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INTERNATIONAL STANDARD

colour inside

Global maritime distress and safety system (GMDSS) – Part 6: Narrowband direct-printing telegraph equipment for the reception of navigational and meteorological warnings and urgent information to ships (NAVTEX)

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

GLOBAL MARITIME DISTRESS AND SAFETY SYSTEM (GMDSS) –

Part 6: Narrowband direct-printing telegraph equipment for the reception of navigational and meteorological warnings and urgent information to ships (NAVTEX)

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This consolidated version of IEC 61097-6 consists of the second edition (2005) [documents 80/419/FDIS and 80/424/RVD] and its amendment 1 (2011) [documents 80/619/CDV and 80/648/RVC]. It bears the edition number 2.1.

The technical content is therefore identical to the base edition and its amendment and has been prepared for user convenience. A vertical line in the margin shows where the base publication has been modified by amendment 1. Additions and deletions are displayed in red, with deletions being struck through.

International Standard IEC 61097-6 has been prepared by IEC technical committee 80: Maritime navigation and radiocommunication equipment and systems.

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

IEC 61097 consists of the following parts under the general title *Global maritime distress and safety system (GMDSS)*:

Part 1: Radar transponder – Marine search and rescue (SART) – Operational and performance requirements, methods of testing and required test results

Part 2: COSPAS-SARSAT EPIRB – Satellite emergency position indicating radio beacon operating on 406 MHz – Operational and performance requirements, methods of testing and required test results

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

Part 4: INMARSAT-C ship earth station and INMARSAT enhanced group call (EGC) equipment – Operational and performance requirements, methods of testing and required test results

Part 5: Inmarsat-E – Emergency position indicating radio beacon (EPIRB) operating through the Inmarsat system – Operational and performance requirements, methods of testing and required test results

Part 6: Narrowband direct-printing telegraph equipment for the reception of navigational and meteorological warnings and urgent information to ships (NAVTEX)

Part 7: Shipborne VHF radiotelephone transmitter and receiver – Operational and performance requirements, methods of testing and required test results

Part 8: Shipborne watchkeeping receivers for the reception of digital selective calling (DSC) in the maritime MF, MF/HF and VHF bands – Operational and performance requirements, methods of testing and required test results

Part 9: Shipborne transmitters and receivers for use in the MF and HF bands suitable for telephony, digital selective calling (DSC) and narrow band direct printing (NBDP) – Operational and performance requirements, methods of testing and required test results

Part 10: Inmarsat-B ship earth station equipment – Operational and performance requirements, methods of testing and required test results

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

Part 13: Inmarsat F77 ship earth station equipment – Operational and performance requirements, methods of testing and required test results

The committee has decided that the contents of the base publication and its amendments will remain unchanged until the stability date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

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

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

IMPORTANT – The "colour inside" logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this publication using a colour printer.

INTRODUCTION

NAVTEX provides shipping with navigational and meteorological warnings and urgent information by automatic display and/or print out from a dedicated receiver.

NAVTEX is a component of the IMO/IHO World-Wide Navigational Warning Service (WWNWS) defined by IMO Assembly Resolution A.706(17), as amended, and the WMO Manual on Marine Meteorological Services, Part I*bis*, Provision of warnings and weather and sea bulletins (GMDSS application). It has been included as an element of the Global Maritime Distress and Safety System (GMDSS).

The original NAVTEX specification allowed for equipment with integral printers and precluded the fitting of equipment which relied on other ways of recording and displaying NAVTEX data. The use of Liquid Crystal Displays and other Visual Display Units is now ubiquitous on ships' bridges and this revision of the specification allows for their use in displaying NAVTEX data.

As a result of the final cessation of the distresss watch on 500 kHz in 1999 the frequency 490 kHz became available for use as a national NAVTEX channel and this has now been widely implemented around the world. This NAVTEX specification therefore requires simultaneous operation on an additional channel to the international channel of 518 kHz.

IMO Resolution MSC.148(77) states that the equipment should comprise radio receivers, a signal processor and:

a) an integrated printing device; or

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

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

INTRODUCTION
(to Amendment 1)

The amendment removes the description in Annex C of the sentences NRX and NRM. These sentences are now described in IEC 61162-1 (see NOTE below).

NOTE Applies as of edition 4 (2010).

GLOBAL MARITIME DISTRESS AND SAFETY SYSTEM (GMDSS) –

Part 6: Narrowband direct-printing telegraph equipment for the reception of navigational and meteorological warnings and urgent information to ships (NAVTEX)

1 Scope

This part of IEC 61097 specifies the minimum performance requirements, technical characteristics and type-testing requirements for narrowband telegraph equipment for the reception of navigational and meteorological information as required by Regulation IV/7.1.4 of the 1988 amendments to the 1974 International Convention for Safety of Life at Sea (SOLAS), and which is associated with IEC 60945. When a requirement in this standard is different from IEC 60945, the requirement in this standard takes precedence.

This standard incorporates the performance standards of IMO Resolution MSC.148(77), the technical characteristics of ITU-R Recommendation M.540, takes account of the IMO Resolution A.694(17) and conforms with the ITU Radio Regulations where applicable.

All text of this standard, whose meaning is identical to that in IMO Resolution MSC.148(77) and ITU-R Recommendation M.540 will be printed in *italics* and the Resolution/Recommendation and paragraph number indicated between brackets.

2 Normative references

The following referenced documents are indispensable for the application 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, *Marine navigation and radio communication equipment – 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*

IMO *Safety of Life at Sea (SOLAS) Convention* (1974), as amended (GMDSS)

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

IMO Resolution MSC.148(77) (2003) *Revised performance standards for narrow-band direct-printing telegraph equipment for the reception of navigational and meteorological warnings and urgent information to ships (NAVTEX)*

IMO Publication – *NAVTEX Manual*

IMO Resolution MSC/Circ.1122 *Adoption of the revised NAVTEX manual*

ITU-R Recommendation 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*

ITU-R Recommendation M.625-3:1995, *Direct-printing telegraph equipment employing automatic identification in the maritime mobile service*

3 Definitions and abbreviations

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

3.1 Definitions

3.1.1
LORAN-C
long range radio-navigation system operating on an assigned frequency of 100 kHz

3.1.2
NAVTEX
system for the broadcast and automatic reception of maritime safety information by means of narrow-band telegraphy

3.1.3
Test script
text file containing a number of NAVTEX messages formatted as defined in 5.5. The STF is a particular example of a test script

3.2 Abbreviations

ASCII	American Standard Code for Information Interchange
CER	character error rate
EMC	electromagnetic compatibility
EUT	equipment under test
HMI	human-machine interface
INS	integrated navigation system
IMO	International Maritime Organization
ITU	International Telecommunication Union
PC	performance check
PT	performance test
RTC	real time clock
SAR	search and rescue
STF	standard test file
STS	standard test signal
USB	Universal Serial Bus
UTC	Co-ordinated Universal Time

4 Performance requirements

4.1 General

(148/A.1.1) *The equipment, in addition to meeting the requirements of the Radio Regulations, the provisions of Recommendation ITU-R M.540 applicable to shipborne equipment and the general requirements set out in resolution A.694(17)*, and specified in IEC 60945 shall *comply with the* revised IMO performance standards for NAVTEX equipment Resolution MSC 148(77).

(148/A.2.1) *The equipment* shall *comprise radio receivers, a signal processor and: either*

a) an integrated printing device; or

b) *a dedicated display device, printer output port and a non-volatile message memory; or*

NOTE *Where there is no printer, the dedicated display device shall be able to be located in the position from which the ship is normally navigated.*

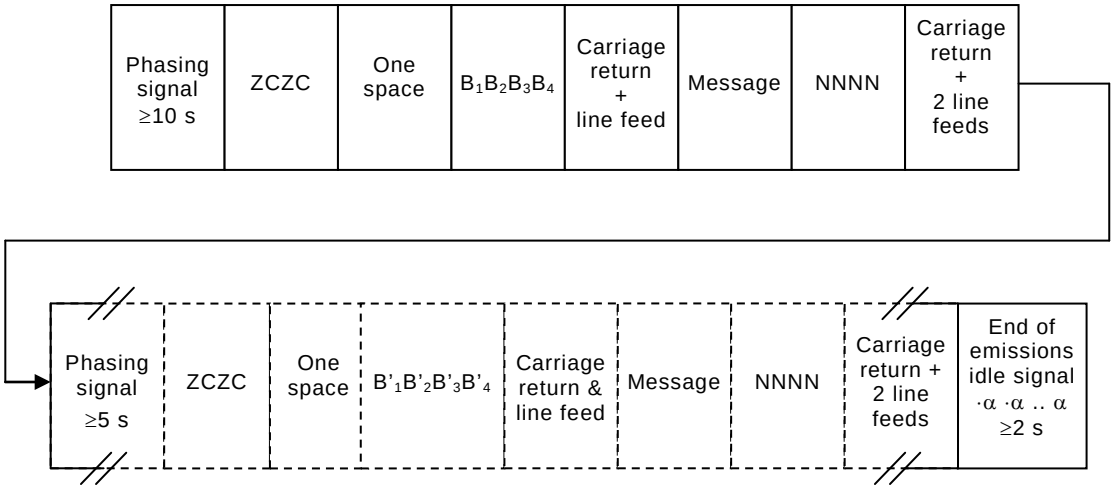
c) *a connection to an integrated navigation system (INS) and a non-volatile message memory.*

Examples of NAVTEX systems are given in Annex A.

