_4$.

(540/All.6) A message shall always be printed, stored, displayed and INS port output if $B_3 B_4 = 00$. Messages broadcast number $B_3 B_4 = 00$ shall not be rejected and shall automatically override any selection of B_1 as well as any B_2 characters selected on the receiver.

(540/All.2.3) The characters ZCZC $B_1 B_2 B_3 B_4$ need not be printed/displayed.

NOTE It is possible that HF-MSI messages will be received which do not include $B_1 B_2 B_3 B_4$ characters.

8.3 Receiver

(See E.5)

(MSC.508(105)/4.2.1) The receiver sensitivity shall be equal to or better than e.m.f. of 6 μ V at the receiver input to produce an NBDP output character error rate of not greater than 10^{-2} .

(MSC.508(105)/4.2.2) A UTC clock, accurate to at least one second, and associated with a reprogrammable memory which contains the frequency sequence and UTC broadcast schedules of all stations, shall control the HF receiver to provide automatic MSI reception.

(MSC.508(105)/4.2.3) The receiver shall be capable of being alerted by digital selective calling and tuned to the HF-MSI frequency to receive unscheduled broadcasts automatically.

The recognised receive frequencies shall include [at least] 4 210 kHz, 6 314 kHz, 8 416.5 kHz, 12 579 kHz, 16 806.5 kHz, 19 680.5 kHz, 22 376 kHz and 26 100.5 kHz.

8.4 Display device and printer

(See E.4 and E.6)

(MSC.508(105)/5.1) The display device and/or printer shall be able to display a minimum of 32 characters per line.

(MSC.508(105)/5.2) If a dedicated display device is used, the following requirements shall be met:

.1 an indication of newly received unsuppressed messages shall be immediately displayed until acknowledged or until 24 hours after receipt; and

.2 newly received unsuppressed messages shall also be displayed.

671 [New search and rescue (SAR) messages [with the B₂ characters A, B, D and L] shall be
672 displayed immediately that they are received and stored, and shall cause an [alert] to be set.
673 SAR messages shall be displayed until they are acknowledged by the cancellation of the [alert].

674 The reception and storage of new messages other than SAR messages shall be clearly
675 indicated to the user by a method declared by the manufacturer.]

676 (MSC.508(105)/5.3) The display device shall be able to display at least 16 lines of message
677 text.

678 (MSC.508(105)/5.4) The design and size of the display device shall be such that displayed
679 information is easily read under all conditions by observers at normal working distances and
680 viewing angles.

681 (MSC.508(105)/5.5) If automatic line feed entails division of a word, this shall be indicated in
682 the displayed/printed text.

683 (MSC.508(105)/5.6) When displaying received messages on a display device, a clear
684 indication of the end of a message shall be given by automatically adding line feeds after the
685 message or including some other form of delineation. The printer or printer output shall
686 automatically insert line feeds after completing print of the received message.

687 (MSC.508(105)/5.7) The equipment shall display/print an asterisk if the character is received
688 corrupted.

689 (MSC.508(105)/5.8) Where the printer is not integrated, it shall be possible to select the
690 following data to be output to a printer:

- 691 .1 all messages as they are received;
- 692 .2 all messages stored in the message memory;
- 693 .3 all messages received on specified frequencies, from specified locations or
694 having specified message designators;
- 695 .4 all messages currently displayed; and
- 696 .5 individual messages selected from those appearing on the display.

697 The equipment shall store the message (non-printing equipment) or message identification
698 (printing equipment) but shall allow the stored message/message identification to be replaced
699 if it is subsequently received with lower error rate.

700 An equipment with an integral printer shall print the messages indicating a character error rate
701 of ≤ 33 %.

702 An equipment with an integral display shall display the messages indicating a character error
703 rate of ≤ 33 %.

704 The equipment shall not store or print messages if the received character error rate > 33 %.

705

706 8.5 Storage

707 8.5.1 Non-volatile message memory

708 (See E.7.1)

709 (MSC.508(105)/6.1.1) It shall be possible to record at least 200 messages of average length
710 500 characters (printable and non-printable) in non-volatile message memory. It shall not be

711 possible for the user to erase messages from memory. When the memory is full, the oldest
712 messages shall be overwritten by new messages.

713 It shall be possible to record individual messages up to 8000 characters in length.

714 (MSC.508(105)/6.1.2) The user shall be able to tag individual messages for permanent
715 retention. These messages can occupy up to 25 % of the available memory and shall not be
716 overwritten by new messages. When no longer required, the user shall be able to remove the
717 tag on these messages which can then be overwritten in normal course.

718 **8.5.2 Message identifications**

719 (See E.7.2)

720 (MSC.508(105)/6.2.1) The equipment shall be capable of internally storing at least 200
721 message identifications.

722 (MSC.508(105)/6.2.2) After between 60 h and 72 h, a message identification shall automatically
723 be erased from the store (unless tagged for permanent retention). If the number of received
724 message identifications exceeds the capacity of the store, the oldest message identification
725 shall be erased.

726 (MSC.508(105)/6.2.3) Only message identifications which have been satisfactorily received
727 shall be stored; a message is satisfactorily received if the error rate is below 4 %.

728 **8.5.3 Programmable control memories**

729 (See E.7.4)

730 (MSC.508(105)/6.3) Information for location (B_1) and message (B_2) designators, as described
731 in Recommendation ITU-R M.540, in programmable memories shall not be erased by
732 interruptions in the power supply of less than 6 h.

