



USER MANUAL

NSR GMDSS TESTER
NGT-200

Test for MF/HF/VHF DSC & AIS/EPIRB/NAVTEX

MODIFY RECORD

No.	Modify by	Date	Paragraph	Version	Reason
1	Q/A	2019/12/12		01	First edition
2	Q/A	2021/05/20	all	02	Software upgrade

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1 PURPOSE

NGT-200 NSR GMDSS Tester (Marine Radio Test Set) is intended to carry out the operation, maintenance and servicing tests of MF/HF/VHF Radios with DSC and NAVTEX receivers in accordance with IMO A.948 (23) or A.997(25), A.1020(26) resolutions. Besides, if in extended version (A) Tester also lets to check AIS mobile stations and AIS-SARTs according to the circular letter MSC.1/Circ.1252 and Cospas-Sarsat beacons such as EPIRB, PLB, ELT, MOB devices in accordance with MSC/Circ.1040.

NGT-200 supports testing of the following equipment:

- VHF transceivers:
 - operation tests on any simplex channel including 6, 9, 13 and 16 channels;
 - measurement of carrier frequency and frequency deviation;
 - measurement of antenna feeder SWR, forward and reflected power;
- VHF transceivers with DSC:
 - test of correct transmission/reception of DSC messages by means of transmission/reception of distress or test call to particular MMSI number and Distress (to all ships) messages;
 - check the MMSI code programmed in equipment without any broadcast emission;
 - measurement of frequency and frequency deviation;
 - measurement of output and reflected power;
- MF/HF radiotelephone equipment:
 - measurement of frequency in range (1600 – 30000) kHz;
 - measurement of output power;
 - functional tests in frequency range (1600 – 30000) kHz;
- MF/HF controllers with DSC:
 - check the MMSI code programmed in equipment;
 - check receipt of DISTRESS signal by MF/HF equipment with DSC by means of transmit of selective DISTRESS message;
- MF/HF radiotelephone equipment with DSC:
 - test of correct transmission/reception of DSC messages by means of transmission/reception of selective Test call to particular MMSI number and Distress (to all ships) messages on any of 6 distress channels;
- NAVTEX equipment:
 - operation tests by means of sending test message;
- VHF equipment of duplex radiotelephony (portable):

- operation tests on channels 6, 9, 13, 16 (at least);
- measurement of output power, carrier frequency and frequency deviation;
- VHF equipment of duplex radiotelephony with airplanes including operating on 121.5MHz and 123,1MHz:
 - operation tests by transmission/reception of modulated signal;
 - measurements of frequency, output power level and frequency modulation depth;
- VHF radiotelephone stations operating in range (300 - 337) MHz (intended for river-sea vessels):
 - measurement of output power, carrier frequency and frequency deviation;
- AIS mobile stations Class A and Class B and AIS-SARTs working in the Marine-VHF band:
 - measurement of output power, carrier frequency and antenna VSWR;
 - receiving and decoding of the AIS messages;
 - sending data/messages to AIS stations;
 - passing the DSC polling information (channel 70);
 - checking AIS response to “virtual vessels”.
- Cospas-Sarsat radio beacons:
 - measurement of output power and carrier frequency on channel 406MHz;
 - receipt, demodulation and decoding of messages on channel 406MHz;
 - measure of output power level and carrier frequency on channel 121.5MHz;
 - measure of output power level and carrier frequency on channel 243MHz;

NGT-200 allows to:

- generate the RF signals in range of 0.4 – 30 MHz and 118 – 275 MHz, including those with tonal amplitude and frequency modulation;
- measure the signal frequency and power level of narrow-band radio signals in range of 0.4 – 30 MHz, 118 – 137.5 MHz and 156 – 163 MHz.

The tester is capable to transmit and receive the signals by:

- broadcast antenna
- direct connection to radiofrequency IN/OUT
- through Power sensor SWR meter
- direct connection by means of attenuator and cables (*conductive measurements*)

2 GENERAL VIEWS

2.1 Front view

The front view of tester is shown on figure 2.1.

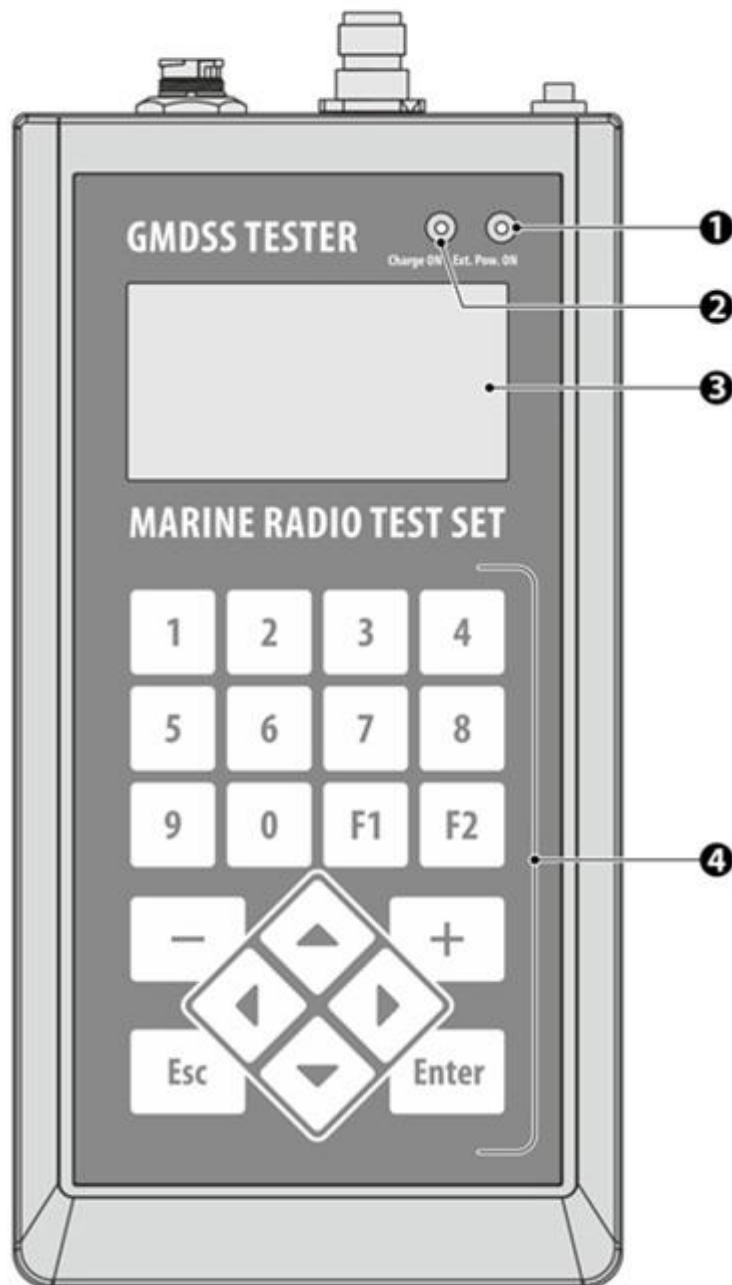


Fig. 2.1 NGT-200 front view

2.2 Top and Bottom views

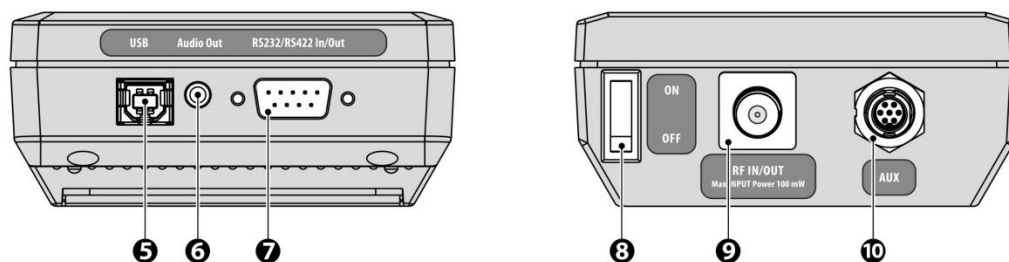


Fig. 2.2 NGT-200 top and bottom views

- 1 – green led:** indication of external voltage supply;
- 2 – red led:** indication of accumulator charging; after the accumulator is charged, the led will fade;
- 3 – LCD;**
- 4 – keyboard;**
- 5 – USB-B socket** for connection to PC and battery charging;
- 6 – audio output** for connection 3,5 mm jack; Impedance $> 8 \Omega$; right and left channels are shorted;
- 7 – DB-9 socket** for connection to RS232 / RS422 / RS485 interfaces;
- 8 – ON/OFF rocker switch;**
- 9 – RF IN/OUT TNC connector;**
- 10 – AUX:** universal socket for VHF Power sensor VSWR meter connection.