4.2 General characteristics

(540/AII.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*, Annex I,4.

(540/AII.3) *The technical format of the transmission* shall be in accordance with ITU-R Recommendation M.540, Annex II,3 as follows:



where

ZCZC defines the end of the phasing period

B_1 character is a letter (A-Z) identifying the transmitter coverage area.

B_2 character is a letter (A-Z) for each type of message as follows:

A navigational warning

B meteorological warning

C ice report

D search and rescue information/piracy and armed robbery

E meteorological forecast

F pilot message

G AIS

H LORAN-C message

I reserved presently not used

J SATNAV message

K other electronic navigational aid system message

L navigational warning (additional)

M to Y reserved presently not used

Z QRU (no message on hand)

B_3B_4 characters are the serial number of the message between 01 and 99.

4.3 Specific characteristics

4.3.1 B_1 and B_2 characters

(540/AII.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 (see 4.3.7).

4.3.2 B_3 and B_4 characters

(540/AII.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* (see 4.3.5).

4.3.3 Preamble

(540/AII.3) *The printer* or message store shall *only be activated if the preamble B_1 B_2 B_3 B_4 is received without errors.*

4.3.4 Repetition of printing/display

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

4.3.5 Mandatory printing/display

(540/AII.6) *A message* shall *always be printed,* stored and displayed *if B_3 B_4 = 00* and if it is transmitted by a coast station that the equipment is programmed to select.

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

4.3.6 Reception of messages with character errors

4.3.6.1 Messages with character error rate of >4 % and ≤33 %

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

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

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

4.3.6.2 Messages with character error rate of >33 %

The EUT shall not store or print messages if the received character error rate >33 %. See Annex B.

4.3.7 Controls and indicators

(148/A.3.1) *Details of the coverage areas and message categories which have been excluded by the operator from reception and or display* shall *be readily available.*

It shall be possible to exclude at least four different message categories. It shall not be possible to exclude message categories A, B, D and L.

4.3.8 Programmable control memories

(148/A.6.3) *Information for location (B_1) and message (B_2) designators in programmable memories* shall be permanently stored in non-volatile memory and shall *not be erased by interruptions in the power supply of less than 6 h.*

Default programmable settings shall be, for the location (B_1) designators set to all characters and for the message (B_2) designators set to characters ABCDEFHJKLVZ.

NOTE Location (B_1) and message (B_2) designators are described in 4.2.

4.3.9 Alarms

4.3.9.1 Generation of alarms

(148/A.7) *The receipt of search and rescue information (B_2 = 'D')* shall *give an alarm at the position from which the ship is normally navigated. It* shall *only be possible to reset this alarm manually.*

The EUT may either contain an integral alarm sounder or a pair of relay contacts for the provision of an external sounder.

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

If an additional alarm is provided it shall be distinguishable from a search and rescue alarm.

The audible volume of the alarm shall be 75 dBA to 85 dBA.

If a pair of relay contacts is provided to switch an external sounder on for an alarm condition then the relay contacts shall be free of earth.

The alarm condition shall be reported via an ALR command on the INS serial port.

4.3.9.2 Using the ALR formatter

An ALR command shall be used to report the reception of a search and rescue alarm, navigational or meteorological warnings or to indicate a failure or malfunction that will reduce the integrity of the NAVTEX receiver.

Alarm messages shall be IEC 61162-1 compliant "$--ALR" sentences and shall contain the local alarm numbers and alarm text shown in the following table:

Table 1 – Alarm conditions signaled using the ALR sentence formatter

Alarm number	Alarm text
001	"NAVTEX: Navigational warning"
002	"NAVTEX: Meteorological warning"
003	"NAVTEX: Search and rescue information"
004	"NAVTEX: Receiver malfunction" [a]
005	"NAVTEX: Built in self test failure" [b]
006	"NAVTEX: General failure"
[a] The text may be extended to indicate which receiver has the malfunction [b] The text may be extended to indicate the nature of the test failure	

Additional numbers may be used by the manufacturers for other purposes but shall be in the range 051-099.

4.3.9.3 Repetition of alarm conditions

Whilst any alarm conditions persist, the NAVTEX receiver shall repeat the appropriate ALR sentences once every 30 s until acknowledged.

When all the alarm conditions are acknowledged (but still active), the NAVTEX receiver shall stop the output of any audible alarm indication (whether by integral sounder or by relay contacts) but shall continue to repeat the ALR sentences once every 30 s.

When the alarm condition has returned to "healthy", an ALR sentence with the status set to "V" shall be sent out at one minute intervals.

When there are no active alarms, the NAVTEX receiver may send out a single ALR sentence with alarm number 006 and a status of "V" once every minute as an indication that all is well.

4.3.10 Test facilities

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

Equipment with a dedicated display shall include a visual or aural alert if a malfunction or general failure occurs.

4.4 Interfaces

(148/A.9.1) *The equipment* shall *include at least one interface for the transfer of received data to other navigation or communication equipment.*

(148/A.9.2) *All interfaces provided for communication with other navigation or communication equipment* shall *comply with IEC 61162 series of standards.*

As a minimum the equipment shall be capable of communicating with the sentences ACK, ALR, NRM and NRX 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.

NOTE New IEC 61162 sentences used to interface the EUT to an INS are described in Annex C.

(148/A.9.3) *If there is no integrated printer, the equipment* shall *include a standard printer interface* (for example an RS232, Centronics, USB interface for an FX80 type printer, or other serial protocols and support for other printer types).

4.5 Receiver

4.5.1 Number of receivers

(148/A.4.1) *The equipment* shall *contain one receiver operating on the frequency prescribed by the Radio Regulations for the international NAVTEX system* (518 kHz)*. The equipment* shall *contain* at least *a second receiver capable of working at the same time as the first* one *on at least two other frequencies recognised for the transmission of NAVTEX information. The first receiver* shall *have priority in the display or printing of received information. Printing or displaying of messages from one receiver* shall *not prevent reception by the other receiver.*

4.5.2 Receive frequencies

The recognised receive frequencies shall be 490 kHz, 518 kHz and 4209,5 kHz.

Where the second receiver can be switched between operating frequencies, this shall be done both manually and via the INS port.

4.5.3 Sensitivity

(148/A.4.2) *The receiver sensitivity* shall *be such that for a source with an e.m.f. of 2 μV in series with a non-reactive impedance of 50 Ω* (equivalent to –107 dBm)*, the character error rate is below 4 %.*

4.6 Display

4.6.1 General

If a display is included as part of the EUT then the following requirements shall be met.

4.6.1.1 User interface

There shall be a display mode that clearly shows the user which transmitter coverage area (B_1) and message types (B_2) are currently selected for each receiver.

There shall be controls for adjusting the display illumination and contrast settings.

There shall be an indication of which receiver(s) are currently receiving.

New search and rescue (SAR) messages shall be displayed immediately that they are received and stored, and shall cause an alarm to be set. SAR messages shall be displayed until they are acknowledged by the cancellation of the alarm.

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

It shall be possible to select transmitter coverage area (B_1) and message types (B_2) independently for message storage to non-volatile memory, for message output to the INS port and for message output to the printer port.

4.6.1.2 Number of characters displayed per line

(148/A.5.1) *The display device* shall *be able to display a minimum of 32 characters per line.*

NOTE Designers of displays should note that some NAVTEX messages have lines with 40 characters or more.

4.6.1.3 Number of lines displayed

(148/A.5.3) *The display device* shall *be able to display at least 16 lines of message text.*

4.6.1.4 Display requirements

(148/A.5.2) *If a dedicated display device is used, the following requirements* shall *be met:*

a) an indication of newly received selected *messages* shall *be immediately displayed until acknowledged or until 24 h after receipt;*

b) newly received selected *messages* shall *also be* capable of being *displayed;* and

c) stored messages shall be capable of being displayed and searchable by location (station) designators and type of message designators.

4.6.1.5 Visibility of display

(148/A.5.4) *The design and size of the display device shall be such that displayed information is easily read under all conditions by observers at normal working distances and viewing angles*.

This requirement shall apply for all displayed information received from any of the receivers, whether in English or in any other national language or any other supported alphabet.