733 **8.6 Alert**

734 (See X,X)

735 (MSC.508(105)/7) The receipt of search and rescue information ($B_2 = D$) shall give an alert
736 at the position from which the ship is normally navigated. It shall only be possible to reset this
737 alert manually.

738 [If an additional alert is provided at the equipment to indicate, for example, the reception of
739 navigational and/or meteorological warnings, it shall be capable of being suppressed.]

740 For bridge alert management related requirements specific to MSI-receiver, see Annex G.

741 **8.7 Test facilities**

742 (See X,X)

743 (MSC.508(105)/8) The equipment shall be provided with a facility to test that the radio
744 receiver, the display device/printer and non-volatile message memory are functioning correctly.

745 **8.8 Interfaces**

746 (MSC.508(105)/9.1) The equipment shall include at least one interface for the transfer of
747 received data to other navigation or communication equipment (see 4.4).

748 (MSC.508(105)/9.2) All interfaces provided for communication with other navigation or
749 communication equipment shall comply with the relevant international standards (see 4.4).

750 (MSC.508(105)/9.3) If there is no integrated printer, the equipment shall include a standard
751 printer interface.

752 (MSC.508(105)/9.4) The equipment shall include an interface for alert management in
753 accordance with the Performance standards for bridge alert management (resolution
754 MSC.302(87)) (see 4.4).

755 **9 Automatic connection system**

756 **9.1 General**

757 (See Annex F)

758 (MSC.512(105)/F) The function for automatic connection system can be an integral part or a
759 separate unit of the MF/HF station.

760 The required operation of ACS is given in Annex F.

761 **9.2 Transmitter**

762 (See F.3)

763 (MSC.512(105)/F1) The system shall be able to send a DSC call on DSC routine calling
764 frequencies in all or selected bands either by the user or by a predefined automatic algorithm.
765 The call sent out shall provide a provisional transmit frequency as defined by the ITU-R Radio
766 Regulations.

767 **9.3 Receiver**

768 (See F.4)

769 (MSC.512(105)/F2.1) A dedicated receiver which can be the same receiver as that used as
770 DSC watch receiver to monitor the DSC distress frequencies or an additional receiver shall
771 scan the DSC routine calling frequencies as defined by the ITU-R Radio Regulations.

772 If the DSC watch receiver has an ACS reception function, it shall not interfere with reception of
773 distress, urgency and safety calls.

774 (MSC.512(105)/F2.2) The scanning process shall only stop when a scanning receiver is
775 employed to watch more than one DSC channel, all selected channels shall be scanned within
776 two seconds and the dwell time on each channel shall be adequate to allow detection of the dot
777 pattern which precedes each DSC call. The scan shall only stop on detection of a 100 baud dot
778 pattern.

779 (MSC.512(105)/F2.3) The system shall be able when receiving a DSC call requesting a
780 connection to confirm if the proposed frequency/channel is available. In case the proposed
781 frequency/channel is not available, or the noise level is not adequate, the system shall propose
782 an appropriate frequency/channel in the band with the lowest noise by using a defined DSC call
783 and using the transmitter defined in 9.2.

784 (MSC.512(105)/F2.4) If the requested frequency is confirmed the system shall switch
785 automatically to the confirmed frequency.

786 **10 Methods of testing and required test results**

787 **10.1 Test conditions**

788 **10.1.1 Normal and extreme test conditions**

789 Tests shall be made under normal test conditions and also, where stated, under extreme test
790 conditions as specified in IEC 60945, of dry heat and upper limit of supply voltage applied
791 simultaneously and low temperature and lower limit of supply voltage applied simultaneously.

10.1.2 Procedure for tests at extreme temperatures

For tests at extreme temperatures, the EUT shall be placed in a test chamber and left until thermal equilibrium is reached. The EUT shall then be switched on for 5 min, after which it shall meet the requirements of this standard.

10.1.3 Test power source

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

10.1.4 Unspecified test conditions

Any requirement in Clauses 3 to 9 for which no test is specified in Clauses 10 to 15 shall be checked by inspection of the equipment, the manufacturing drawings or other relevant documents. The result of the inspection shall be stated in the test report.

10.2 General requirements

The equipment shall comply with the general requirements contained in IEC 60945, as applicable to the equipment category, for example “protected”, “exposed”.

For the purposes of IEC 60945 a performance check and performance test is:

a) with the transmitter connected to an artificial antenna (10.3.5) the transmitter shall be tuned to 2 182 kHz and operated in the J3E mode. For frequency error the test signal of 11.2.2 for SSB shall be applied to the transmitter input. For output power the test signal of 11.3.2 for SSB shall be applied to the transmitter input; and

b) with the AGC operative, the receiver shall be adjusted to 2 182 kHz in the J3E mode and the J3E test signal (10.3.2) 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 of 12.1.3.

The output frequency shall be within ± 10 Hz and the output power shall be within 60 W PEP and 400 W PEP. The level of the receiver input signal shall be less than 22 dB μ V.

The test shall be performed on 2 182 kHz if the transmitter is designed to work in the 1 605 kHz – 4 000 kHz band only, or 8 291 kHz for J3E if the equipment is designed to work on all maritime bands in the 1 605 kHz – 27 500 kHz range

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

10.3 General conditions of measurement

10.3.1 Arrangements for test signals applied to the receiver input

For the purpose of testing, the receiver shall meet the requirements of this standard when connected as described below at the point at which the antenna is normally connected.