3 COMPLETE SET AND ACCESSORIES

The complete set of tester includes the items in accordance with table:

No	Item name	Qty	Notes
1	GMDSS Tester. Marine Radio Test Set model NGT-200 main unit	1	
2	Power adaptor	1	
3	Telescopic antenna	1	
4	NMEA cable IN/OUT (DB9 open wire)	1	
5	USB-A – USB-B cable	1	
6	VHF Power sensor VSWR meter (VHFPS1)	1	
7	RF cable UHF male-UHF male RG58 1m	1	
8	RF cable UHF female-UHF male RG58 0.5m	1	
9	MF/HF Attenuator 40dB, 200W	1	Optional
10	Crushproof and watertight plastic box	1	
11	Calibration Certificate	1	
12	User Manual	1	

VHF Power sensor VSWR meter (60W) - designed for conducted measurements of the power and SWR in VHF frequency ranges; frequency range: 30 – 410 MHz; inserted attenuation between RF-In and NGT-200-Output: 63 dB.

* conducted measurements – measurements done by direct connection of equipment, e.g. by means of RF-cable.

MF/HF Attenuator 40dB, 200W (optional) - used for conducted measurements of the power in MF/HF frequency ranges.

NMEA IN/OUT cable - enables checking the Pilot plug performance capability and checking of vessel's transducers: GNSS, gyrocompass, log, etc.



Fig. 3.1 What inside the box

4 MENU TREE



Fig. 4.1 NGT-200 main menu

The tester has user-friendly interface.

The tester operation is managed through MENU and 20 independent navigation keys: numeric keys from **0** to **9**, menu navigation buttons **▲**, **▼**, **◀**, **▶**, **Enter**, **Esc**, **+**, **-**, **F1** and **F2**.

You can toggle between the menu lines using **▲** and **▼** keys.

Confirm/select something by means of **Enter** and **Esc** keys, cancel or move up menu level by means of **Esc** key.

After the tester is turned ON it displays the device's model, its serial number, date, time and manufacturer logo.

Press **Enter** key to enter the main menu.

The main menu allows to select one of the operating modes, please see menu tree on figure 4.1.

Each menu item has its own subsections. User moves among the subsections using the same buttons as for the moving in main menu.

Use the **Esc** key to go back to main menu.

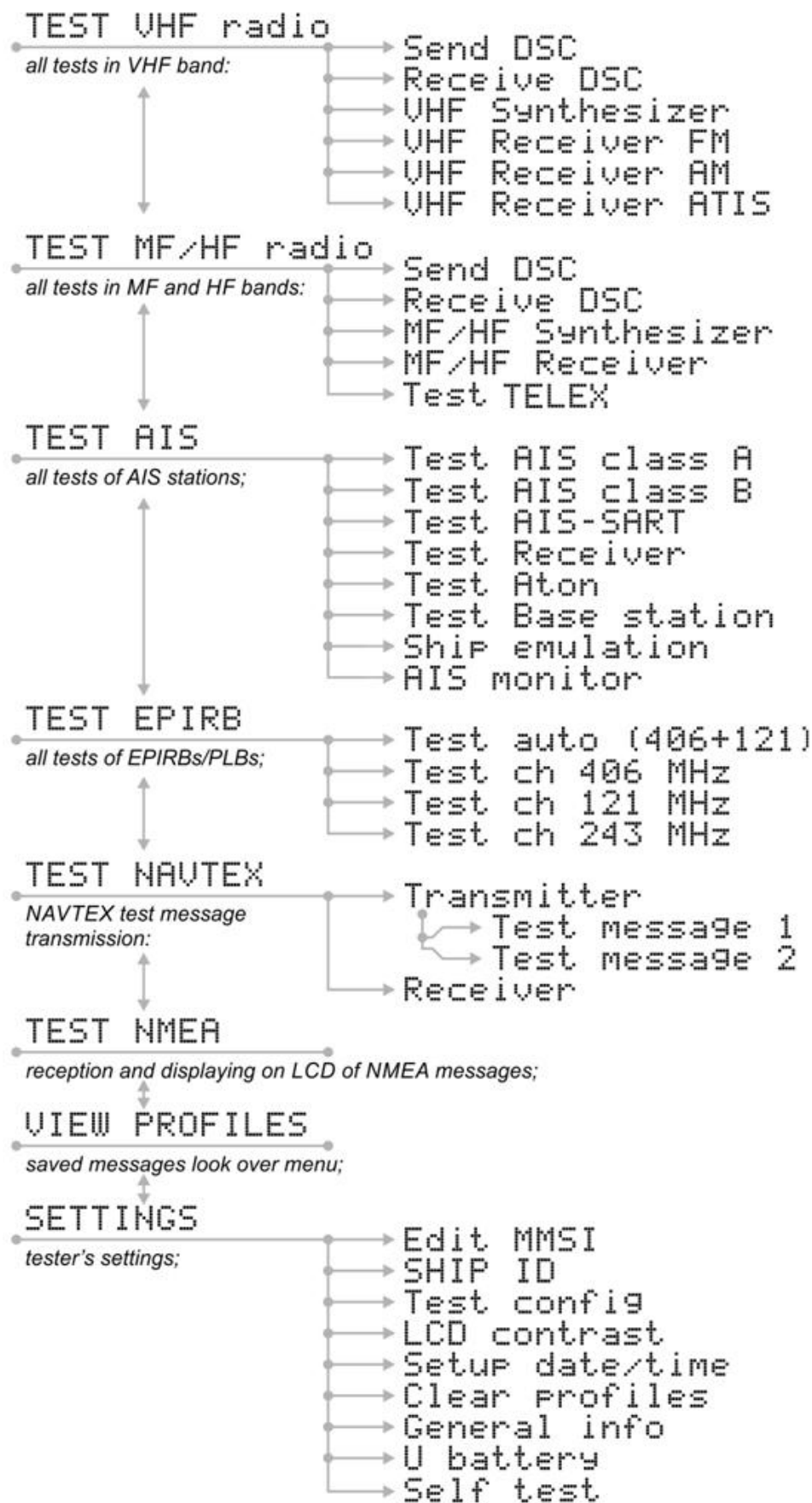


Fig. 4.2 Menu tree

5 RADIO TESTS

5.1 TEST VHF. Set of VHF Tests

==== TEST VHF ==== Send DSC Receive DSC VHF synthesizer VHF Receiver FM VHF Receiver AM VHF RECEIVER ATIS Test config - F2	TEST VHF menu contains the following items: Send DSC – to send Test or Distress DSC message; Receive DSC – to receive DSC message; VHF Synthesizer – CW/SSB/AM/FM RF signal generator; VHF Receiver FM – narrow-band signals measurement; VHF Receiver AM – AM signals measurement; VHF Receiver ATIS – ATIS signals measurement.
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5.1.1 TEST VHF > SEND DSC

=== VHF: Send DSC === Select message: Test Safety Distress Select required message and press Enter :	You can select between Test, Safety, and Distress messages. Test – special test message according ITU-R M.493; it has format specifier – 120 (Individual call). So this message will not disturb anybody except for DUT (Device Under Test). Safety - format specifier – 120 (Individual call), category – 108 (Safety). Distress - DSC message with format specifier – 112 (DISTRESS). This message can be accepted by any maritime and coastal radio stations. <i>Thus it is recommended to send this DSC message only by means of cable with reduced level taking into account all safety measures to avoid false DISTRESS alert.</i>
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<pre> == VHF:Send DSC == Test message To: 413999333 From: 413999997 Pow:-40 dBm X Send - press Enter </pre>	Test message – if you select “Test”; To : 413999333 – enter the correct MMSI code of the DUT (Device Under Test). From: 413999997 – MMSI code of the NGT-200 by default. Pow : -40 dBm – power of the output signal can be tuned with help of ,  buttons with step 10dB; recommended power level is -50 dBm to -20 dBm. X – signalizes the selected measurement configuration (same as below): D- direct connection ¥- antenna S- Power Sensor and VSWR meter A- external attenuator Measurement configuration can be selected in menu SETTINGS / Test config.
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Press  to transmit Test message:

<pre> == VHF:Send DSC == Test message To: 413999333 From: 413999997 Pow:-40 dBm X --- Sending --- </pre>	<pre> == VHF:Send DSC == Test message To: 413999333 From: 413999997 Pow:-40 dBm X OK ! Repeat: press ENT </pre>
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Repeated pressing of  will transmit DSC messages again. If necessary, output power level can be adjusted.

To go back to menu **SEND DSC**, press  . Press  twice to enter **MAIN MENU**.

ATTENTION: It is necessary to enter the correct MMSI number of tested radio station to provide the reception of the **TEST (Individual call)** DSC message. Otherwise the message will be sent but not be received by this station!