4.6.1.6 Automatic line feed

(148/A5.5) *If automatic line feed entails division of a word, this* shall *be indicated in the displayed text.*

4.6.1.7 End of message display

(148/A.5.6) *When displaying received messages on a display device, a clear indication of the end of a message* shall *be given by automatically adding line feeds after the message or including some other form of delineation.*

4.6.1.8 Corrupt characters

(148/A.5.7) *The equipment* shall *display an asterisk if the character is received corrupted.*

4.6.1.9 Printer interface message selection requirements

(148/A.5.8) *Where the printer is not integrated, it* shall *be possible to select the following data to be output to the printer* interface*:*

a) *all messages as they are received;*

b) *all messages stored in the message memory;*

c) *all messages received on specified frequencies, from specified locations or having specified message designators;*

d) *all messages currently displayed; and*

e) *individual messages selected from those appearing on the display.*

4.7 Integral printer

4.7.1 General

If a printer is included as part of the EUT then the following requirements shall be met.

4.7.1.1 Number of characters printed per line

(148/A.5.1) *The printer* shall *be able to print a minimum of 32 characters per line.*

4.7.1.2 Automatic line feed

(148/A5.5) *If automatic line feed entails division of a word, this* shall *be indicated in the printed text.*

4.7.1.3 End of message display

(148/A.5.6) *The printer or printer output* shall *automatically insert line feeds after completing print of the received message.*

4.7.1.4 Corrupt characters

(148/A.5.7) *The equipment* shall *print an asterisk if the character is received corrupted.*

4.7.1.5 Printer requirements

The integral printer:

a) shall print easily legible signs and produce a level of acoustic noise <60 dBA;

b) shall print the message received on paper. Changing the paper or printing mechanism, if required, shall be a simple operation. The paper and printing capacity shall be sufficient to enable at least 200 000 characters to be printed;

c) shall be provided with an alarm to indicate that the paper has nearly run out or has run out;

d) shall provide temporary storage for partially printed messages. If any message is incompletely printed because the paper has run out or the printer is out of order, the message shall be stored in the memory and printed once new paper has been loaded. Memory storage of further new message identifications shall be inhibited if there is no paper available in the printing device.

4.7.1.6 Printer message selection requirements

It shall be possible to select the following data to be output to the integral printer:

a) all messages as they are received;

b) all messages received on specified frequencies, from specified transmitter coverage areas or having specified message type designators.

4.8 NAVTEX message memory

4.8.1 Equipment without integral printers

These requirements shall apply to equipment that does not contain an integral printer such as devices incorporating an integral display.

4.8.1.1 Number of messages

(148/A.6.1.1) *For each receiver fitted it* shall *be possible to record at least 200 messages of average length 500 characters (printable and non-printable) in non-volatile message memory. It* shall *not be possible for the user to erase messages from memory. When the memory is full, the oldest messages* shall *be overwritten by new messages.*

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

4.8.1.2 Message tagging

(148/A.6.1.2) *The user* shall *be able to tag individual messages for permanent retention. These messages may occupy up to 25 % of the available memory* (i.e. up to 50 of the required minimum of 200 x 500 character message slots) *and* shall *not be overwritten by new messages. When no longer required, the user* shall *be able to remove the tag on these messages which may then be overwritten in normal course*.

The message tagging function does not need to be supported on a NAVTEX receiver which does not have a dedicated display device.

4.8.1.3 Automatic erasure

(148/A.6.2.2) *After between 60 h and 72 h, a* message and *message identification* shall *automatically be erased from the store* (unless tagged for permanent retention). *If the number of received messages exceeds the capacity of the store, the oldest* message and *message identification shall be erased.*

4.8.2 Equipment with integral printer

These requirements shall apply only to equipment that contains an integral printer.

4.8.2.1 Number of messages

(148/A.6.2.1) *The equipment* shall *be capable of internally storing at least 200 message identications for each receiver provided.*

4.8.2.2 Automatic erasure

After between 60 h and 72 h, a message shall automatically be erased from the store. If the number of received messages exceeds the capacity of the store, the oldest message shall be erased.

4.9 Power supplies

The equipment shall be powered from one of the ship's main sources of electrical energy (power) as defined by the manufacturer.

4.10 Source of UTC

The equipment may optionally use an externally provided source of UTC or an internal RTC to provide timing data for handling message ageing.

5 Test conditions

5.1 General

The EUT shall, unless otherwise agreed, be set up by the test laboratory following instructions contained in the user/installation manual. The test laboratory shall ensure that the EUT is operating normally before testing commences.

The tests to this standard may be performed on one or more units of the EUT as agreed between manufacturer and test laboratory. At least one EUT shall in addition to its normal operation be provided with

a) a test point at the processor output to the printing device (EUTs with an INS or printer interface shall utilize them for the tests); the level and format of the signal shall be stated by the manufacturer;

b) suitable means to either output to the printing device or give access to examine with an external device the contents of the message storage and/or message identifier storage; the means shall be stated by the manufacturer;

c) a method of clearing all stored messages and/or message identifiers from non-volatile memory; and

d) a method of pre-loading a message and/or message identifier file into non-volatile memory by an external device so that the non-volatile memory may be filled or nearly filled with messages. This file shall be provided by the manufacturer and shall be referred to as the 'standard test file (STF)' in this document.

The test laboratory shall be capable of

a) generating NAVTEX transmissions, on each specified receive frequency, with all possible variations of $B_1\ B_2\ B_3\ B_4$ characters in accordance with the technical format specified in ITU-R Recommendation M.540. The calibrated apparatus shall also be capable of generating incorrect signals, and

b) generating the standard test signals contained in 5.5 for transmission to the EUT.

No adjustments are permitted to the EUT throughout the complete test program except for removal and application of primary power as required by the test procedures, changing of paper rolls where appropriate and changes to internal settings where required to allow the test to be conducted.

A performance test is required at various points in the test sequence. An inability to meet the performance test or failure of any test required by the test procedure shall be considered a critical failure, and the test shall be terminated.

A performance check is required at various points in the test sequence. An inability to meet the performance check or failure of any test required by the test procedure shall be considered a critical failure, and the test shall be terminated.

The values of all parameters of EUT conditions/states measured or observed, respectively, during each of the tests prescribed in the procedures of this standard, shall be duly recorded and submitted to the appropriate national authority as part of the required test approval data set. The measurement accuracy of each value (or set of values) shall also be reported in the test data. A completed summary of test results shall also be submitted to the appropriate national authority.

Except as specified by the test procedures, opening of the unit is not allowed.

5.2 Performance test

The performance test (PT) is a receiver call sensitivity test (refer to 9.1) with the test signal at the applicable STS level.

5.3 Performance check

A performance check (PC) is a receiver call sensitivity test (refer to 9.1) with the test signal +6 dB relative to the applicable STS level.

5.4 Normal and extreme conditions

5.4.1 Normal test conditions

5.4.1.1 Temperature and humidity

The normal test conditions are defined in terms of temperature, humidity and supply voltage.

Temperature and humidity shall be within following range:

Temperature +15 °C to +35 °C

Humidity 20 % to 75 %

When it is impractical to carry out the test under the conditions stated above, a note to this effect, stating the actual temperature and relative humidity during the tests, shall be added to the test report.

5.4.1.2 Power supply

The normal test power supply voltage shall be within a tolerance of ±3 % relative to the nominal voltage of one (or any) of the ship's power supplies for which the equipment is designed. For a.c. supplies, the test power supply frequency shall be within ±1 Hz of the nominal frequency. Refer to 5.2.1 of IEC 60945.

The nominal supply voltage and frequency are the declared or any of the declared voltages or frequencies for which the EUT is designed.

5.4.2 Extreme test conditions

NOTE The extreme environmental conditions are covered by clause 6.

5.4.2.1 Power supply

Table 2 – Extreme power supply variation

Power supply	Voltage variation %	Frequency variation %
a.c.	±10	±5
d.c.	+30 –10	Not applicable

Refer to 5.2.2 of IEC 60945 for further information.

5.4.3 Excessive test conditions

These conditions exceed the extreme test conditions in which the EUT is required to operate, with or without performance degradation, as indicated herein.

a) Excessive current is defined as greater than normal working current.

b) Excessive voltage is defined as 50 % greater than the nominal voltage.

Protection shall be provided against such excesses at an appropriate level chosen by the manufacturer and, when activated, may require the EUT to be reset, for example by fuse replacement. The power supply shall be adjusted to cause activation of the protection and after EUT reset, a performance check under normal test conditions shall be carried out.

Power supply miss-connections are also regarded as excessive conditions. Where appropriate, the EUT shall be subjected to an input from a power supply of reversed d.c. polarity or improper a.c. phase sequence for a period of 5 min. After completion of the test, and reset of the protection of the EUT, if required, the power supply shall be connected normally and a performance check shall be carried out.

5.5 Standard test signal

The standard test signal (STS) shall be in accordance with ITU-R Recommendation M.625, Annex I,4, collective B-mode. It shall consist of an F1B radio-frequency signal modulated with a frequency shift of ±85 Hz centered on the receive frequency (490 kHz, 518 kHz or 4209,5 kHz),

(540/AII.10) *The transmitter frequency tolerance for the mark and space signals shall be better than ± 10 Hz*.