The 50 Ω network may be substituted, at the request of the manufacturer, by a network consisting of a 10 Ω resistor in series with a 250 pF capacitor for frequencies below 4 MHz. This shall in no way imply that the receiver should operate satisfactorily only with antennas having these impedance characteristics. The arrangement used shall be stated in the test report.

Test signals shall be connected through a network so that the impedance presented to the receiver antenna input is 50 Ω , except as permitted in 10.3.5, irrespective of whether one or

more signals are applied to the receiver simultaneously. In the case of multiple test signals, steps shall be taken to prevent any undesirable effects due to interaction between the signals in the generators or other sources.

The level of the test input signals shall be expressed in terms of the electromotive force (e.m.f.) which would exist at the output terminals of the source including the associated network.

10.3.2 Normal test signals applied to the receiver input

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 $\pm$ 0,1 Hz above the carrier frequency to which the receiver is tuned.

- Class of emission F1B:

for DSC a signal on the assigned frequency modulated as appropriate.

10.3.3 Arrangements for test signals applied to the transmitter input

Unless otherwise stated, the transmitter audio frequency modulation signal shall be supplied by a generator to an interface connected to the microphone input and this interface shall be provided by the manufacturer.

10.3.4 Normal test signals applied to the transmitter

Test signals for transmitter testing are specified in each appropriate test.

10.3.5 Artificial antennas

For the purpose of testing, the transmitter shall meet the requirements of this standard at the output of the antenna matching device when connected to the artificial antennas listed below. This shall in no way imply that the transmitter shall only work with antennas having these characteristics.

- 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.

- 4 MHz to 27,5 MHz:

The artificial antenna shall consist of a resistance of 50 Ω .

10.3.6 Testing frequencies

The frequencies used during each test shall be stated in the test report.

10.3.7 Bit error rate testing

BER testing is very time consuming especially when looking for a specific level such as a BER of 10^{-2} . It is therefore recommended that tests are made with the correct level signals and a pass or fail result is recorded in the test report, except for sensitivity tests in 12.5, where the absolute result is used as a reference for later tests.

10.3.8 Measurement uncertainty

Maximum values of absolute measurement uncertainties shall be as follows:

RF frequency	$\pm 1 \times 10^{-8}$
--------------	------------------------

873	RF power (PEP in 10 Ω 250 pF)	$\pm 2,5$ dB
874	(PEP in 50 Ω)	$\pm 1,5$ dB
875	Adjacent channel power	± 5 dB
876	Conducted spurious of transmitter	± 4 dB
877	Audio output power	$\pm 0,5$ dB
878	Sensitivity at 20 dB SINAD	± 3 dB
879	Conducted emission of receiver	± 3 dB
880	Two-signal measurement	± 4 dB
881	Three-signal measurement	± 3 dB
882	Radiated emission of transmitter	± 6 dB
883	Radiated emission of receiver	± 6 dB

884 11 Transmitter

885 11.1 General

886 11.1.1 Frequencies and classes of emission

887 (See 5.1 and 5.5)

888 The transmitter shall provide upper side-band signals only or upper side-band and frequency
889 shift keying signals in accordance with 5.1.

890 11.1.2 Antenna matching

891 (See X.X)

892 The transmitter shall be fitted with an appropriate antenna matching device which shall be
893 activated automatically or by simple means from the control panel.

894 11.1.3 Output indication

895 (See X.X)

896 The transmitter shall incorporate an indicator of the antenna current and/or output power.

897 11.2 Frequency error

898 11.2.1 General

899 (See 5.2)

900 The frequency error of the transmitter is:

901 – for SSB telephony:

902 The difference between the measured frequency minus 1 000 Hz and the nominal value of
903 the frequency for the particular telephony frequency;

904 – for DSC:

905 The difference between the measured Y-state frequency and the nominal assigned
906 frequency minus 85 Hz and the difference between the measured B-state frequency and the
907 nominal assigned frequency plus 85 Hz.

908 11.2.2 Methods of test

909 The frequency shall be measured with the transmitter connected to an artificial antenna as
910 defined in 10.3.5.

911 – SSB telephony:

912 The transmitter shall be modulated with a signal of 1 000 Hz $\pm$ 0,1 Hz. The 1 000 Hz signal
913 shall be subtracted from the measured frequency to obtain the transmitter frequency.

914 – DSC:

915 The digital input shall first be connected to a digital 0 and then to a digital 1.

916 Measurements shall be carried out at the highest and lowest frequency available in the
917 transmitter for telephony and the digital DSC interface.

918 The tests shall be performed under both normal and extreme test conditions, as defined in
919 IEC 60945, of dry heat and upper limit of supply voltage applied simultaneously and low
920 temperature and lower limit of supply voltage applied simultaneously.

921 **11.2.3 Required results**

922 The transmitter frequencies, after the warming-up period specified in 5.5, shall be within ± 10 Hz of
923 the frequencies defined in 5.1.

924 **11.3 Output power and intermodulation products**

925 **11.3.1 General**

926 (See 5.3)

927 The output power shall be set automatically by the equipment according to frequency band and
928 mode of operation as declared by the manufacturer.

929 If the transmitter is capable of a higher output power than 400 W, means shall be provided to
930 limit the power automatically to a value of 400 W or less, when the transmitter is switched to
931 the MF band.