5.1.2 TEST VHF > RECEIVE DSC

= VHF:ReceiveDSC = Wait for signal Att: 20 dB X After reception of the message following information will appear on the screen:	By entering this menu Tester is ready to receive Test or Distress DSC message on channel 70 with frequency 156525 kHz. Tester is capable to receive DSC message of category Individual call addressed to the radio station specified by MMSI code. Att: 20 dB – set the internal attenuation level in range 0...93 dB. Attenuation will be taken into account during estimation of the received signal level. X – signalizes the selected measurement configuration.
= VHF:ReceiveDSC = MMSI: 413000000 Format: Individual Categ: Safety CRC : OK To : 413999997. Save -F2 Prof:x ↓↑	FIRST SCREEN of measurements: MMSI: 413000000 – sender's MMSI code; Format: Individual – format specifier: Individual call (120); Categ: Safety – category Safety (108); CRC : OK – control sum; To : 413999997 – receiver's MMSI code; Save -F2 Prof:x ↓↑ - to save received information to memory in selected profile press F2; profile number is set up automatically; - to receive messages again press Enter; - to navigate the screens use buttons ▼, ▲.

= VHF:ReceiveDSC = Freq:156525123 Hz dev+: 400 Hz dev-: -400 Hz Δp-p: 800 Hz Pow.: 44.3 dBm X Saved OK !	SECOND SCREEN of measurements: Freq: measured carrier frequency; dev+: positive deviation of audio subcarrier frequency 1700 Hz; dev-: negative deviation of audio subcarrier frequency 1700 Hz; Δp-p : peak-to-peak deviation of subcarrier frequency; Pow.: measured power level of received signal; Saved OK ! - if you press F2 and save data to memory.
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5.1.3 TEST VHF > VHF SYNTHESIZER

The main task of this mode is testing of VHF-FM and VHF-AM radio stations mobile and stationary; besides the Tester can operate as a RF signal generator.

=VHF Synthesizer = CH: 16 F: 156800 kHz dF: 0025 kHz L: -063 dBm X dL: 10 dB Mod: FM F: 1.0k D:4.5kHz	CH: Number of the VHF channel (ITU); F : Carrier frequency, kHz; dF: Frequency tuning step; L: Level of the output signal, dBm; dL: Level step by keys [+] and [-]; Mod: FM - Modulation type; Supported: FM>CW>SSB>AM>Amsweep; F: 1.0k D:4.5kHz frequency modulation and deviation on FM; Amsweep – amplitude modulation of sweep audio signals, it is applied in homing signal (121MHz) of emergency beacons such as EPIRB, ELT.
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Frequency can be adjusted by one of the following ways:

1. By channel: You may directly input channel number or select it using buttons **[+]** and **[-]**; all ITU simplex channels are available.

2. By frequency: You may directly input frequency using numeric buttons. If the selected frequency corresponds to any of channels – the channel is settled automatically. If the frequency doesn't correspond to any of existing channels, then channel will be shown (**CH: ---**).
3. Frequency is tuned with a **step (dF)** with help of buttons  and . The **step (dF)** is tuned by selecting the position by buttons  and , tune it by buttons , .

Frequency subranges:

- a) 118 – 275 MHz full range; for frequencies higher than 163MHz accuracy of output signal is not guaranteed;
- b) 118 – 138 MHz avionic band, AM;
- c) 156 – 165 MHz marine band, FM-narrow;
- d) 144 – 146 MHz ham band, “2 meters”.

Output power level tuning:

1. Direct input of required level in dBm; due to the maximum level is **0** dBm, the input level is always understood as negative number.
For example, to settle (**-45**) dBm just press  and . Minimal output level is (-93) dBm or (+14) dBuV or 5 uV.
2. Output power level can be adjusted with **step (dL)** by means of  and , **step** can be set by direct input or increased/decreased by 10dB by means of  and .

5.1.4 TEST VHF > VHF Receiver FM

The main purpose of this mode is measuring of power level, frequency and frequency deviation of FM VHF stations. Also it can be used as regular nFM receiver (*nFM – narrow-band FM*). Tester provides emission measurements through broadcast by means of antenna and conductive measurements provided by means of VHF Power sensor SWR meter (VHF PS1). You need to choose correct measurement configuration in **Test config.** Menu, see **Item 7.3** for details.

<pre> == FM Receiver == CH: 16 F: 156800 kHz dF: 25 kHz Fx: 156301567 Hz RSSI: 44.1 dBm ¥ Fdev: 4.9 kHz peak New-Enter Save-F2 Stop - Esc </pre>	Measurements through antenna: CH : Operation channel (ITU); F : Operation frequency, kHz; dF : Frequency step; Fx : Measured carrier frequency; RSSI: Measured signal level; ¥ : test configuration – through antenna; Fdev: peak carrier frequency deviation; If the signal level is lower than (-90) dBm the frequency and frequency deviation data will not be displayed, the notification “Low level” is shown. Press Esc to stop the measurements.
<pre> = VHF-FM Receiver= CH16 156800 kHz dF : 25 kHz Fx : 156301567 Hz Fdev: 1234 Hz P : 43.5/11.3dBm S VSWR: 1,08 New-Enter Save-F2 Start - ENTER </pre>	Measurement through VHF Pow. Sensor SWR meter: CH16 156800 kHz : by entering menu you need to set up operating frequency; To set up operating channel use numeric keys; Navigate using buttons  and , not while measuring. P: 43.5/11.3dBm S – incident / reflected power. S: measurement through Sensor (VHF Power Sensor VSWR meter). VSWR: 1.08 – measured VSWR.
<pre> = VHF-FM Receiver= CH: 16 F: 156800 kHz dF : 25 kHz Audio - F1 Start - Enter </pre>	Audio control: Audio - F1: to turn ON audio control mode of selected channel press F1. Demodulated signal will be sent to audio-output (<i>position 6, Fig.2.2</i>).

Frequency can be adjusted by one of the following ways:

1. By channel: You may directly input channel number or select it using buttons  and ; all ITU simplex channels are available.

2. By frequency: You may directly input frequency using numeric buttons. If the selected frequency corresponds to any of channels – the channel is settled automatically. If the frequency doesn't correspond to any of existing channels, then channel will be shown (**CH: ---**).
3. Frequency is tuned with a **step (dF)** with help of buttons  and . The **step (dF)** is tuned by selecting the position by buttons  and , tune it by buttons , .

Measurements results can be saved in non-volatile memory of the Tester:

1. Stop measurement by pressing .
2. Press button .
3. In appeared menu you will see the number of the next free profile to save the data, or you can select the previous profile by pressing button . You can save the test results of channels 70/DSC, 06, 09, 13 and 16 in one profile. It can be used when preparing complex report about tested radio station.

See **Item 9** for more details about and testing strategy.

5.1.5 TEST VHF > VHF Receiver AM

The main purpose of this mode is measuring of power level, carrier frequency and AM-depth of an avionic band VHF-AM station. Tester provides measurements through broadcast by means of antennas and conductive measurements provided with help of external attenuator.

= VHF-AM Receiver= F: 121500 kHz dF: 25 kHz Fx: 121500123 Hz RSSI: 47.1 dBm ¥ AMd: 51% 1012 Hz Stop-Esc	Measurement through Antenna (¥): F : Operation frequency, kHz; dF : Frequency step; Fx : Measured carrier frequency; RSSI: Measured signal level; ¥ - Measurement through antenna; AMd: amplitude modulation depth and measured frequency of modulating signal. If the signal level is lower than (-90) dBm the frequency and frequency deviation data will not be displayed, the notification "Low level" is shown.
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5.2 TEST MF / HF – collection of MF / HF Tests

=== Test MF/MF === Send DSC Receive DSC MF/HF Synthesizer MF/HF Receiver Test TELEX Test config - F2	Send DSC – to send Test or Distress DSC message; Receive DSC – to receive DSC message; MF/HF Synthesizer – RF signal generator; MF/HF Receiver – frequency and power measurement on the selected frequency channel; signal demodulation. Test TELEX – TELEX transmitter and receiver measurement.
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5.2.1 TEST MF / HF > SEND DSC

= MF/HF:Send DSC = Select message: Distress Safety Routine Test Ack	You can select between Distress, Safety, Routine, and Test Acknowledge messages. Distress – DSC message with Format specifier – 112 (<i>DISTRESS</i>), which will be sent on specially dedicated GMDSS-frequencies. This message can be accepted by any maritime and coastal radio stations. Thus it is recommended to send this DSC message only by means of cable with reduced level taking into account all safety precautions to avoid false DISTRESS alert. Safety – it is a Selective call (to addressed station) on the Distress frequencies. So you can check <i>Watching receiver</i> and do not disturb anybody except for addressed station/vessel. Routine – it is a Selective call on the Routine frequencies. So you can check <i>Main receiver</i> and do not disturb anybody except for addressed station/vessel. Test Ack (acknowledge) – this is response on the standard Test request. Select required message and press Enter:
---	--

= MF/HF:Send DSC = Distress message 2187.5 kHz 4207.5 kHz 6312.0 kHz 8414.5 kHz 12577.0 kHz 16804.5 kHz	One of the DSC distress frequency should be selected here for Distress and Safety calls. Note that Routine call will require different frequencies: 2177.0 kHz 4219.5 kHz 6331.0 kHz 8436.5 kHz 12657.0 kHz 16903.0 kHz During this procedure the receiver of DUT is to be tuned accurately to the selected frequency!
= MF/HF:Send DSC = To: 413999333 From: 413999997 Freq: 2187.5kHz Pow: -30 dBm Send - press Enter	Safety message – if you selected “Safety” (same procedure for Distress message); To: 413999333 (example only!) – MMSI code of tested station; From: 413999997 – MMSI of the NGT-200 by default; Freq: 2187.5 kHz – operation frequency; Pow: -30 dBm – output level of RF signal; you may directly input power level using numeric buttons or toggle between the positions using ◀ ▶, and tune it by buttons + and - ; recommended power level: -60... -30 dBm.