The technical format of the transmission shall be in accordance with ITU-R Recommendation M.540, Annex II,3 and shall contain the following traffic information signals as the message content:

For 490 kHz :

(figure shift) 4 9 0 (space)

(letter shift) K H Z (space) (carriage return) (line feed)

(letter shift) A B C D E F G H I J (space)

(letter shift) K L M N O P Q R S T (space)

(letter shift) U V W X Y Z (figure shift) 1 2 3 4 (space)

(figure shift) 5 6 7 8 9 0 ? : . , (space)

(figure shift) - ( ) ' =/+ (space) (carriage return) (line feed)

For 518 kHz :

(figure shift) 5 1 8 (space)

(letter shift) K H Z (space) (carriage return) (line feed)

(letter shift) A B C D E F G H I J (space)

(letter shift) K L M N O P Q R S T (space)

(letter shift) U V W X Y Z (figure shift) 1 2 3 4 (space)

(figure shift) 5 6 7 8 9 0 ? : . , (space)

(figure shift) - ( ) ' =/+ (space) (carriage return) (line feed)

For 4209,5 kHz :

(figure shift) 4 2 0 9 (space)

(letter shift) K H Z (space) (carriage return) (line feed)

(letter shift) A B C D E F G H I J (space)

(letter shift) K L M N O P Q R S T (space)

(letter shift) U V W X Y Z (figure shift) 1 2 3 4 (space)

(figure shift) 5 6 7 8 9 0 ? : . , (space)

(figure shift) - ( ) ' =/+ (space) (carriage return) (line feed)

Each message shall be preceded by '*ZCZC* $B_1B_2B_3B_4$' and followed by 'NNNN'.

The STS shall be of sufficient length for the measurements to be performed or it shall be possible to repeat the message (with the correct period of phasing between messages) without interruption for as long as is required for the test to be performed.

The level of the STS at the source including the associated network shall be –107 dBm (2 μV e.m.f. for an artificial antenna type a) and 5 μV e.m.f. for an artificial antenna type b)).

5.6 Standard test file

The standard test file (STF) shall consist of a series of unique identifiable messages each 500 characters long. The STF is intended to be used to fill the declared memory capacity of the EUT exactly and shall be downloaded directly into the EUT's memory via the INS port or some other method declared by the manufacturer.

5.7 Arrangement for test signal applied to the receiver input

Sources of test signals for application to the EUT input shall be connected through a network so that the impedance presented to the EUT input is equal to the impedance of the artificial antenna specified in 5.8, irrespective of whether one or more test signals are applied to the EUT simultaneously.

In the case of multiple test signals, steps shall be taken to prevent any undesirable effects due to interactions between signals in the generators or other sources.

5.8 Artificial antennas

Where specified, tests shall be carried out with the EUT, connected as appropriate, to the following artificial antennas:

a) a non-reactive resistance of 50 Ω, or

b) a resistance of 10 Ω in series with a capacitance of 150 pF.

5.9 Measurement uncertainty

Absolute measurement uncertainties, maximum values:

Receiver sensitivity	±3 dB
Conducted emission	±3 dB
Radiated emission	±6 dB

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

5.10 Interpretations of measurement results

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

a) the measured value related to the corresponding limit shall be used to decide whether an EUT meets the requirements of the standard;

b) the measurement uncertainty value for the measurements of each parameter shall be stated in the test report; and

c) the recorded value of the measurement uncertainty shall, for each measurement, be equal to or lower than the figures in 5.9.

5.11 Conducted and radiated RF immunity tests exclusion bands

The frequencies on which NAVTEX receivers are intended to operate, shall be excluded from conducted and radiated RF immunity tests.

There shall be no frequency exclusion bands applied to emission measurements of NAVTEX receivers, and/or associated ancillary equipment.

The immunity test exclusions are referred to as "exclusion bands" and are defined in 5.11.1.

5.11.1 Exclusion bands for receivers

The exclusion band for NAVTEX receivers operating at 518 kHz is the frequency range 490 kHz to 546 kHz.

The exclusion band for NAVTEX receivers operating at 490 kHz is the frequency range 462 kHz to 518 kHz.

The exclusion band for NAVTEX receivers operating at 4209,5 kHz is the frequency range 3969 kHz to 4449 kHz.

5.12 Narrow band responses on receivers

The requirements of Clause 10 of IEC 60945 shall apply with the following modifications.

No immunity tests shall be carried out on frequencies of identified narrow band responses on NAVTEX receivers.

An increase of the character error rate (CER) above the value of 4 % shall be used as criterion for the identification of narrow band responses.

The nominal frequency offset to be used for the identification of narrowband responses shall be ±1 kHz for the first part of the identification procedure, and ±1,25 kHz for its second part.

All narrowband responses shall be disregarded from immunity tests.

6 Environmental tests required

The EUT shall be subjected to the tests in IEC 60945 required for equipment protected from exposure to weather, unless the manufacturer has stated that the equipment is intended for use in exposed locations in which case rain and spray testing is also required. When a requirement in this standard is different from IEC 60945, the requirement in this standard shall take precedence.

7 Serial interface tests

(See 4.4.)

7.1 INS input electrical tests

7.1.1 Method of test

The INS input port configured in accordance with IEC 61162-1 and IEC 61162-2, shall be tested according to the relevant standard with regard to minimum and maximum voltage and current at the input terminals.

7.1.2 Required results

The interfaces shall fulfil the applicable requirements of IEC 61162-1 and IEC 61162-2.

7.2 INS input performance tests

7.2.1 Method of measurement

Operate the input with simulated data that represent the receiver control functions defined in Annex C, including messages with invalid and unavailable data formatters. This test shall include loading the EUT input with 100 % of the interface's capacity for a period of not less than 5 min. Check for correct operation of the EUT.

7.2.2 Required results

Verify that the displayed data/EUT operation agrees with the simulated input data and that invalid and unavailable data formats do not stop/inhibit the correct operation of the EUT.

7.3 INS output electrical tests

7.3.1 Method of test

The INS output port configured in accordance with IEC 61162-1 and IEC 61162-2, shall be tested according to the relevant standard with regard to minimum and maximum voltage and current driving capability at the output terminals.

7.3.2 Required results

The interfaces shall fulfil the applicable requirements of IEC 61162-1 and IEC 61162-2.

7.4 INS output performance tests

7.4.1 Method of measurement

Set the EUT to output to the INS port so that it is loaded with 100 % of the interface's capacity. Check for correct operation of the EUT.

7.4.2 Required results

Verify that the output data/EUT operation agrees with the requested output data.

7.5 Printer output electrical tests

These tests are only applicable for EUTs that do not contain an integral printer.

These tests shall be conducted against the standard that the manufacturer has declared this interface will meet.

7.5.1 Method of test

The printer output port configured in accordance with the manufacturer's data, shall be tested according to the relevant standard with regard to minimum and maximum voltage and current driving capability at the output terminals.

7.5.2 Required results

The interfaces shall fulfil the applicable requirements of the relevant standard.

7.6 Printer output performance tests

7.6.1 Method of measurement

Set the EUT to output to the printer port so that it is loaded with 100 % of the interface's capacity. Check for correct operation of the EUT.

7.6.2 Required results

Verify that the output data/EUT operation agrees with the requested output data.

8 General and signal processing tests

8.1 Exclusion of stations

(See 4.3.1.)

8.1.1 Method of measurement

The EUT shall be programmed to select all B_2 characters and specific B_1 characters.

A test signal +6 dB relative to the STS level, with the B_1 and B_2 characters varied at random over 25 repetitions of the STS, shall be applied to the EUT. B_3B_4 = 00 shall not be used.

The test shall be repeated for other selected B_1 characters.

8.1.2 Results required

For each value of B_1 not selected, the EUT shall neither display nor print the test message.

8.2 Exclusion of message categories

(See 4.3.1)

8.2.1 Method of measurement

The EUT shall be programmed to select all B_1 characters and specific B_2 characters.

A test signal +6 dB relative to the STS level, with the $B_1$and B_2 characters varied at random over 25 repetitions of the STS, shall be applied to the EUT. B_3B_4 = 00 shall not be used.

The test shall be repeated for other selected B_2 characters.

8.2.2 Results required

The EUT shall display or print the messages with the currently programmed B_2 characters, and also the messages with the B_2 characters A, B, D and L.

8.3 Receiver test facility

(See 4.3.10)

8.3.1 Method of measurement

By inspection of the manufacturer's test data and documentation and actuating the test facility.

8.3.2 Results required

The test display/print-out shall contain at least 36 valid characters and an indication of whether the test passed or failed.

The test data shall be displayed but not stored in memory.

8.4 Search and rescue (SAR) alarm provision and reset

(See 4.3.9)

8.4.1 Method of measurement

An STS with B_2 = D is input to the EUT once only.

8.4.2 Results required

An alarm shall be activated. The EUT shall be examined for the means whereby an alarm is generated.

It shall be demonstrated that this alarm can be reset manually via the user interface in the case of an EUT with integral display.

It shall be demonstrated that this alarm can be reset via the INS port and the use of the IEC 61162 ‘ACK’ sentence.

The audible level of the alarm signal shall be measured to be between 75 dBA to 85 dBA.