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

935 The rated output power is the power as declared by the manufacturer.

936 **11.3.2 Methods of test**

937 The transmitter shall be connected to the appropriate artificial antenna as specified in 10.3.5.

938 – SSB telephony:

939 The transmitter shall be modulated by a test signal consisting of two audio frequency tones,
940 applied simultaneously to the microphone input, at frequencies of 1 100 Hz and 1 700 Hz.
941 The level of the tones shall be adjusted so that they produce equal output power. The level
942 of the input test signal shall be increased until the transmitter power output is not more than
943 1,5 dB below the rated output power as declared by the manufacturer. The level of the input
944 signal shall then be increased by 10 dB.

945 The peak envelope power and the intermodulation products shall be measured.

946 The input signal shall then be decreased by 20 dB, and measurement of the intermodulation
947 products is repeated.

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

949 – DSC:

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

The tests shall be performed under both normal and extreme test conditions, as defined in IEC 60945, of dry heat and upper limit of supply voltage applied simultaneously and low temperature and lower limit of supply voltage applied simultaneously.

Measurements shall be carried out at the highest and lowest frequency available in the transmitter for telephony and the digital DSC interface.

11.3.3 Required results

– Output power in the range 1 605 kHz – 4 000 kHz for all modulation modes:

At any frequency in the band 1 605 kHz – 4 000 kHz the peak envelope power or mean power as appropriate, shall be more than 60 W and not exceed 400 W, and shall be within $\pm 1,5$ dB of the rated output power.

– Output power in the range 4 MHz – 27,5 MHz for all modulation modes:

At any frequency in the maritime bands between 4 MHz and 28 MHz the peak envelope power or mean power as appropriate, shall be more than 60 W and not exceed 1 500 W, and shall be within $\pm 1,5$ dB of the rated output power.

– Intermodulation products for SSB telephony modes:

The value of intermodulation products shall not exceed 25 dB below the highest of the two tones.

– Difference of power of B-state frequency and Y-state frequency:

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

– Output spectrum:

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

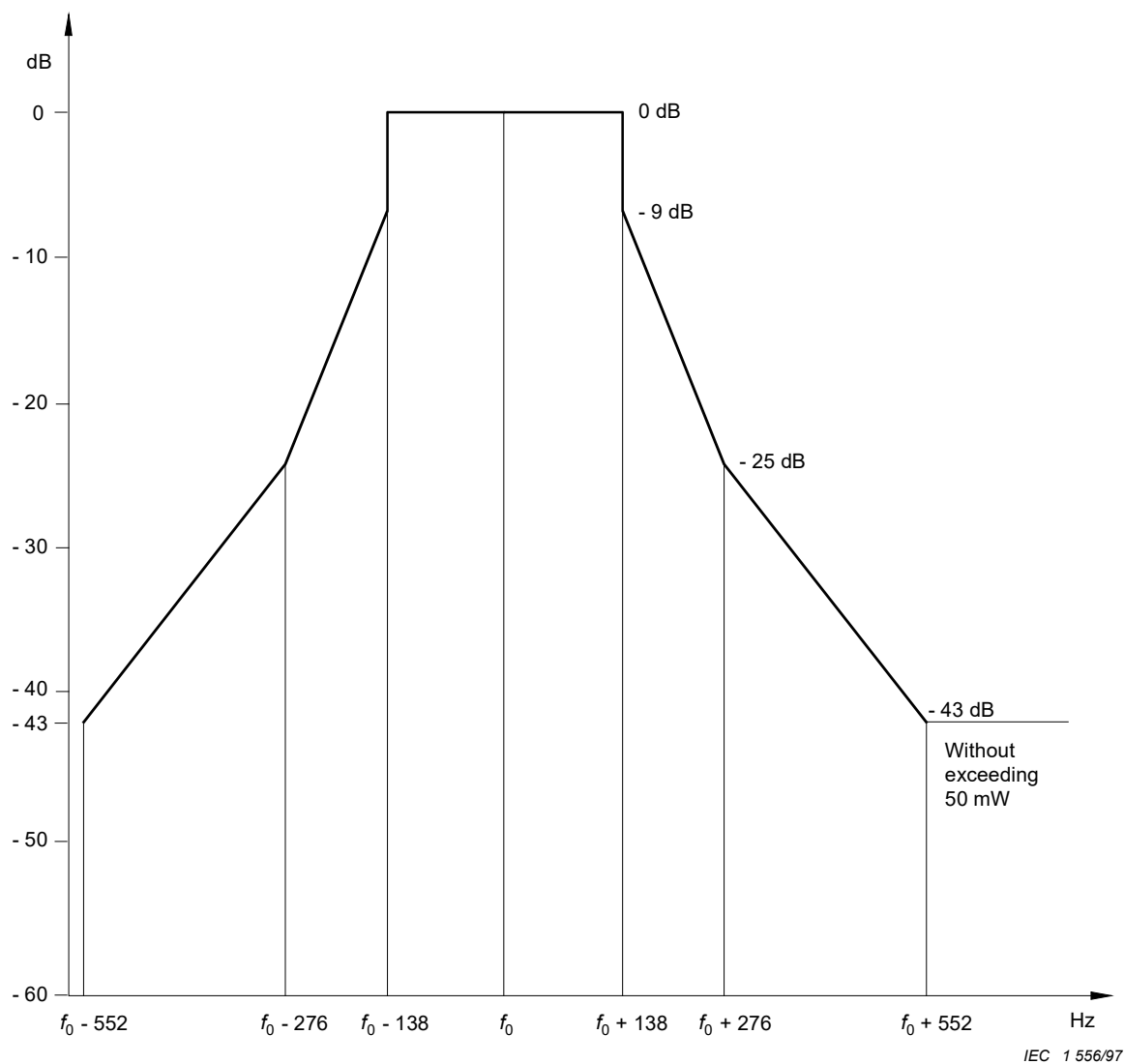


Figure 2 – Limits for unwanted emission (MF/HF transmitter)