Press **Enter** to transmit Test message – you will see next screens:

= MF/HF:Send DSC =
Safety message
To: 413999333
From: 413999997
Freq: 2187.5kHz
Pow: -30 dBm
--- Sending ---

= MF/HF:Send DSC =
Safety message
To: 413999333
From: 413999997
Freq: 2187.5kHz
Pow: -30 dBm
OK!
Repeat: press ENT

Repeated pressing of **Enter** will transmit DSC messages again. If necessary, output power level can be adjusted.

To enter menu **SEND DSC**, press **Esc**. Press **Esc** twice to enter **MAIN MENU**.

ATTENTION: It is necessary to specify (input) the correct MMSI number of tested radio station to provide the reception of the DSC message of **Individual call** format. Otherwise the message will be sent, but will not be received by this station! The correct MMSI number may be input in menu **SETTINGS / Edit MMSI** then it will automatically be shown every time it is needed.

5.2.2 TEST MF/HF > RECEIVE DSC

=MF/HF:ReceiveDSC= Dist/Safety/Test Routine	Operation frequency should be selected here: Dist/Safety/Test : 2187.5 kHz 4207.5 kHz 6312.0 kHz 8414.5 kHz 12577.0 kHz 16804.5 kHz Routine : 2177.0 kHz 4208.0 kHz 6312.5 kHz 8415.0 kHz 12577.5 kHz 16805.0 kHz
---	--

=MF/HF:ReceiveDSC= Wait for signal Att: 00 dB X	Tester is capable to receive DSC message of Individual call category with any MMSI address. Wait for signal - Tester is ready to receive DSC message. Att: 00 dB X - selected attenuation of <i>internal</i> attenuator; range: 0...93 dB. Attenuation is taken into account automatically. X – corresponds to the selected measurement configuration: Y-Antenna / A-Attenuator. Optimal input signal level is: -30 dBm. <i>Example of Att calculation:</i> If you need to measure Power of 150W or 51.76 dBm with an external Att of 40 dB then the internal attenuation shall be: 51.76 dBm – 40dB – (-30) dBm = 42 dB. Tester's input Power level: Pin = 51.76 -40 -42 = -30.24 dBm – it is OK.
After receipt of message the following information will appear: =MF/HF:ReceiveDSC= MMSI: 413999333 Format: Individual Categ: Safety CRC: OK To: 413999997 Save- F2 Prof:3 ↓↑	MMSI: 413999333 - MMSI code of the sender; Format: Individual – format specifier; Categ: Safety – Category selected (108); CRC: OK – control sum; if the CRC received in message and the CRC calculated by the Tester coincide, then OK is shown, otherwise it will display: Bad ; To: 413999997 – MMSI of the Tester; Save - F2 Prof:x ↓↑ - to save received information to memory in selected profile press F2; profile number is set up automatically; - to receive messages again press Enter; - to navigate the screens use buttons ▼, ▲.

=MF/HF:ReceiveDSC= Freq: 8414501 Hz dev+: 85 Hz dev-: -85 Hz ddev: 170 Hz Pow.: -21.4 dBm ¥ Saved OK!	Second screen of measured data: Freq : measured carrier frequency; dev+ : positive deviation of carrier frequency; dev- : negative deviation of carrier frequency; ddev : peak to peak deviation of carrier frequency; Pow.: measured power of received signal; Saved OK! message appears if you press F2 and save data to memory.
---	---

5.2.3 TEST MF/HF > MF/HF Synthesizer

In this mode Tester works as RF-synthesizer supporting the following modulations:
CW > SSB > AM > FMn.

= HF Synthesizer = F: 02100.000 kHz dF: 1000.000 kHz L: -20 dBm dL: 10 dB Mod: AM F: 1.0k M:50 %	F - Carrier frequency, kHz; dF - Frequency step; L - Level of the output signal, dBm; dL - Output power level step; it is tuned by keys - and +; Mod: AM – modulation type, select by keys - and +; Supported modulation types: CW > SSB > AM > FM. F: 1.0k M:50% frequency of modulating signal and amplitude modulation depth for AM; F: 1.0k D:2.0kHz: frequency of modulating signal and frequency deviation for FM.
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5.2.4 TEST MF / HF > MF/HF RECEIVER

The main purpose of this mode is measuring of power level and carrier frequency of MF/HF radio station. Tester allows to carry out measurements through broadcast by means of antenna and conductive measurements provided with help of external attenuator (supplied optionally). The receiver's bandwidth BW(-3dB) is 3kHz.

= MF/HF Receiver = F: 02187 kHz dF: 000 kHz Att: 00 dB ----- Fx: 2187,501 kHz RSSI: -87,1 dBm ¥	Measurements through Antenna: F : Operation frequency , kHz; dF : Frequency step; Att: attenuation of internal attenuator; when measuring through telescopic antenna recommended attenuation – 00 dB.; Fx : Measured carrier frequency; RSSI : Measured signal level; ¥ : selected measurement configuration through Antenna; configuration is selected in menu SETTINGS / Pow. meas. config. If the signal level is lower than (-90) dBm the frequency data will not be displayed, the notification “Low level” is shown.
= MF/HF Receiver = F: 02187.5 kHz dF: 0.1 kHz Att: 20 dB ----- Fx: 2187.501 kHz RSSI: 53.9 dBm A	Measurements through Attenuator: This mode allows to measure power level up to 200W with help of external attenuator. Power limit is defined by external attenuator parameters. Attenuation of internal attenuator is selected in order to input signal doesn't exceed (-20) dBm. For example, if transmitted power is 250W (54dBm) and external attenuation is 40 dB, then internal attenuation is calculated as below: $54\text{dBm} - (-20)\text{dBm} - 40\text{dB} = 34\text{dB}.$ Attenuation of external attenuator can be changed through menu SETTINGS/Test config. or in menu MF/HF Receiver by pressing F2.

5.2.5 TEST MF / HF > TEST TELEX

The main purpose of this mode is measuring of TELEX transmitter and receiver of MF/HF radio station.

<pre> === Test TELEX === Transmitter Receiver </pre>	Transmitter - TELEX transmitter measurement; Receiver - TELEX message receiving measurement.
<pre> === Test TELEX === Message 1 Message 2 ----- ABCDEFGHIJKLMNOR STUVWXYZ /1234567890+(-)=, . ?# </pre>	Transmitter menu includes: Message 1: ABCDEFGHIJKLMNOR STUVWXYZ /1234567890+(-)=, . ?# Message 2: NSR TEST MESSAGE 1234567890ABCDE NNNN
<pre> === Test TELEX === 2174.5 kHz 4174 5 kHz 6268.0 kHz 12520.0 kHz 16695.0 kHz </pre>	Select TELEX frequency: 2174.5 kHz 4174 5 kHz 6268.0 kHz 12520.0 kHz 16695.0 kHz
<pre> === Test TELEX === NSR TEST MESSAGE 1234567890ABCDE NNNN Freq : 2174.5 kHz POWER: 0.0 dBm START: ENTER </pre>	After selecting TELEX message and frequency, the following menu appears (<i>for example</i>): NSR TEST...NNNN: Selected message2; Freq: Selected TELEX frequency; Power: Output power level; START: Press Enter to transmit the message.

5.3 TEST AIS – collection of AIS Stations and AIS-SARTs Tests

TEST AIS Menu contains the following items:

==== TEST AIS ==== Test AIS class A Test AIS class B Test AIS-SART Test AIS Receiver Test AtoN Test BASE station Ship Emulation AIS monitor	TEST AIS Class A – to test the AIS station class A; TEST AIS Class B – to test the AIS station class B; TEST AIS-SART – to test the AIS-SART; TEST AIS Receiver – to test AIS receivers; Test AtoN – to test AtoN navigation devices; Test BASE station – to test AIS base stations; Ship Emulation – “virtual ship” emulation; AIS monitor – continuous reception by tester of all data sent by AIS station in VHF AIS channels and displaying it on LCD.
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5.3.1 TEST AIS Class A

The **TEST AIS Class A** has following subitems:

=== TEST AIS-A === AUTO TEST MODE Interrogate Msg 3 Interrogate Msg 5 Polling DSC Demo mode	AUTO TEST MODE – the automatic mode for complex test of AIS station class A; Interrogate Msg 3 – request for message 3 and waiting for respond; Interrogate Msg 5 – request for message 5 and waiting for respond; Polling DSC – request for data in channel 70 (DSC) and waiting for respond; Demo mode – emulation of normal work without connection to AIS station; it is intended for exhibitions for example.
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AUTO TEST MODE – the automatic mode for complex test of AIS station class A.