8.5 Additional alarms

(See 4.3.9.)

8.5.1 Method of measurement

The manufacturer shall declare any additional alarms available.

8.5.2 Results required

It shall be demonstrated that such additional alarms can be suppressed.

It shall be demonstrated that such additional alarms can be reset.

9 Receiver tests

The following tests shall be repeated at each of the manufacturer’s stated supported frequencies in turn.

9.1 Call sensitivity

(See 4.5.3.)

9.1.1 Definition

The call sensitivity of the receiver is a defined level of the radio-frequency signal at which the receiver gives a character error ratio better than a defined value.

9.1.2 Method of measurement

An STS repeated 25 times shall be connected to the EUT by an appropriate artificial antenna as specified in 5.8 at a level of –107 dBm (2 μV for artificial antenna type a) or 5 μV for artificial antenna type b)).

9.1.3 Results required

The character error rate shall be ≤4 %.

9.2 Interference rejection and blocking immunity

9.2.1 Definition

Interference rejection and blocking immunity is the receiver's ability to discriminate between the wanted and unwanted signals on frequencies outside of the receiver's pass band.

9.2.2 Method of measurement

NOTE If an active antenna is supplied with the receiver or otherwise required for the receiver to operate, the active antenna shall operate in such a manner that the requirements specified in this sub clause are met.

The receiver shall be connected to the artificial antenna specified in item a) of 5.8.

Two signals shall be applied to the EUT as specified in 5.7. The wanted signal shall be an STS +6 dB relative to the STS level, repeated 25 times.

The unwanted signal shall be un-modulated. The levels shall be as defined in Table 3 below. Suitable means shall be used to examine responses to interference.

Table 3 – Unwanted signal levels

	490 kHz receiver		518 kHz receiver		4209,5 kHz receiver	
Test step	**Frequency range**	**Level**	**Frequency range**	**Level**	**Frequency range**	**Level**
Test 1	489-489,5 kHz	+20 dB	517-517,5 kHz	+20 dB	4208,5-4209 kHz	+20 dB
Test 2	490,5-491 kHz	+20 dB	518,5-519 kHz	+20 dB	4210-4210,5 kHz	+20 dB
Test 3	487-489 kHz	+40 dB	515-517 kHz	+40 dB	4206,5-4208,5 kHz	+40 dB
Test 4	491-493 kHz	+40 dB	519-521 kHz	+40 dB	4210,5-4212,5 kHz	+40 dB
Test 5	100-487 kHz	+70 dB	100-515 kHz	+70 dB	100-4206,5 kHz	+70 dB
Test 6	493 kHz-30 MHz	+70 dB	521 kHz-30 MHz	+70 dB	4212,5 kHz-30 MHz	+70 dB
Test 7	156-174 MHz	+70 dB	156-174 MHz	+70 dB	156-174 MHz	+70 dB
Test 8	450-470 MHz	+70 dB	450-470 MHz	+70 dB	450-470 MHz	+70 dB

9.2.3 Results required

The unwanted signal shall not induce a character error rate >4 % in any of the received messages.

9.3 Co-channel rejection

9.3.1 Definition

The co-channel rejection is the receiver's ability to receive a wanted signal in the presence of an unwanted signal, with both signals being at the nominal frequency of the wanted channel.

9.3.2 Method of measurement

The receiver shall be connected to the artificial antenna specified in item a) of 5.8.

Two signals shall be applied to the EUT as specified in 5.7. The wanted signal shall be an STS +6 dB relative to the STS level, repeated 25 times. The unwanted signal shall be unmodulated at a level of –6 dB relative to the wanted signal, at the nominal EUT frequency.

9.3.3 Results required

The unwanted signal shall not induce a character error rate of >4 % in any of the received messages.

9.4 Intermodulation

9.4.1 Definition

Intermodulation is a process whereby signals are produced from two or more signals simultaneously present in a non-linear circuit.

9.4.2 Method of measurement

NOTE If an active antenna is supplied with the receiver or otherwise required for the receiver to operate, the active antenna shall operate in such a manner that the requirements specified in this sub clause are met.

The receiver shall be connected to the artificial antenna specified in item a) of 5.8.

Three signals shall be applied to the EUT as specified in 5.7. The wanted signal shall be an STS +6 dB relative to the STS level. The two unwanted signals shall be unmodulated at equal levels of +50 dB relative to the wanted signal, outside of a guard band specified around the receive frequency.

The intermodulation frequency pairs shall include those defined in Table 4.

Table 4 – Intermodulation frequency pairs

	490 kHz		518 kHz		4209,5 kHz	
Test 1	488	486	516	514	4207,5	4205,5
Test 2	487	484	515	512	4206,5	4203,5
Test 3	486	482	514	510	4205,5	4201,5
Test 4	492	494	520	522	4211,5	4213,5
Test 5	493	496	521	524	4212,5	4215,5
Test 6	494	498	522	526	4213,5	4217,5

9.4.3 Results required

Intermodulation shall not induce a character error rate of >4 %.

9.5 Off-frequency transmitter

9.5.1 Definition

The off-frequency transmitter test is a check that the receiver performance is not compromised if the transmitter is operating off frequency by up to 25 Hz.

9.5.2 Method of measurement

The receiver shall be connected to the artificial antenna specified in item a) of 5.8.

The STS at a level +6 dB relative to the STS level, shall be applied to the EUT for more than 3 min with the objective of obtaining sufficient confidence that the equipment is working correctly. The test shall be repeated with a shift of the selected receive frequency so that the total mark and space frequency error is 25 Hz.

9.5.3 Results required

The test signal shall not produce in the EUT a character error rate of >4 % for each tests.

9.6 Simultaneous operation on several receive frequencies

(See 4.5.1)

9.6.1 Definition

This test is a check that the receiver performance is not compromised if one of the other receivers is simultaneously receiving.

9.6.2 Method of measurement

The receiver shall be connected to the artificial antenna specified in item a) of 5.8.

As in 9.1 with two STSs set to two operating frequencies which the manufacturer has declared supported by the EUT, applied simultaneously to the EUT.

Apply one wanted STS at a level +6 dB relative to the STS level and the other at a level of +50 dB relative to the STS level, each at one of the EUT's specified operating frequencies. The test shall be repeated for several combinations of receiver frequencies and power levels.

9.6.3 Results required

The display/print-out of the STS transmitted on each frequency shall have a character error rate of ≤4 %.

9.7 Protection of input circuits

9.7.1 Method of measurement

An unmodulated signal at an e.m.f. level of 30 V r.m.s. shall be applied to the antenna input of the EUT, as specified in 5.7, for a period of 15 min on any frequency between 100 kHz to 28 MHz.

A performance check shall be carried out after the test signal is removed.

9.7.2 Results required

The EUT shall continue to operate normally.

10 Printer tests

10.1 Basic requirements

(See 4.7.1.1 and 4.7.1.5.)

10.1.1 Method of measurement

The manufacturer shall declare the paper requirement and printing capacity of the EUT.

An STS shall be applied to the EUT.

10.1.2 Results required

The declarations in Annex D shall be consistent with a minimum paper and printing capacity of 200 000 characters.

The EUT print-out shall have at least 32 easily legible characters per line. The acoustic noise shall be ≤60 dBA at a distance of 1 m from any part of the equipment.

10.2 Paper roll end alarm and storage inhibition

(See 4.7.1.5)

10.2.1 Method of measurement

The printer shall be set up so that while the STS is received the paper-end alarm is activated.

An STS +6 dB relative to the STS level, with its message content repeated 25 times, shall be applied to the EUT. A new paper roll is then inserted into the printer. One further identical STS shall be applied to the EUT.

10.2.2 Results required

The paper-end alarm shall be activated when the paper is running out.

The EUT shall neither print out the initial (for example 25 times long) test message nor store the associated message identifications.

After insertion of the new roll of paper, the EUT shall print out the (one) extra test message.

10.3 Automatic line feed indication and paper feed

(See 4.7.1.2)

10.3.1 Method of measurement

The manufacturer shall declare the number of characters per line for the EUT. The STS shall be applied to the EUT with a message containing more characters than the declared characters per line.

10.3.2 Results required

Any division of a word by an automatic line feed shall be indicated in the print-out.

There shall be two line feeds at the end of the message.

10.4 Mutilated character indication

(See 4.7.1.4)

10.4.1 Method of measurement

ITU-R Recommendation M.625 Annex I, 4.6.5 defines the conditions under which a character is defined as mutilated. A test signal shall be applied to the EUT containing randomly mutilated characters in the message.

10.4.2 Results required

The print-out shall contain an asterisk for each mutilated character.

10.5 Tests of technical characteristics (ITU-R Recommendation M.540)

10.5.1 B_1/B_2 characters selection

(See 4.3.1)

These tests are in 8.1 and 8.2.

10.5.2 Printer activation/error-free preamble B_1-B_4

(See 4.3.3)

10.5.2.1 Method of measurement

The EUT shall be programmed to select specific B_1 and B_2 characters.

An STS shall be input to the EUT with the B_1, B_2, B_3 and B_4 message identification characters mutilated in turn.