11.4 Unwanted frequency modulation

11.4.1 General

(See X.X)

Unwanted frequency modulation is the deviation of output frequency of the transmitter which may occur due to a number of causes, e.g. vibration.

11.4.2 Methods of test

The transmitter complete with chassis covers and shock absorbers (if supplied) shall be clamped in its normal operating position to a vibrating table and shall be connected to the appropriate artificial antenna as specified in 10.3.5. The transmitter shall then be switched on, adjusted for the transmission of class of emission J3E and, after the warming-up period permitted under 5.5, shall be modulated by means of a test signal consisting of an audio frequency tone applied to the modulation input at a frequency of 1 000 Hz for SSB telephony or 1 700 Hz for DSC. The level of the input test signal shall be adjusted to such a level that the output power is 3 dB below the result of the power measurement in 11.3.

994 Any frequency deviation shall be measured by means of a monitoring receiver having a 6 dB
995 bandwidth of ± 125 Hz and using a suitable calibrated FM demodulator or frequency deviation
996 meter. The table shall be vibrated in accordance with IEC 60945.

997 The test shall be performed on 2 182 kHz if the transmitter is designed to work in the 1 605 kHz –
998 4 000 kHz band only, or on 8 291 kHz for J3E if the equipment is designed to work on all
999 maritime bands in the 1 605 kHz – 27 500 kHz range.

1000 **11.4.3 Required results**

1001 The frequency peak deviation shall not exceed ± 5 Hz.

1002 **11.5 Sensitivity of the microphone**

1003 **11.5.1 General**

1004 (See 5.4)

1005 This measurement shows the capability of the transmitter to produce its full output power and
1006 be fully modulated when an acoustic tone signal corresponding to the normal mean speech
1007 level is applied to the microphone supplied with the equipment.

1008 **11.5.2 Methods of test**

1009 An acoustic tone at a frequency of 1 000 Hz and a sound level of 94 dBA shall be applied to
1010 the microphone.

1011 The test shall be performed on 2 182 kHz if the transmitter is designed to work in the 1 605 kHz –
1012 4 000 kHz band only, or 8 291 kHz for J3E if the equipment is designed to work on all maritime
1013 bands in the 1 605 kHz – 27 500 kHz range.

1014 **11.5.3 Required results**

1015 The output power level shall be within -3 dB and -9 dB relative to the maximum output power
1016 as measured in 11.3.

1017 **11.6 Sensitivity of the 600 Ω line input for SSB telephony**

1018 **11.6.1 General**

1019 (See 5.4)

1020 This measurement shows the capability of the transmitter to produce its full output power and
1021 be fully modulated when a normal audio line signal level is applied to the 600 Ω line input.

1022 **11.6.2 Methods of test**

1023 An audio tone with a frequency of 1 000 Hz and a level of -16 dBm shall be applied to the
1024 600 Ω line input terminals.

1025 The test shall be performed on 2 182 kHz if the transmitter is designed to work in the 1 605 kHz –
1026 4 000 kHz band only, or 8 291 kHz for J3E if the equipment is designed to work on all maritime
1027 bands in the 1 605 kHz – 27 500 kHz range.

1028 **11.6.3 Required results**

1029 The output power level shall be within -3 dB and -9 dB relative to the maximum output power
1030 as measured in 11.3.

11.7 Automatic level control and/or limiter for SSB telephony**11.7.1 General**

(See 5.1)

The transmitter shall be equipped with an automatic level control or a limiter of the modulation level, or both, suitable for SSB telephony operation. It shall not be possible for the user to disable this facility.

11.7.2 Methods of test

The transmitter shall be connected to the appropriate artificial antenna as specified in 10.3.5 and modulated to within 0 dB and –1 dB of the maximum output power as measured in 11.3, by a test signal consisting of four audio-frequency tones of equal amplitude, applied to the modulation input, at frequencies of 700 Hz, 1 100 Hz, 1 700 Hz and 2 500 Hz.

Where the level of the test signal is so low as to make its measurement impractical, it is permissible to employ a calibrated attenuator having a characteristic impedance equal to the transmitter input impedance as declared by the manufacturer. The input level to the transmitter may then be calculated from measurements of signal level at the input to the attenuator and the value of attenuation in circuit.

The level of the test signal shall be varied and the peak voltage of the input signal, together with the corresponding values of peak envelope power, shall be measured at a sufficient number of points for a graph of input level against peak envelope power to be plotted. The graph shall be placed in Figure 3 in such a way that it touches the upper limits at two points at least, without exceeding the upper limits anywhere.

The input signal level corresponding to –10 dB relative to rated output power shall be recorded.

The test shall be repeated using the 600 Ω audio line input.