== MMSI FILTER == MMSI: 000000000 Pow: 00 dBm No filter F1 - Clear filter Start - ENTER	It is recommended to enter the MMSI number of the AIS station before starting tests. This allows ignoring the messages from other AIS stations. It will help to perform tests by means of antenna through broadcast in port area. You may directly input MMSI using numeric buttons or selecting the position by buttons ◀ and ▶, tune it by buttons [+], [-]; or use numeric keys to directly input the number. Press Enter button after the MMSI code was input. The “000000000” MMSI code means the filter is not applied, so the device will receive all messages from any AIS station.
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Note that not only zero values can be displayed here. The tester automatically offers to use the MMSI code encoded from last received message. So, if the MMSI code of AIS Station is unknown or you’d like to avoid the manual input of the code use **AIS MONITOR** mode and receive at least 1 message from the AIS Station to be tested. Return to **AUTOTEST MODE** to perform all tests.

Also if you perform tests by means of Power Sensor (VHFPS1), you may leave zero MMSI number. To apply zero MMSI press **F1** key.

=== AUTO AIS-A === Rx* ID * ***** dF ***** Hz A RSSI ***** dBm Slot ***** ■■■■■■■■ Check NMEA 0 Wait 8	Check NMEA 0 – search for working mode of NMEA-interface connection: Mode 1: RS-232 and 4800 Baud; Mode 2: RS-232 and 38400 Baud; Mode 3: RS-422 and 4800 Baud; Mode 4: RS-422 and 38400 Baud. The mode is working if one of !AIVDM messages is received. For each mode 2 seconds are provided. If messages !AIVDM... were not received in any of these modes, the interface will not be connected and the following message will appear in the bottom of the screen: Interf. Not found (Interface is not found, and measurements will be carried out without feedback from tested station.)
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<pre> === AUTO AIS-A === RxA ID 1 413123456 dF +123 Hz ¥ RSSI 41.5 dBm Slot 123 ■■■■■AB1u5 DSC 120°31.63E Save-F2 31°26.93N Prof:8 </pre>	The following information will be received, measured or decoded and displayed on LCD in this mode: Rx X, where X – (A or B) – the AIS channel of the received message; ID X, where X – (1, 2, 3.or 5) – the message number, under M.1371-5; 413123456 – MMSI of AIS station ; dF +123 Hz – carrier frequency error of AIS station transmitter; A RSSI 41.5 dBm – AIS station transmitter power level in dBm; ¥ – test config. is “Antenna”; Slot x, (where x from 0 to 2249) – received slot number (informative); ■■■■■ - Status Bar, 4-cell complete state. The complete state of the status bar confirms that the tester collect all necessary information about tested AIS station and ready to save the data to memory.
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The tester requires to receive Message 1 or Message 3 in any channel, receive any message in A or B channels, receive Message 5 in any channel to get all necessary information. The tester will allow to save the data only when all information is received.

The maximum measurement cycle time is about 15 minutes.

There are additional information about received data, viewed near the status bar:

- A** – received message in channel A,
- B** – received message in channel B,
- 1** – received Message 1 or Message 3,
- u** – confirms that UTC info is received in Msg.1,
- 5** – received Message 5.
- DSC** – received respond in DSC channel (In accordance with M.1371-3 the respond to DSC request **is not regulated** as it was in M.1371-1, so AIS station **may not respond** to DSC request).

Usually it is enough to receive the message 1 (Msg1) in channel A or B, message 5 (Msg5) in any channel and measure the frequency and power level of received signal. At the bottom left corner the received and decoded coordinates (Msg.1/3) are displayed.

After the status bar is completed the following note will be displayed in bottom right corner:

Save-F2 – allows saving all received data by pressing **F2**, and the **Prof: X**, where X = 1 to 100, - profile number where all data will be saved. The number is increased automatically by circle, and after Prof.100 – the Prof.1 will be used, new data will erase the old one automatically, so no any special function to free the memory is required.

In automatic mode all data will be collected automatically, the tester receives the Message 1 (Msg1) or Message 3 (Msg3), measures the power level and frequency deviation, sends the request for Message 5 (Msg5), and after reception of Message 5, the tester sends the “virtual ship” message to AIS station (ship emulation located 0.1 nautical mile on East from AIS station). The MMSI of virtual ship is 413999998 by default.

----- TIMEOUT ----- RxA complete RxB complete Msg1 complete Msg5 not received Save - F2 Exit - ESC	The measurement cycle can be interrupted by pressing F1. In this case the tester offers to save incomplete data. When the F1 is pressed the TIMEOUT menu will be viewed with list of received and not received data. The tester will be switched to this menu automatically if the required data will not be received in 15 minutes period.
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Interrogate Msg3 Menu – allows to send the request for message 3 (Msg3).

In accordance with M.1371-5 Message-3 is an interrogated Position report.

=== Message 3 === Channel A Channel B To: 000000000 Pow: 00 dBm	The menu offers to select the channel to send the request and to receive the message 3. Select the channel by means of ▲, ▼ keys and press Enter. The MMSI code of the tested AIS station is displayed below on the screen. It is possible to change the MSSSI code manually. You may directly input MMSI using numeric buttons or selecting the position by buttons ◀ and ▶, tune it by buttons +, -; use numeric keys to directly input MMSI. After the channel is selected press Enter. The following menu will be displayed.
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<pre> ==REQUEST 3 ChA == Rx* ID * ***** dF **** Hz S RSSI **** dBm Slot **** Start right now-F2 Wait for Request </pre>	Start right now-F2 – press F2 if you want to send request immediately without slot sync; note that some AIS stations may not respond correctly in such case; Wait for Request – Tester waits for any message from tested AIS station for slot synchronization and then transmits request – Message 15 to the tested AIS station. Then the Tester goes to receive mode and waits for Message 3. All other messages will be ignored.
--	---

The received Message 3 will be displayed in following view:

<pre> = REQUEST 3 ChA = RxA ID 3 413000000 dF -123 Hz S RSSI 41.5 dBm Slot 160 120°31.63 E 31°26.93 N </pre>	Rx A – the AIS channel where the message is received; ID 3 – the number of Message in accordance with M.1371-5; 413000000 (<i>as example only</i>) – the tested AIS station transmitter’s MMSI; RSSI 41.5 dBm – AIS station transmitter power level in dBm; S - test configuration is “Power Sensor”; Slot x, (<i>where x from 0 to 2249</i>) – received slot number (informative); 120°31.63E (<i>as example only</i>) 31°26.93N – the AIS station coordinates.
---	---

The message 3 as the response to request should be transferred and received in 60 seconds after the sound was terminated. If the AIS station has reception indicator (usually it is RX Led), after the sound was terminated this LED should confirm the reception of the request.

Interrogate Msg5 Menu – allows to send the request for message 5 (Msg5). In accordance with M.1371-5 Message-5 is Static and voyage related data.

<pre> === Message 5 === Channel A Channel B To: 413000123 Pow: 00 dBm </pre>	The menu offers to select the channel to send the request as well to receive the message 5. Select the channel by means of ▲ and ▼ keys and press Enter. The AIS station MMSI code of target station is displayed lower. It is possible to change the MSSI code manually. You may directly input MMSI using numeric buttons or selecting the position by buttons ◀ and ▶, tune it by buttons +, -.
<pre> ==REQUEST 5 ChA == Rx* ID * ***** dF **** Hz S RSSI **** dBm Slot **** Start right now-F2 Wait for Request </pre>	After the channel is selected press Enter. The following menu will be displayed. Start right now-F2 – press F2 if you want to send request immediately without slot sync; note that some AIS stations may not respond correctly in such case; Wait for Request – Tester waits any message from tested AIS station for slot synchronization and then transmits request – Message 15 to the tested AIS station. Then the Tester goes to receive mode and waits for Message 5. All other messages will be ignored.

The received Message 5 will be displayed in following view:

<pre> ==REQUEST 5 ChA == RxB ID 5 413000123 dF -123 Hz S RSSI 41.5 dBm Slot 1021 SUZHOU </pre>	RX B – the AIS channel where the message is received; ID 5 – the number of Message in accordance with M.1371-5; 413000123 (<i>as example only</i>) – the tested AIS station transmitter’s MMSI; S RSSI 41.5 dBm – AIS station transmitter power level in dBm; S - test configuration “Power Sensor”; Slot 1021 – received slot number (<i>as example only</i>); SUZHOU (<i>as example only</i>) – vessel name where the AIS station is installed.
---	--

The message 5 as the respond to request should be transferred and received in 60 seconds after the sound was terminated. If the AIS station has reception indicator (usually it is RX Led), after the sound was terminated this LED should confirm the reception of the request.