10.5.2.2 Results required

The EUT shall neither store the message identifications nor print out the messages.

10.5.3 Non-repetitive printing of a message

(See 4.3.4)

This test is covered by 11.3.

10.5.4 Message with B_3B_4 = 00

(See 4.3.5)

10.5.4.1 Method of measurement

The EUT shall be programmed to select a specific B_1 character.

An STS +6 dB relative to the STS level, with B_3B_4 = 00 and with the selected B_1 and then with a B_1 not selected, shall be applied to the EUT.

10.5.4.2 Results required

The EUT shall always print, store and display the test message when transmitted with B_1 selected.

11 Memory tests

These tests require that the manufacturer provides a method of deleting all stored messages via a method unavailable to the end user. The manufacturer shall also provide a 'standard test file' STF which shall be used to pre-load and 100 % fill the non-volatile message memory, and a method of loading this file into memory.

The message storage capacity shall be declared by the manufacturer.

The EUT must be configured to display/print the stations and message types used in the test.

11.1 Internal storage, message tagging and erasure of oldest message identifications

(See 4.8.1.3)

This test is not required for EUTs with integral printers and can be conducted using any combination of the declared receive frequencies as the source of test messages.

11.1.1 Method of measurement

a) The STF shall be used to pre-load and 100 % fill the non-volatile message memory. The size of this file shall be defined by the manufacturer and the last message shall be MSGn.

b) The 5 oldest messages shall then be tagged for permanent retention.

c) A test script consisting of 10 unique identifiable messages each 500 characters long shall be sent to the EUT.

d) The tagged messages shall then be untagged and a new test script of ten unique messages (MSG 211-220) shall then be sent to the EUT.

11.1.2 Results required

a) The following results are required: a check of the EUT shall indicate that all messages of the STF have been stored;

NAVTEX messages stored
MSG1
MSG2
| | |
MSGn

b) the EUT shall be checked to ensure it has correctly tagged the messages;

NAVTEX messages stored
MSG1 TAG
MSG2 TAG
MSG3 TAG
MSG4 TAG
MSG5 TAG
MSG6
| | |
MSGn

c) a check of the EUT shall indicate that all messages of the test script have been stored, that the first (oldest) 5 tagged messages are still stored and that the next 10 oldest messages of the STF are no longer stored;

NAVTEX messages stored
MSG1 TAG
MSG2 TAG
MSG3 TAG
MSG4 TAG
MSG5 TAG
MSG16
⋮
MSGn
MSGn+1
⋮
MSGn+10

d) a check of the EUT shall indicate that the 10 oldest messages have been replaced by the 10 new messages.

NAVTEX messages stored
MSG21
MSG22
MSG23
MSG24
MSG25
MSG26
⋮
MSGn
MSGn+1
⋮
MSGn+20

11.2 Erasure of message identifications/storage time

(See 4.8.1.3)

This test is required for EUTs that do not contain an integral printer and can be conducted using any combination of the declared receive frequencies as the source of test messages.

11.2.1 Method of measurement

After the test of 11.1 wait 59 h and then apply to the EUT one more message with a specific message identification previously used and currently stored in the EUT. At the same time, tag another of the previously used messages for permanent retention. Wait another 2 h and apply a new previously unused message ‘A’. Check the contents of non-volatile message storage. Wait another 12 h, check the contents of non-volatile message storage. Then again apply the test script of 11.1 with the message identifications previously used. Check non-volatile storage for the last time.

11.2.2 Results required

A check of the EUT shall indicate that the message applied after 59 h was not stored and did not overwrite any of the stored contents of the EUT.

A check of the EUT shall indicate that the message ‘A’ applied after 61 h was stored and overwrote the oldest message stored in the EUT.

A check of the EUT after 73 h shall indicate that only message ‘A’ and the message tagged for retention are stored in the EUT.

After applying the test script the EUT shall contain the contents of the test script, message ‘A’, and the message tagged for retention.

11.3 Storage of message identifications

(See 4.8.2)

This test is required for EUTs with an integral printer only and can be conducted using any combination of the declared receive frequencies as the source of test messages.

11.3.1 Method of measurement

An STS is applied to the EUT. The test signal shall be so composed that the message identification is correct. The signal shall contain a character error rate of ≤4 %. The STS shall be repeated 35 times with unique message identification for each transmission.

After the first part of this test, wait 59 h and then apply to the EUT one more message with a specific message identification previously used and currently stored in the EUT. Wait another 2 h and apply a new previously unused message ‘A’. Check the contents of non-volatile message storage. Wait another 12 h, check the contents of non-volatile message storage. Then again apply the test script with the message identifications previously used. Check non-volatile storage for the last time

11.3.2 Results required

The print-out or display of the test messages shall be examined and the character error rate shall not exceed 4 %. The message identifications shall be stored.

A check of the EUT shall indicate that the message applied after 59 h was not stored and did not overwrite any of the stored contents of the EUT.

A check of the EUT shall indicate that the message ‘A’ applied after 61 h was stored in the EUT.

A check of the EUT after 73 h shall indicate that only message ‘A’ was stored in the EUT.

After applying the test script the EUT shall contain the contents of the test script and message A.

11.4 Reception of messages with character errors

(See 4.3.6)

This test is required for all EUTs and can be conducted using any combination of the declared receive frequencies as the source of test messages.

11.4.1 Method of measurement

a) An STS is applied to the EUT. The test signal shall be so composed that the message identification is correct. The signal shall contain a character error rate of >20 % and ≤33 %. The STS shall be repeated 35 times with unique message identification for each transmission. There shall then be a check of the contents of message memory (for non-printing EUTs) or the print-out (printing NAVTEX).

b) An STS with the same 35 message identifications shall be applied to the EUT. The signal shall contain a character error rate of >4 % and ≤20 %. There shall then be a check of the contents of message memory (for non-printing EUTs) or the print-out (printing NAVTEX).

11.4.2 Results required

a) The EUT shall store (non-printing EUTs) or print (printing EUTs) the 35 messages, each indicating character error rate of >20 % and ≤33 %.

b) The EUT shall store (non-printing EUTs) or print (printing EUTs) the 35 messages, each indicating character error rate of >4 % and ≤20 %.

11.5 Unsatisfactory reception

(See 4.3.6)

This test is required for all EUTs and can be conducted using any combination of the declared receive frequencies as the source of test messages.

11.5.1 Method of measurement

An STS is applied to the EUT. The test signal shall be so composed that the message identification is correct. The signal shall contain a character error rate of >33 %. The STS shall be repeated 35 times with unique message identification for each transmission.

11.5.2 Results required

The EUT shall not store messages or message identifications. An EUT with an integral printer shall not print any of the test messages.

11.6 Power-off check

(See 4.3.8)

This test is required for all EUTs that do not contain an integral printer and can be conducted using any combination of the declared receive frequencies as the source of test messages.

11.6.1 Method of measurement

The STF shall be loaded into the EUT. The power shall be removed for a period of 6 h. Power shall then be applied and the contents of the non-volatile message storage shall then be checked. The previously applied settings for transmitter coverage area (B_1) and message type (B_2) for each receiver and any other settings that the manufacturer has declared are non-volatile shall also be checked.

11.6.2 Results required

After a 6 h power-down cycle the EUT's non-volatile message storage shall contain the set of messages defined in the STF. All settings that the manufacturer has declared as non-volatile shall be unchanged from before the power-off cycle.

11.7 Brown-out test

(See 4.9)

This test is required for all EUTs.

This test simulates the situation where the nominal supply voltage drops to below acceptable levels and then recovers over a medium time period. This is consistent with the performance of a flat or unhealthy battery when an engine is started. The unit shall not enter into any undefined or undesirable state.

11.7.1 Method of measurement

Operate the EUT at the nominal supply voltage as indicated by the manufacturer.

Gradually reduce the supply voltage to 40 % of the nominal supply voltage over a time period of 30 s.

Gradually increase the supply voltage back to 80 % of the nominal supply voltage over a time period of 30 s.

The contents of the EUT's message and/or message identification memory, settings for transmitter coverage area (B_1) and message type (B_2) for each receiver and any user settings declared non-volatile by the manufacturer shall be inspected prior to and after a power supply brown-out condition.

11.7.2 Results required

After a power supply brown-out the EUT's non-volatile message storage shall contain the set of messages defined in the STF. All settings that the manufacturer has declared as non-volatile shall be unchanged from before the brown-out condition.

11.8 UTC handling check

(See 4.10)

This test is required for all EUTs that do not contain an integral printer and but only when the manufacturer has declared that the EUT can use a source of time (for example UTC from an external source or an internal RTC). The test can be conducted using any combination of the declared receive frequencies as the source of test messages.

11.8.1 Method of measurement

An external source of UTC shall be applied as defined by the manufacturer. The STF shall be loaded into the EUT. The power shall then be removed for a period of 6 h. Power shall then be applied for 53 h and the contents of the non-volatile message storage shall then be checked.