The test shall be performed on 2 182 kHz if the transmitter is designed to work in the 1 605 kHz – 4 000 kHz band only, or 8 291 kHz for J3E if the equipment is designed to work on all maritime bands in the 1 605 kHz – 27 500 kHz range.

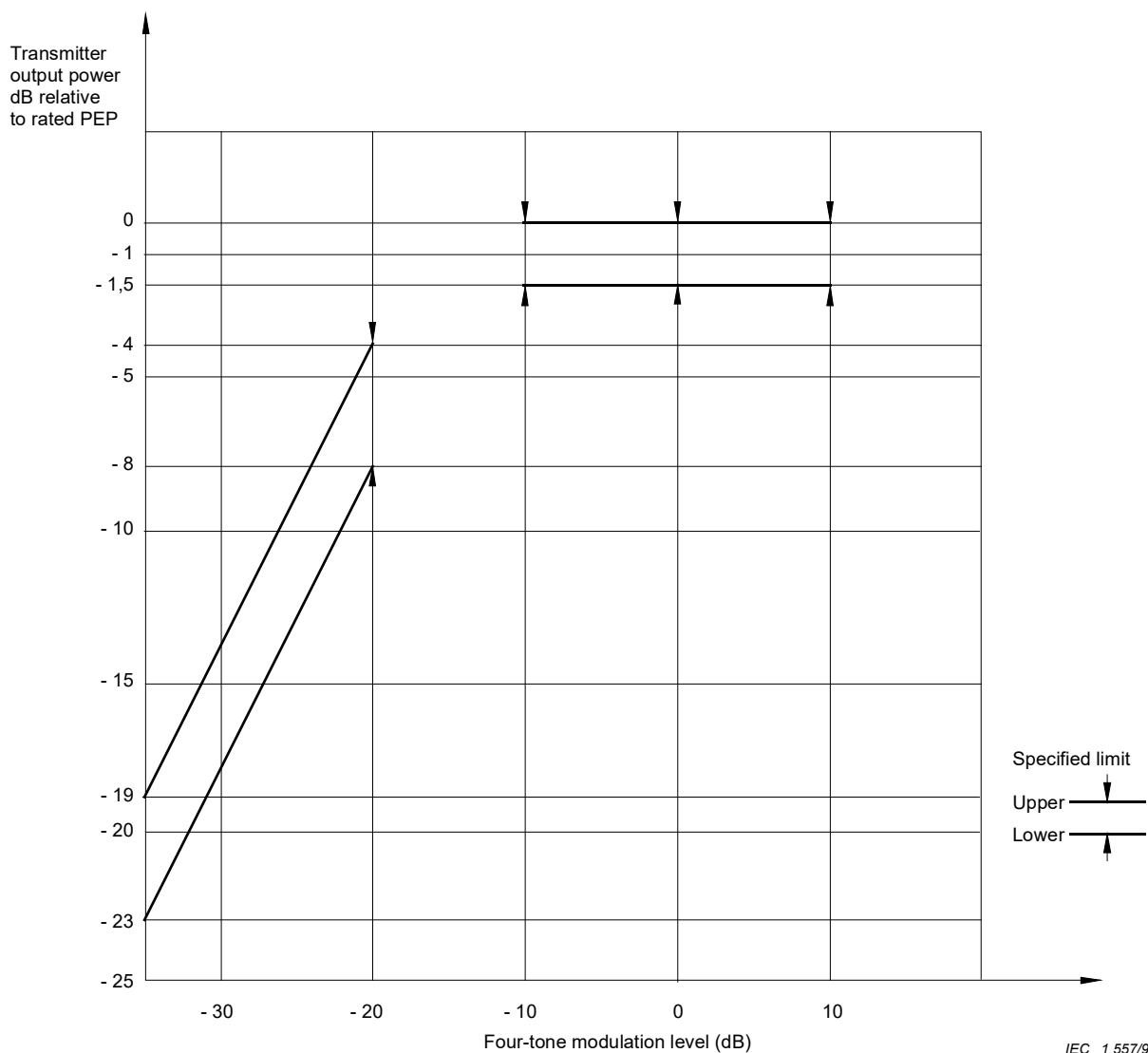


Figure 3 – Limits for automatic level control

11.7.3 Required results

The graph shall lie within the limits given in Figure 3.

11.8 Audio frequency response using SSB telephony

11.8.1 General

(See X.X)

The audio frequency response is the variation of the output power as a function of the modulation audio frequency. The peak of the response is defined as the 0 dB line of the graph shown in Figure 4.