Polling DSC Menu

This menu item allows sending the request in DSC channel for vessel name programmed in AIS station and receiving the response.

Note: In accordance with ITU-R M.1371-3(-4, -5) (in opposition to M.1371-2), the AIS station response in DSC channel is not strictly regulated.

The following data is displayed in this menu:

== Polling DSC == To: 413000333 From: 413999997 Start - ENTER	To: 413000333 – requested station MMSI; From: 413999997 – Tester’s MMSI. The requested station MMSI is determined by message received in AUTO TEST MODE. But It is possible to change the MSSSI code manually. You may directly input MMSI using numeric buttons or selecting the position by buttons ◀ and ▶, tune it by buttons ▲ and ▼. If the MMSI code is correct press Enter to send the request. The sound signal confirms the request was sent in DSC channel. The tester goes to waiting mode for response in DSC channel. The tester will wait for 20 seconds for AIS station response.
--	--

After the respond message is received the following information will be displayed:

== RECEIVED DSC == Format: Individual Category: Inform. From: 413000333 Name: SUZHOU RSSI: 41.1 dBm FCh70: 156525001Hz	Format: Individual – format of received DSC message; Category: Inform. (Information) – category of received DSC message; From: 413000333 – AIS station’s MMSI; Name: SUZHOU – vessel’s name where the AIS station is installed; RSSI: 41.1 dBm – power level of received signal in dBm; FCh70: 156525001Hz – measured carrier frequency.
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The request sent to AIS station contains the following DSC message in accordance with ITU-R M.825-3 :

120, 120	Format specifier – Individual call
41,30,00,33,30	MMSI requested station (<i>as example only</i>)
103	Category – Information
41,30,00,55,50	Self-identification = tester's MMSI no.
111	Message – Report ship's name/identification
117	End of sequence – Ack.RQ
xxx	ECC – modulus-2 checksum (can variate)
117,117	End of sequence – Ack.RQ

5.3.2 TEST AIS Class B

The **TEST AIS Class B** has following subitems:

=== TEST AIS-B === AUTO TEST MODE Interrogate Msg 18 Interrogate Msg 24	AUTO TEST MODE – the automatic mode for complex test of AIS station class B; Interrogate Msg 18 – request for message 18 and wait for response; Interrogate Msg 24 – request for message 24 and wait for response.
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AUTO TEST MODE – the automatic mode for complex test of AIS station class B.

== MMSI FILTER == MMSI: 000000000 Pow: 00 dBm No filter F1 - Clear filter Start - ENTER	It is recommended to enter the MMSI number of the AIS station before starting tests. This allows ignoring the messages from other AIS stations. It will help to perform tests by means of antenna (through broadcast) in a port area. You may directly input MMSI using numeric buttons, or select the position by buttons  and , set it up by buttons , . Press Enter after the MMSI code was input. The 000000000 MMSI code means the filter is not applied, so the device will receive all messages from any AIS station.
--	---

Note that here can be displayed not only zero meaning. The tester automatically offers to use the MMSI code encoded from the last received message. So, if the MMSI code of AIS Station is unknown or you'd like to avoid the manual input of the code use **AIS MONITOR** mode and receive at least 1 message from the AIS Station to be tested. Return to **AUTOTEST MODE** to perform all tests.

Also if you perform tests by means of Power Sensor and VSWR meter you may leave zero MMSI number. Zero MMSI number is applied by pressing of **F1** button.

<pre> === AUTO AIS-B === Rx* ID * 00000000 dF **** Hz A RSSI **** dBm Slot **** [][][][] Check NMEA 0 Wait 8 </pre>	Check NMEA 0 – search for working mode of NMEA-interface connection: Mode 1: RS-232 and 4800 Baud; Mode 2: RS-232 and 38400 Baud; Mode 3: RS-422 and 4800 Baud; Mode 4: RS-422 and 38400 Baud. The mode is working if one of messages is received <i>!AIVDM...</i> For each mode 2 seconds are provided. If messages <i>!AIVDM...</i> were not received in any of these modes, the interface will not be connected and the following message will appear in the bottom of the screen: Interf. Not found (Interface is not found, and measurements will be carried out without feedback from tested station.)
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The following information will be received, measured or decoded and displayed on LCD in this mode (all numeric data is an example only):

<pre> === AUTO AIS-B === RxA ID18 413000234 dF +123 Hz A RSSI 32.9 dBm Slot 432 [][][][]AB 24a 24b 33°29.24E Save-F2 44°35.33N Prof: X </pre>	RxX, where X – (A or B) – the AIS channel of the received message; ID X, where X – (18 or 24a/24b) – the message number under M.1371-5; 413000234 (<i>as example</i>) – MMSI number of the tested AIS station; dF +123 Hz – carrier frequency deviation of AIS station transmitter; RSSI 32.9 dBm – AIS station transmitter power level in dBm; A - test configuration is “External Attenuator”; Slot x, (where x from 0 to 2249) – received slot number (informative parameter); [][][][] - Status Bar, 4-cell complete state. The complete state of the status bar confirms that the tester has collected all necessary information about tested AIS station and is ready to save the data to memory.
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The tester requires to receive Message 18 (Msg18) in any channel, receive any message in A or B channels, receive Message 24a (Msg24a) and message 24b (Msg24b) in any channel to get all necessary information. The tester will allow to save the date only when all information is received.

There are additional symbols displayed near the status bar:

- A** – received message in channel A;
- B** – received message in channel B;
- 18** - received Message 18;
- 24a** – received Message 24a;
- 24b** – received message 24b.

After the status bar is completed the following note will be displayed in bottom right corner of the screen:

Save-F2 – allows saving all received data by pressing **F2**, and the **Prof: X** (where $X = 1$ to 100) - profile number where all data will be saved. The number is increased automatically by circle, and after Prof100 – the Prof1 will be used, new data will erase the old one automatically. You can clear selected profile or all the profiles using menu **SETTINGS/Clear profiles** (see Item 7.6).

In this mode all data will be collected automatically, the Tester receives the Message 18, measures the power level and frequency deviation, sends the request for Message 24, and after reception of Message 24a and 24b, the tester sends the “virtual ship” message to AIS station (ship emulation located 0.1 nautical mile on East from AIS station). The MMSI of virtual ship is 413999998.

-----TIMEOUT----- RxA complete RxB complete Msg18 complete Msg24 not complete Save-F2 Exit-ESC	The measurement cycle can be interrupted by pressing F1 button. In this case the tester offers to save incomplete data. When F1 is pressed the TIMEOUT menu will be viewed with list of all received and missing data. The tester will be switched to this menu automatically if the required data will not be received within 15 minutes period.
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Interrogate Msg18 Menu – allows sending the request for message 18 (Msg18). In accordance with M.1371-5 Message-18 is a Standard Class B equipment position report.

<pre> === Message 18 === Channel A Channel B To:000000000 Pow: 00 dBm </pre>	The menu offers to select the channel to send the request as well to receive the message 18. Select the channel by means of ▲, ▼ keys and press Enter. The AIS station MMSI code of target station is displayed lower. It is possible to change the MSSI code manually. Use the ▲, ▼ keys and select line “TO:”. You may directly input MMSI using numeric buttons, or select the position by buttons ◀ and ▶, set it up by buttons +, -.
<pre> = REQUEST 18 ChA = Rx* ID * 000000000 dF **** Hz ¥ RSSI **** dBm Slot **** Start right now-F2 Wait for Request </pre>	After the channel is selected press Enter. The following menu will be displayed. Start right now-F2 – press F2 if you want to send request immediately without slot sync; some AIS stations may not respond in such a case. Wait for Request – Tester waits for any message from tested AIS station for slot synchronization and then transmits a request (Message 15) to the tested AIS station. Then the Tester goes to receive mode and waits for Message 18. All other messages will be ignored.

The received Message 18 will be displayed in the following view:

<pre> = REQUEST 18 ChA = RxA ID18 413111333 dF -234 Hz ¥ RSSI 32.8 dBm Slot 160 CRC: OK 33°29.24E 121°35.33N </pre>	RxA – the AIS channel where the message is received; ID18 – the number of Message in accordance with M.1371-5; 413111333 (<i>as example only</i>) – tested AIS station MMSI code; dF -234 Hz – carrier frequency deviation of AIS station transmitter; RSSI 32.8 dBm – AIS station transmitter power level in dBm; ¥ - test configuration is “Antenna”; Slot 160 – received slot number (<i>as example only</i>) CRC: OK – (cyclic redundancy check) if calculated and received CRC are equal then CRC is stated as OK; otherwise – BAD. 33°29.24E (<i>as example only</i>) 121°35.33N – the AIS station coordinates.
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The message 18 as the response to request should be transferred and received in 60 seconds after the sound was terminated. If the AIS station has reception indicator (usually it is RX Led), at the end of the audio signal, LED should light up briefly.