11.8.2 Results required

After a 6 h power-down cycle the EUT's non-volatile message storage shall contain the set of messages defined in the STF.

12 Miscellaneous tests

12.1 Spurious emissions

Spurious emissions are any radio-frequency emissions generated in the EUT and radiated by conduction from the antenna.

12.1.1 Method of measurement

The EUT shall be connected to the artificial antenna specified in 5.8 and the r.m.s. value of any component of the spurious emissions shall be measured. The measurements shall cover the frequency range from 9 kHz to 2 GHz.

12.1.2 Results required

The power of any discrete component shall be $\leq 1 \times 10^{-9}$ W.

12.2 Equipment manuals – checks of the manufacturer's documentation

In addition to checking that the requirements of 4.8 and Annex D of IEC 60945 are met, the manufacturer shall submit to the test laboratory sufficient technical documentation of the EUT to define its interfaces.

The following checks shall be made for the input port, if applicable:

- approved sentences against IEC 61162-1 and/or IEC 61162-2 and the requirements of Annex C of this standard;
- proprietary sentences (if any) against IEC 61162-1 and/or IEC 61162-2;
- transmission intervals and baud rates against IEC 61162-1 and/or IEC 61162-2;
- load on the line of inputs;
- electrical isolation of input circuits.

The interface connections required shall be clearly identified in the operator manual or other appropriate literature. This shall include identification of A and B signal lines for IEC 61162 interfaces.

In addition, the manuals shall include the needed information for correct siting of the antenna(s).

12.3 Marking and identification

The markings on the EUT shall include details of the power supply from which the equipment is intended to be operated as well as those specified in 4.9 of IEC 60945.

The interface connections required shall be clearly identified in the operator manual or other appropriate literature. This shall include identification of A and B signal lines for IEC 61162 interfaces.

Annex A
(informative)

Block diagrams of NAVTEX systems

Figures A.1 to A.3 show the block diagrams of NAVTEX systems.

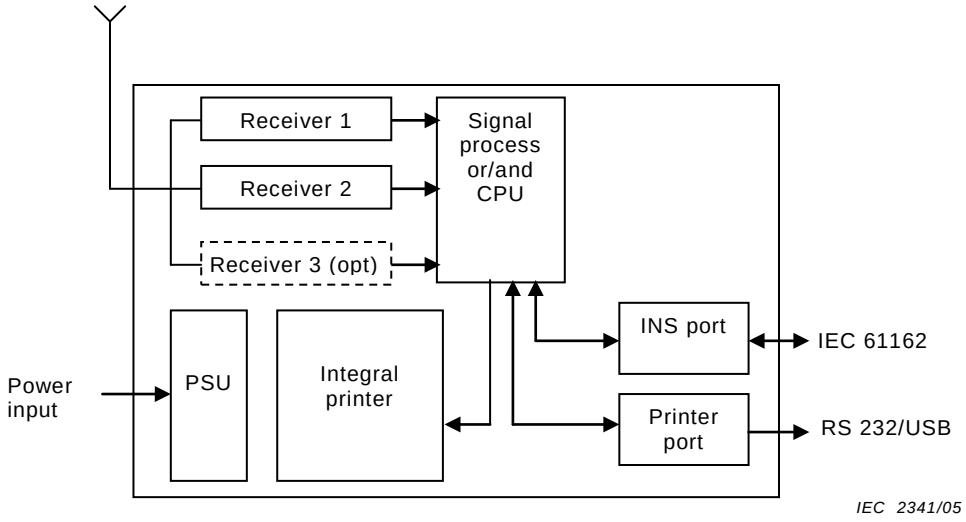


Figure A.1 – EUT with an integral printing device

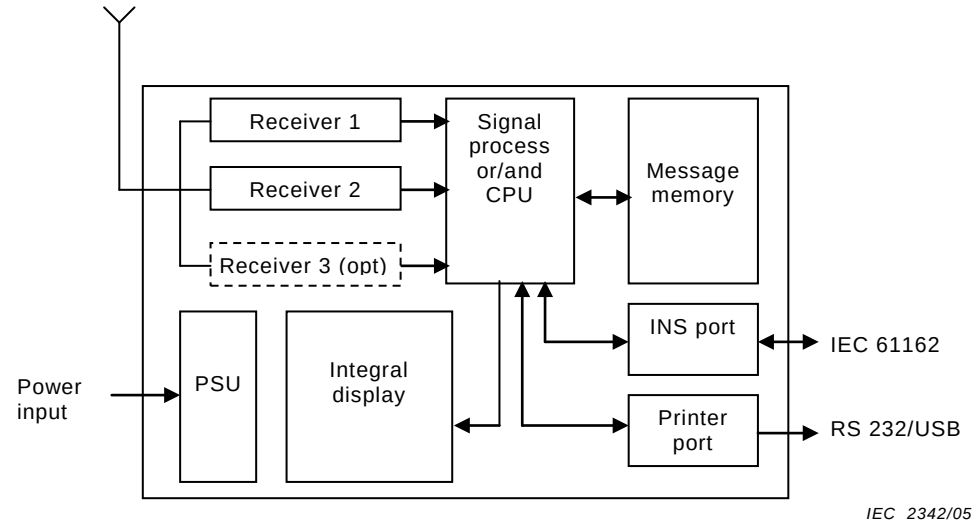


Figure A.2 – EUT with an integral display device

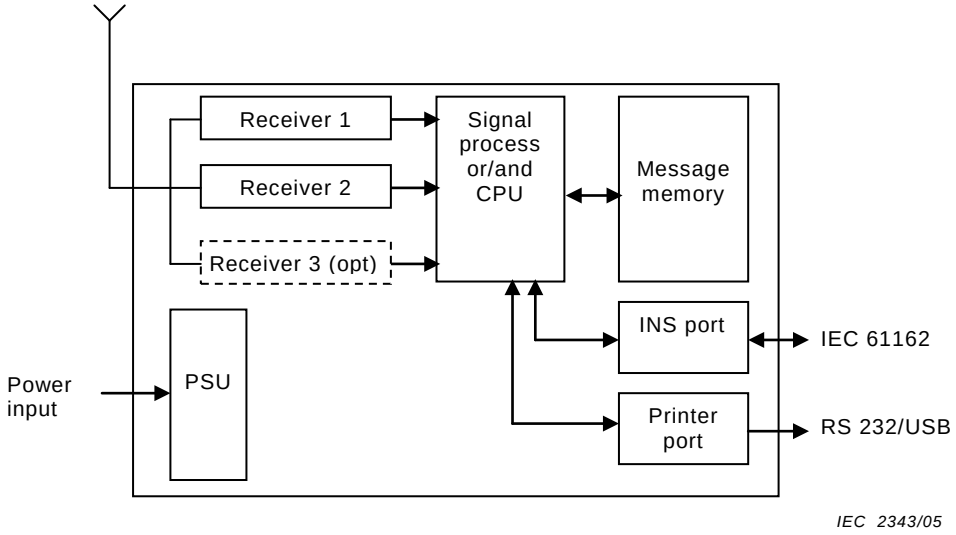


Figure A.3 – EUT black box receiver

Annex B
(normative)

Definition of satisfactory reception of a message

B.1 Satisfactory reception of a message

(148/A.6.2.3) *Only* messages or *message identifications which have been satisfactorily received* shall *be stored; a message is satisfactorily received if*:

a) *the character error rate is ≤4 %;* or

b) the received character error rate does not exceed 33 % for more than 5 s.

B.2 Character error rate

The character error rate (CER) shall be defined as:

$$CER = (100 \times errors)/total\ characters$$

CER shall be calculated for each complete message.

CER shall be rounded up to the nearest integer. For example a single error in a message of less than 100 characters shall result in a CER of 1 %.

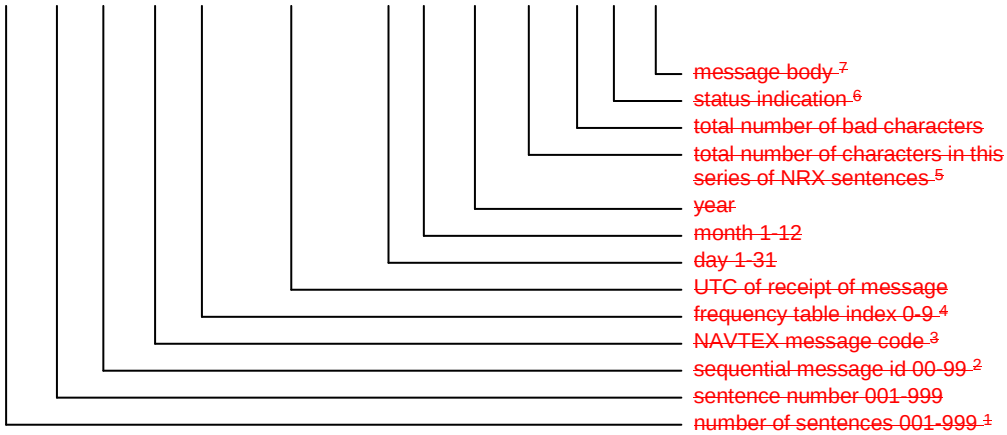
Annex C
(informative)

IEC 61162 sentences for NAVTEX operation

C.1 NRX – NAVTEX received message

The NRX sentence is used to transfer the contents of a received NAVTEX message from the NAVTEX receiver to another device. As the length of a single NAVTEX message may exceed the number of characters permitted in a single sentence, many NRX sentences may be required to transfer a single NAVTEX message.