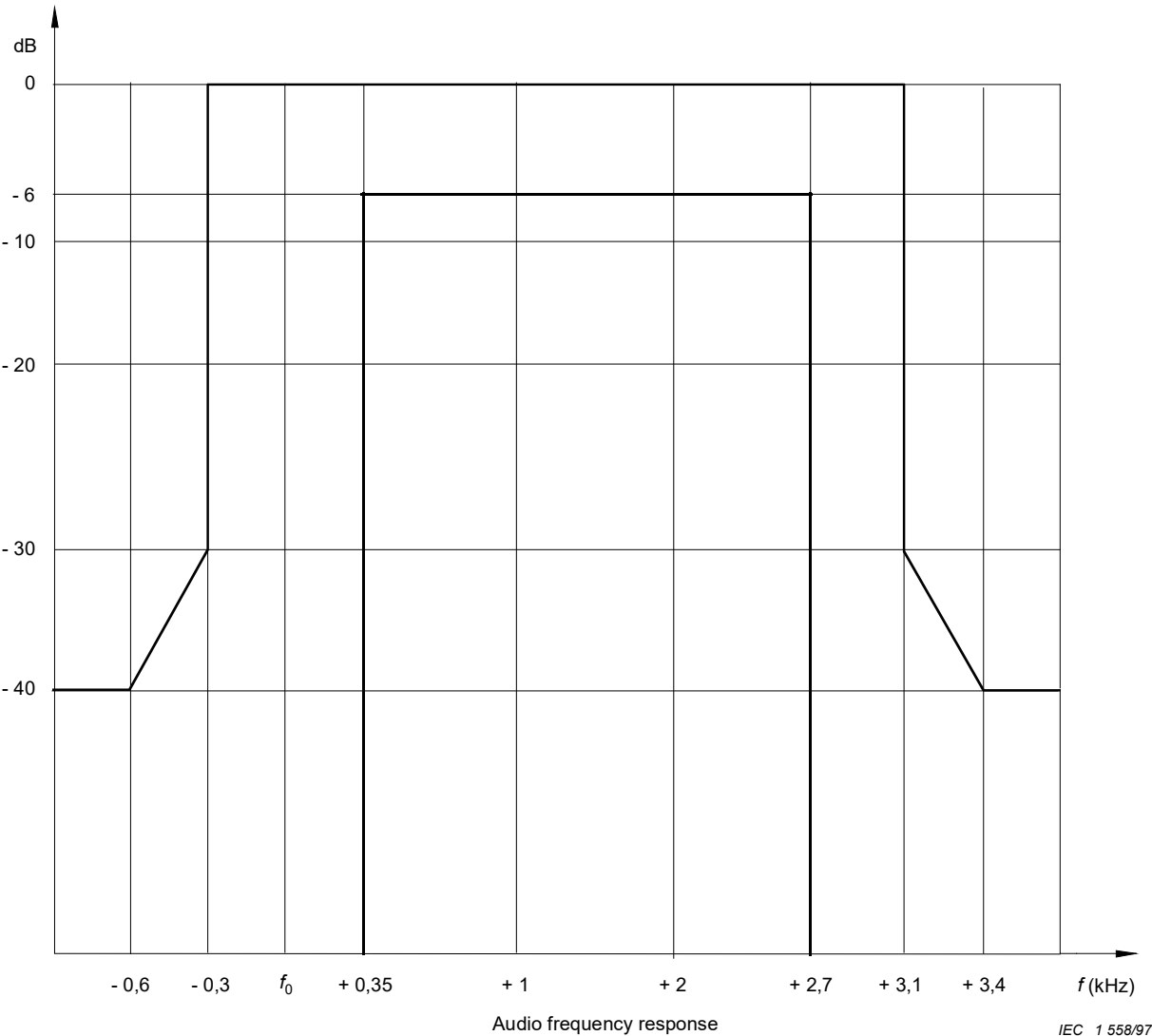


Figure 4 – Limits for audio frequency response

11.8.2 Methods of test

The transmitter shall be connected to the appropriate artificial antenna described in 10.3.5 and modulated by a sinusoidal audio frequency test signal connected to the modulation input. The frequency of the test signal shall then be varied between 100 Hz and 10 kHz. The resulting radio frequency power shall be measured at the output of the transmitter using a selective method (e.g. spectrum analyzer).

The level of the test signal shall be adjusted so that the output power at the peak of the response characteristic is 10 dB below the rated output power.

The test shall be repeated using the 600 Ω audio line input.

The test shall be performed on 2 182 kHz if the transmitter is designed to work in the 1 605 kHz – 4 000 kHz band only, or 8 291 kHz for J3E if the equipment is designed to work on all maritime bands in the 1 605 kHz – 27 500 kHz range.

11.8.3 Required results

The audio frequency response characteristic shall lie between the limit lines shown in Figure 4.

11.9 Power of out-of-band emissions using SSB telephony

11.9.1 General

(See X.X)

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

11.9.2 Methods of test

The transmitter shall be connected to the appropriate artificial antenna as specified in 10.3.5 and driven to the maximum output power measured in 8.3 by a modulating signal consisting of two audio-frequency tones with a frequency separation between them so that all intermodulation products occur at frequencies at least 1 500 Hz removed from a frequency 1 400 Hz above the carrier.

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

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

11.9.3 Required results

The power of any out-of-band emission supplied to the artificial antenna shall be in accordance with the Table 7.

Table 7 – Power of out-of-band emissions

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

11.10 Power of conducted spurious emissions of SSB telephony

11.10.1 General

(See X.X)

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.

11.10.2 Methods of test

The transmitter shall be connected to the appropriate artificial antenna as specified in 10.3.5. The modulation input shall be terminated by a 600 Ω termination, and the transmitter shall be placed in a transmit mode.

The spurious emissions shall be measured from 9 kHz to 2 GHz. The frequencies ± 12 kHz of the assigned frequency shall be excluded from this transmitter test.

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

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

11.10.3 Required results

The power of any conducted spurious emission supplied to the artificial antenna shall be in accordance with Table 8.

Table 8 – Conducted spurious emissions

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

11.11 Residual hum and noise power using telephony

11.11.1 General

(See X.X)

The residual hum and noise power is that power supplied by the transmitter to the artificial antenna when the modulation input signals are interrupted.