Interrogate Msg24 menu – allows sending the request for message 24 (Msg24).

In accordance to M.1371-5 Message-24 is a Class B “CS” static data.

Message 24 is transmitted in VHF channel in two separated, one-slot messages – 24a and 24b usually following each other.

=== Message 24 === Channel A Channel B To:000000000 Pow: 00 dBm	The menu offers to select the channel to send the request as well to receive the message 24. Select the channel by means of ▲, ▼ keys and press Enter. The AIS station MMSI code of target station is displayed lower. It is possible to change the MSSSI code manually. Select line “TO:”. Now you may directly input MMSI using numeric buttons, or select the position by buttons ◀ and ▶, set it up by buttons +, -.
= REQUEST 24 ChA = Rx* ID * ***** dF ***** Hz A RSSI ***** dBm Slot ***** Start right now-F2 Wait for Request	After the channel is selected press Enter. The following menu will be displayed. Start right now-F2 – press F2 if you want to send request immediately without slot sync; some AIS stations may not respond in such a case. Wait for Request – Tester waits for any message from tested AIS station for slot synchronization and then transmits a request (Message 15) to the tested AIS station. Then the Tester goes to receive mode and waits for Message 24. All other messages except for 24a/24b will be ignored.

The received Message 24 will be displayed in the following view:

= REQUEST 24 ChA = RxA ID24 413111333 dF -112 Hz A RSSI 32.7 dBm Slot: 17 PELIKAN	RxA – the AIS channel where the message is received; ID24 – the number of Message in accordance with M.1371-5; 413111333 (<i>as example only</i>) – tested AIS station’s MMSI code; dF -112 Hz – carrier frequency deviation of AIS station transmitter; RSSI 32.7 dBm – AIS station transmitter power level in dBm; Slot 17 – received slot number (<i>as example only</i>); PELIKAN (<i>as example only</i>) – vessel’s name where the AIS station is installed.
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The message 24 as the response to request should be transferred and received in 60 seconds after the audio signal. If the AIS station has reception indicator (usually it is RX Led), at the end of the audio signal, LED should light up briefly to confirm the reception of the request.

5.3.3 TEST AIS-SART

==USER ID FILTER== ID: 00000000 No filter F1 - Clear filter Start - ENTER	It is required to enter the USER ID number of the AIS-SART before starting tests. This allows ignoring the messages from other AIS stations. It will help to perform tests by means of antenna through broadcast in port area. You may directly input MMSI using numeric buttons, or select the position by buttons  and , set it up by buttons , . The 000000000 MMSI code means the filter is not applied, so the device will receive all messages from any AIS station.
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Note that not only zero value can be displayed here. The tester automatically offers to use the MMSI encoded from last received message. So, if the MMSI number of AIS-SART is unknown or you’d like to avoid the manual input of the code use **AIS MONITOR** mode and receive at least 1 message from the AIS-SART. Then return to **TEST AIS SART** to perform all tests.

The following data will be displayed in this mode:

=== AIS SART === RxA ID 1 970000123 dF +123 Hz RSSI 33.0 dBm Slot: 123 ■■■■■A4B4 1:6 14:2 33°29.24E Save-F2 44°35.33N Prof: X	RxX, where X (A or B) – AIS channel in which the message was received; ID X, where X (1 or 14) – the message number in accordance with IEC 61097-14; 970000123 (as example only) – USER ID of AIS SART encoded in received message; dF +123 Hz – carrier frequency deviation of AIS SART; RSSI 33.0 dBm – AIS SART power level in dBm; Slot x, (where x from 0 to 2249) – received slot number (informative); ■■■■■ – Status Bar , 4-cell complete state. The complete state of the status bar confirms that the tester has collected all necessary information about AIS-SART under test and is ready to save the data into non-volatile memory.
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The tester requires to receive 8 messages where 6 messages are Msg.1 (Scheduled Position report) and 2 messages are Msg.14 (Safety related broadcast message) in any channel, and also to confirm reception of any message in A and B channels to get all necessary information. The tester will allow to save the data only when all information is received.

There is additional information about received data displaying near the status bar:

- A4 – number of received messages in channel A,
- B4 – number of received messages in channel B,
- 1:6 – number of received Messages 1,
- 14:2 – number of received Messages 14.

After the status bar is completed the information about sync slot will be removed and Msg14 – “SART TEST” or “SART ACTIVE” note will be displayed.

The coordinates received from AIS-SART are displayed at the left bottom corner of the Tester’s screen. If the test is provided in shielded room AIS SART can’t determine its coordinates. In this case the AIS-SART transmits the *default coordinates* that will be confirmed by corresponding display note.

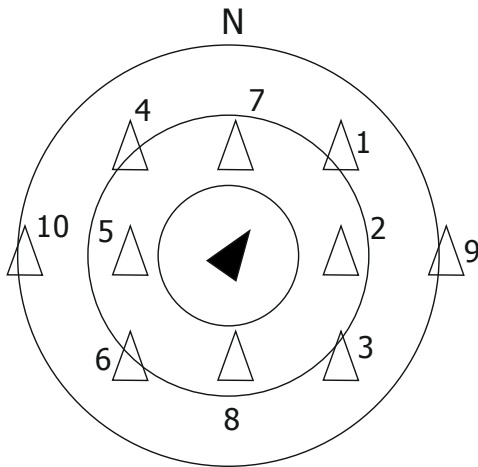
After the status bar is completed the following note will be displayed in bottom right corner:

Save-F2 – allows saving all received data by pressing **F2**, and the **Prof: X** (where X = 1 to 100) - profile number where all data will be saved. The number is increased automatically by circle, and after Mes100 – the Mes1 will be used, new data will erase the old one automatically, so no any special function to clear the memory is required, but in case of necessity the procedure of erasing profiles is described in **Item 7.6**.

---- TIMEOUT ---- RxA complete RxB complete Msg1 complete Msg14 not complete SAVE - Press F2 Exit - ESC	The AIS-SART measurement can be interrupted by pressing F1 button. The tester will offer to save the incompletely measured data. When F1 is being pressed the list with received / not received data status will be displayed. The tester will be automatically set to this mode after 15 minutes operation.
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5.3.4 Test AIS Receiver

=Test AIS Receiver Owner position Long: 00°00.00 E Lat.: 00°00.00 N Change - +, - Start - ENTER	On entering this mode you will be proposed to input manually coordinates of the point which will be used as central for ten AIS messages (Ship emulation). You may directly input coordinates using numeric buttons. On pressing Enter, 10 AIS messages will be transmitted (5 messages on channel A and 5 messages on channel B) with 2 sec. interval. On second line of display will appear note «Mes. X transmitted» where X – is a message's number. Afterwards the procedure can be repeated.
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	After transmit on receiver's display will appear such disposition of virtual vessels as on image. Black triangle is the AIS receiver under test. Numbers of other vessels correspond to MMSI of virtual vessels. 1 – 413999001 2 – 413999002 3 – 413999003 4 – 413999004 5 – 413999005 6 – 413999006 7 – 413999007 8 – 413999008 9 – 413999009 10 – 413999010
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5.3.5 Test AtoN (Aids to Navigation)

AtoN devices can transmit Message 21 (basic), 6, 8 and 14.

== MMSI FILTER == MMSI: 000000000 No filter F1 - Clear filter Start - ENTER	By entering this mode you should input manually the MMSI number of the tested AIS device before starting tests. This allows ignoring the messages from other AIS stations. It will help to perform tests by means of antenna through broadcast in port area. You may directly input MMSI using numeric buttons, or select the position by buttons  and , set it up by buttons , . After input of MMSI press Enter. The 000000000 MMSI number means the filter is not applied, so the device will receive all messages from any AIS station.
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Note that here can be displayed not only zero number of MMSI. The tester automatically uses the MMSI encoded from the last received message. So, if you perform tests by means of Power Sensor and VSWR meter you may leave zero MMSI number. Zero MMSI number is applied by pressing of **F1** button.

In this mode the following information will be received, decoded, measured and displayed (*all data is as an example only*):

<pre> === Test AtoN == RxA ID21 413999997 dF -0025 Hz S RSSI 42.1 dBm Slot 432 ■■■■ A 21 </pre>	RxX - where X (A or B) is the AIS channel of received message; ID X - where X (1 to 26) is the number of the message, according to M.1371-5; 413999997 – MMSI number of AtoN device.
<pre> === Test AtoN == RxB ID 6 413999997 dF -0023 Hz S RSSI 42.3 dBm Slot 968 ■■■■■■■■ A B 6 21 Save-F2 Prof:xx </pre>	■■■■■■■■ – Status Bar , 4-cell complete state. The complete state of the status bar confirms that the tester has collected all necessary information about AtoN device under test and is ready to save the data into non-volatile memory. The tester needs to: - receive signal in channel A (161.975MHz); - receive signal in channel B (162.025MHz); - receive Message 21 (main message for AtoN); - receive Message 6. After that the data can be saved in non-volatile memory of the Tester by pressing F2 key. The information will be recorded in the next free profile (Prof:xx).