$--NRX,xxx,xxx,xx,aaxx,x,hhmmss.ss,xx,xx,xxxx,x.x,x.x,A,c--c*hh<CR><LF>



NOTE 1 The total number of sentences required to transfer the NAVTEX message from the NAVTEX radio receiver. The first field specifies the total number of sentences used for a message, minimum value 1. The Sentence Number field identifies the order of this sentence in the message, minimum value 1. All sentences contain the same number of fields. For efficiency it is recommended that null fields be used in the additional sentences where the data is unchanged from the first sentence (this applies to fields 4 through 12).

NOTE 2 The sequential message identifier provides a unique identifier for each NAVTEX message represented by a group of sentences. Though the message code (field 4) contains a NAVTEX message serial number, there are special cases when the message serial number is set to 00 and has a different meaning or when the same message code can occur more than once. When these conditions occur, the sequential message identifier can be relied upon to uniquely identify this NAVTEX message from other NAVTEX messages with the same message code.

NOTE 3 The NAVTEX message code contains three related entities. The first character identifies the transmitter coverage area and the second character identifies the type of message. Both these characters are as defined in Table I of Recommendation ITU-R M.625-3, combination numbers 1-26. Transmitter identification characters are allocated by the IMO NAVTEX Co-ordinating Panel; these characters and the meanings of the message type characters are described in the NAVTEX manual (IMO publication 951E). The remaining two characters are restricted to numerals with a range of 00 to 99 and represent a serial number for each type of message. The value of 00 is a special case and not considered a serial number. See 4.3.5 for interpretation of special case value of 00.

NOTE 4 The frequency indicator identifies the frequency that the NAVTEX message was received on:
0 = not received over air (eg test messages)
1 = 490 kHz
2 = 518 kHz
3 = 4209,5 kHz
4 through 9 are reserved for future use

NOTE 5 The total number of characters indicates the expected size of the message body sent in this sequence of NRX sentences. It does not include the additional overhead for reserved characters found in table 1 of IEC 61162-1.

NOTE 6 Status 'A' is used for syntactically correct message reception. Status 'V' is used for syntactically incorrect message reception, e.g. end characters NNNN missing.

NOTE 7 The message body may contain reserved characters as defined in IEC 61162-1.

The example below shows a typical message received by the Navtex receiver with 3 bad characters ('*'):

```
<start of example>

ZCZC IE69==================================
ISSUED ON SATURDAY 06 JANUARY 2001.

INSHORE WATERS FORECAST TO 12 MILES
OFFSHORE FROM 1700 UT* TO 0500 UTC.

NORTH FORELAND TO SE**EY BILL.
12 HOURS FORECAST:

SHOWERY WINDS, STRONGEST IN NORTH.

NNNN

<end of example>
```

Inspecting the corresponding NRX sentences would typically show:

```
$CRNRX,007,001,00,IE69,1,135600,27,06,2001,241,3,A,==========================*09
$CRNRX,007,002,00,,,,,,,,,,,,========^0D^0AISSUED ON SATURDAY 06 JANUARY 2001.*29
$CRNRX,007,003,00,,,,,,,,,,,,^0D^0AINSHORE WATERS FORECAST TO 12 MILES^0D^0AOFF*0D
$CRNRX,007,004,00,,,,,,,,,,,,SHORE FROM 1700 UT^2A TO 0500 UTC.^0D^0A^0D^0ANORT*70
$CRNRX,007,005,00,,,,,,,,,,,,H FORELAND TO SE^2A^2AEY BILL.^0D^0A12 HOURS FOREC*16
$CRNRX,007,006,00,,,,,,,,,,,,AST:^0D^0A^0ASHOWERY WINDS, STRONGEST IN NORTH.^0D*15
$CRNRX,007,007,00,,,,,,,,,,,,^0A^0A*79
```

Decoding the message body should give the following result:

```
<start of decoding>
==================================
ISSUED ON SATURDAY 06 JANUARY 2001.

INSHORE WATERS FORECAST TO 12 MILES
OFFSHORE FROM 1700 UT* TO 0500 UTC.

NORTH FORELAND TO SE**EY BILL.
12 HOURS FORECAST:

SHOWERY WINDS, STRONGEST IN NORTH.

<end of decoding>
```

C.2 NRM – NAVTEX receiver mask

This command is used to manipulate the configuration masks that control which messages are stored, printed and sent to the INS port of the NAVTEX receiver.

```
$--NRM,x,x,hhhhhhhh,hhhhhhhh*hh<CR><LF>
```

- message type mask [4]
- transmitter coverage area mask [3]
- frequency table index [2], 1 to 9
- function code [1], 0 to 9

NOTE 1 The function code is used to further identify the purpose of the sentence. The meaning of the function code is as follows:

- 0 – request messages for the given mask
- 1 – set/report the storage mask
- 2 – set/report the printer mask
- 3 – set/report the INS mask
- 4 to 9 – reserved for future use

NOTE 2 The frequency indicator identifies the frequency that the NAVTEX message was received on:

- 1 = 490 kHz
- 2 = 518 kHz
- 3 = 4209,5 kHz
- 4 through 9 are reserved for future use

~~NOTE 3 The transmitter coverage area mask is defined as a 32 bit hex field where the least significant bit represents transmitter coverage area 'A', the next bit is 'B' and so on up to bit 25 which is 'Z'. Bits 31 through 26 are reserved for future use and are set to zero. To select a transmitter coverage area, its corresponding bit should be set to one. To deselect a transmitter coverage area its corresponding bit should be set to zero.~~

~~NOTE 4 The message type mask is defined as a 32 bit hex field where the least significant bit represents message type 'A', the next bit is 'B' and so on up to bit 25 which is 'Z'. Bits 31 through 26 are reserved for future use and are set to zero. To select a message type its corresponding bit should be set to one. To deselect a message type its corresponding bit should be set to zero.~~

~~When another device (for example an INS) wishes to set one or more of the bit masks it sends one or more NRM sentences to the NAVTEX receiver. When another device wishes to determine the current values of the bit masks it sends a query sentence to the NAVTEX receiver as follows:~~

~~$--CRQ,NRM*hh<CR><LF>~~

~~On receiving this query, the NAVTEX receiver will respond with one NRM sentences for each mask type and frequency combination that it supports. For example, a NAVTEX receiver which supports separate storage, printer and INS masks for each of three receiver frequencies will return a total of nine NRM sentences in response to the above query.~~

~~Example usage:~~

~~$INNRM,2,1,00001E1F,00000023*57~~

~~This example specifies that message identifiers 'A', 'B' and 'F', received from transmitter areas 'A' to 'E' and 'J' to 'M' on 490 kHz should be sent to the printer port when they are received. Note that this command sets the printer mask for future use; there is no immediate output generated as a result of receiving this command.~~

~~Example usage:~~

~~$INNRM,0,2,00001E1F,0FFFFFFF*21~~

~~This example requests that all currently stored messages of all message types, received from transmitter areas 'A' to 'E' and 'J' to 'M' on 518 kHz should be immediately returned to the requesting device as a series of NRX sentences. Note that this command does not update any of the stored masks.~~

C.1 NRX – NAVTEX received message

The NRX sentence is used to transfer the contents of a received NAVTEX message from the NAVTEX receiver to another device. Details of the sentence are given in IEC 61162-1.

C.2 NRM – NAVTEX receiver mask

The NRM command is used to manipulate the configuration masks that control which messages are stored, printed and sent to the INS port of the NAVTEX receiver. Details of the sentence are given in IEC 61162-1.

Annex D
(normative)

Manufacturer's declarations/equipment manual

The manufacturer shall make the following declarations/provide the following information in the user/installation manual:

- nominal supply voltage and frequency;
- minimum and maximum supply voltage;
- how the reception and storage of new messages other than SAR messages are indicated to the user;
- the memory capacity of the unit in terms of the number of 500 character long messages;
- whether the unit is IEC 60945 'protected' or 'exposed' category;
- a list of available alarms;
- the receiver frequencies on which the unit operates;
- a list of user settings that are non-volatile;
- whether the unit uses a source of time for handling message ageing (for example UTC from an external source or an internal RTC);
- operating temperature range;
- storage temperature range;
- INS port serial interface electrical and protocol standards and settings;
- printer port serial interface electrical and protocol standards and settings;
- provide an overview of the NAVTEX system;
- manufacturer recommendations, if any, on periodic functional testing and maintenance;
- warranty information;
- a recommendation for mounting the unit;
- information relating to the shipment of the unit;
- information relating to the disposal of the unit at the end of its operational life;
- a list of languages supported by the user interface.

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