11.11.2 Methods of test

The transmitter shall be connected to the appropriate artificial antenna described in 10.3.5. It shall then be modulated by a two-tone test signal to produce the maximum output power as measured in 11.3. The test signal shall then be disconnected from the transmitter modulation input terminals and the radio frequency power shall be measured at the transmitter output within a frequency band which lies between the carrier frequency and 2 700 Hz above the carrier frequency. The modulation input circuit terminals shall then be short-circuited and the radio frequency power shall be measured again.

The test shall be repeated using the 600 Ω audio line input.

The test shall be performed on 2 182 kHz if the transmitter is designed to work in the 1 605 kHz – 4 000 kHz band only, or 8 291 kHz for J3E if the equipment is designed to work on all maritime bands in the 1 605 kHz – 27 500 kHz range.

11.11.3 Required results

The total residual hum and noise power excluding the carrier shall be at least 40 dB below the peak envelope power.

11.12 Residual frequency modulation on DSC

11.12.1 General

(See X.X)

The residual frequency modulation of the transmitter is defined as the ratio in dB of the demodulated B or Y signal relative to the demodulated dot pattern.

11.12.2 Methods of test

The transmitter shall be connected to the appropriate artificial antenna described in 10.3.5. It shall then be modulated by a dot pattern to produce the maximum output power as measured in 11.3.

The RF output terminal of the equipment shall be fed to a linear FM demodulator. The output of the demodulator shall be limited in bandwidth by a low-pass filter with a cut-off frequency of 1 kHz and a slope of 12 dB/octave.

The r.m.s. output level shall be measured during transmission of continuous B or Y signals and during the transmission of continuous dot pattern.

The ratio of the two r.m.s. output levels from the demodulator shall be determined.

DC voltages shall be suppressed by an a.c. coupling device so that they do not influence the result of the measurement.

The test shall be performed on 2 187,5 kHz if the transmitter is designed to work in the 1 605 kHz – 4 000 kHz band only, or 8 414,5 kHz for F1B if the equipment is designed to work on all maritime bands in the 1 605 kHz – 27 500 kHz range.

11.12.3 Required results

The residual frequency modulation shall not be greater than –26 dB.

11.13 Carrier suppression**11.13.1 General**

(See X.X)

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

11.13.2 Methods of test

The transmitter shall be connected to the appropriate artificial antenna described in 10.3.5. It shall then be modulated by an audio frequency of 1 000 Hz to produce the maximum output power as measured in 11.3.

The tests shall be performed under both normal and extreme test conditions, as defined in IEC 60945, of dry heat and upper limit of supply voltage applied simultaneously and low temperature and lower limit of supply voltage applied simultaneously.

The test shall be performed on 2 182 kHz if the transmitter is designed to work in the 1 605 kHz – 4 000 kHz band only, or 8 291 kHz for J3E if the equipment is designed to work on all maritime bands in the 1 605 kHz – 27 500 kHz range.

11.13.3 Required results

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

11.14 Continuous operation**11.14.1 General**

(See 5.6)

Continuous operation of the transmitter is the ability to produce full rated RF output power without interruption for a time as specified in 5.6.

11.14.2 Methods of test

The transmitter shall be connected to the artificial antenna as specified in 10.3.5 and driven to its maximum output power measured under 11.3, using for J3E transmitters the two-tone test signal as described in 11.3.2, and for DSC transmitters continuous dot pattern. For a period of 5 min the equipment shall transmit continuously.

The test shall be performed on 2 182 kHz for J3E and 2 187,5 kHz for F1B if the transmitter is designed to work in the 1 605 kHz – 4 000 kHz band only, or on 8 291 kHz for J3E and 8 414,5 kHz for F1B if the equipment is designed to work on all maritime bands in the 1 605 kHz – 27 500 kHz range.

The measurement shall be carried out under extreme test conditions, as defined in IEC 60945, of upper limits of supply voltage and dry heat applied simultaneously.

11.14.3 Required results

The output power shall not vary by more than ± 3 dB from the rated output power. The limits of 11.3.3 shall not be exceeded. After five min the transmitter shall stop transmitting.

11.15 Protection of the transmitter**11.15.1 General**

(See 5.7)

This represents the protection afforded to the transmitter against damage which may be caused by faults occurring in the ship's transmitting antenna.

11.15.2 Methods of test

After the transmitter has been tuned and whilst the transmitter is being driven to the rated output power by the simultaneous application of either two modulating signals of equal level or a dot pattern, the antenna terminals shall first be short-circuited and then open-circuited, in each case for a period of 5 min.

The test shall be performed on 2 182 kHz for J3E or 2 187,5 kHz for F1B if the transmitter is designed to work in the 1 605 kHz – 4 000 kHz band only, or on 8 291 kHz for J3E or 8 414,5 kHz for F1B if the equipment is designed to work on all maritime bands in the 1 605 kHz – 27 500 kHz range.

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

11.15.3 Required results

During the test the transmitter shall not be damaged. After removal of the short-circuit or open-circuit conditions, the transmitter shall be able to operate normally for all available modes of operation.

11.16 Standing wave ratio control**11.16.1 General**

(See 5.7)

In case the standing wave ratio (SWR) becomes too high, the power of the transmitter can be automatically reduced without stopping the transmission and an alert initiated.