5.3.6 Test BASE station

<pre> ==STAT. ID FILTER= ID: 000000000 No filter F1 - Clear filter Start - ENTER </pre>	By entering this mode you should input manually the MMSI number of the tested AIS base station to ignore messages from other AIS stations. It will help to perform tests by means of antenna through broadcast in port area. You may directly input MMSI using numeric buttons, or select the position by buttons ◀ and ▶, set it up by buttons +, -. After input of MMSI press Enter. The 000000000 MMSI number means the filter is not applied, so the device will receive all messages from any AIS station.
--	--

This mode allows reception, decoding or measuring and displaying of the following information (*all data is as an example only*):

<pre> == Test Base st.== RxA ID 4 413000234 dF +123 A RSSI 39.9 dBm Slot 1784 [Status Bar] Save-F2 Prof: X </pre>	RxX - where X (A or B) is the AIS channel of received message; ID 4 - Base station report – main report of base station; 413000234 – MMSI number of the station under test; dF +123 – carrier frequency deviation of AIS transmitter. RSSI 39.9 dBm – power level of AIS station transmitter; A – measurement configuration, A stands for “External attenuator”; Slot 1784 – received slot number (as example only); [Status Bar] – Status Bar , 4-cell complete state. The complete state of the status bar confirms that the tester has collected all necessary information about device under test and is ready to save the data into non-volatile memory. In this mode Tester waits for only Message 4.
--	--

5.3.7 Ship Emulation

Entering the menu user should select the channel for testing (A or B).

<pre> = Ship Emulation = Channel A Channel B </pre>	Virtual ship emulation procedure is performed as follows: Tester sends the message 1 with the tester’s MMSI code and increased on about 0.1 nautical mile to the last received message coordinates. As a result the virtual ship with a little different coordinates should appear on tested AIS station LCD.
<pre> = Ship Emulation = Channel A From: 413999997 Start - ENTER </pre>	After pressing Enter, a message “Wait !” will appear on the screen. The message transmission will be performed after the audio signal. NOTE: It is important to receive at least one message in <i>AUTO TEST</i> mode or <i>AIS MONITOR</i> mode and only then one should perform the ship emulation. The synchronization of the Tester and AIS station as well as the definition of virtual ship coordinates are required.

5.3.8 AIS Monitor

The tester continuously receives all AIS station messages and displays them on LCD (example):

<pre> == AIS Monitor == RxB ID 1 413000333 dF 0054 Hz A RSSI 41.5 dBm Slot 1234 CRC: OK 33°29.24 E 44°35.33 N </pre>	RxB – the AIS channel where the message is received; ID 1 – the number of Message in accordance with M.1371-5; 413000333 (<i>as example only</i>) – MMSI code of the AIS station under test; Note that in this mode Tester will receive and display AIS messages with any MMSI number. dF -0054 Hz – channel nominal frequency deviation of AIS station transmitter; RSSI 41.5 dBm – AIS station transmitter power level in dBm; Slot x, (where x = 0 to 2249) – received slot number (informative); CRC: OK – (cyclic redundancy check) if calculated and received CRC are equal then CRC is stated as OK; otherwise – BAD; 33°29.24 E 44°35.33 N – the AIS station coordinates.
---	---

This mode is useful when one need to find out:

- If the AIS station under test can transmit any messages;
- MMSI of the AIS station under test;
- AIS station's coordinates.

It is recommended to start AIS station checking with this mode.

5.4 TEST EPIRB – EPIRB Testing Sets

The menu TEST EPIRB includes the following submenus:

---- MEASURE ---- TEST AUTO(406+121) TEST CH 406 MHz TEST CH 121 MHz TEST CH 243 MHz Test config - F2	TEST AUTO (406+121) – complex C/S test; Both 406MHz and 121.5MHz channels are tested automatically; TEST CH 406 MHz – testing of 406MHz channel; TEST CH 121 MHz – testing of 121.5MHz channel; TEST CH 243 MHz – testing of 243MHz channel.
--	--

5.4.1 TEST AUTO (406+121)

In this mode the tester will automatically measure all EPIRB's parameters in channels 406MHz and 121.5MHz.

The following tests will be done in 406MHz channel:

- demodulation and decoding of received message;
- measurement of carrier frequency;
- measurement of signal power level;
- measurement of total transmission time;
- measurement of unmodulated carrier time;
- measurement of signal phase deviation.

And in 121.5MHz channel NGT-200 will measure:

- carrier frequency;
- signal power level in antenna;
- amplitude modulation depth.

Wait 406 message ATT: 20 dB ¥	TEST AUTO (406+121) – complex C/S test; Just press Enter to start measurements. First the Tester waits for a signal in 406MHz channel; then it switches for testing of 121.5MHz channel and waits for a signal during 7 seconds. Operational channel on frequency 406MHz is detected automatically, thus there is no need to input it manually.
---	--

HH:MM dd/mm/yyyy Mes#xx Test ok ID:A7E830C30C30CD1 MARITIME USER MMSI:999999 CC:413 Beacon:0 ↓ F1-Mes# F2-Save	After the signal receipt the measured parameters are displayed: FIRST SCREEN: Mes#xx – number of the memory profile, where the test results will be saved. To save press F2. Test – type of the signal; <i>TEST</i> signal is used for testing purposes and is ignored by Cospas-Sarsat system. <i>DISTRESS</i> is a real emergency mode, do not emit false Distress signals! ID:A7E830C30C30CD1 – 15 HEX ID code, must correspond to the ID code marked on the EPIRB; MARITIME USER – protocol type, in this case it's a maritime user protocol; MMSI – marine identifier; CC:413 – country code; Beacon:0 – beacon number on the vessel; ↓ F1-Mes# F2-Save – you can save the measurements by pressing F2 or go to the next screen to check other parameters by pressing ▼.
P406: 37.0 dBm F406:406025.123kHz FF FE D0 53 F4 18 61 86 18 66 8F 51 46 D0 Phase:+63° -63° UCT:160.2 ms ↓↑F1-Mes# F2-Save	SECOND SCREEN: P406: 37.0 dBm – power level of channel 406MHz; F406:406025.123kHz – carrier frequencies in channel 406MHz; FF FE D0 53 F4 18 – full information in HEX 61 86 18 66 8F 51 format; 46 D0 Phase:+63° -63° – phase deviation; UCT:160.2 ms – unmodulated carrier time.
TTT:440.0 ms F121:121500.321 Hz P121: 4.0 dBm ↑ F1-Mes# F2-Save	THIRD SCREEN: TTT:440.0 ms – Total Transmission Time; F121:121500.321 Hz – carrier frequency of channel 121.5MHz; P121: 4.0 dBm – power level in channel 121.5MHz.

5.4.2 TEST CH 406 MHz

In this menu only channel 406MHz is tested. This may be used when the channel 121.5MHz is absent (like in PLB for example) or faulty. Also it may be useful when you need to check only 406MHz frequency.

All parameters are given only as an example:

HH:MM dd/mm/yyyy Mes#xx Test ok ID:A208334D34D34D1 MARITIME USER MMSI:900000 CC:413 Beacon:0 ↓ F1-Mes# F2-Save	After the signal receipt the measured parameters are displayed: FIRST SCREEN: Mes#xx – number of the memory slot, where the test results will be saved. To save press F2; Test – type of the signal; <i>TEST</i> signal is used for testing purposes and is ignored by Cospas-Sarsat system. <i>DISTRESS</i> is a real emergency mode, do not emit false Distress signals! ID:A208334D34D34D1 – 15 HEX ID code, must correspond to the ID code marked on the EPIRB; MARITIME USER – protocol type, in this case it's a maritime user protocol; MMSI – marine identifier; CC:413 – country code; Beacon:0 – beacon number on the vessel; ↓ F1-Mes# F2-Save – you can save the measurements by pressing F2 or go to the next screen to check other parameters by pressing ▼.
P406: 45.5 dBm F406:406027.294kHz FF FE D0 51 04 19 A6 9A 69 A6 8A 3C 3A D0 Phase:+62° -63° UCT:161.2 ms ↓ F1-Mes# F2-Save	SECOND SCREEN: P406: 45.5 dBm – power level of channel 406MHz; F406:406027.294kHz – carrier frequency; FF FE D0 51 04 19 – full information in HEX A6 9A 69 A6 8A 3C format; 3A D0 Phase:+62° -63° – phase deviation; UCT:161.2 ms – unmodulated carrier time.

5.4.3 TEST CH 121 MHz

All parameters are given only as an example:

NGT-200 UM.E 20210520-02

Important ! The results of measurements in channel 121.5MHz can be saved in non-volatile memory of device, in any profile. To save results press **F2**. You may save results of 406MHz and 121.5MHz independently. Or you may test 406MHz and 121.5MHz separately and save results in one profile.

5.4.4 TEST CH 243 MHz

In this measurement mode you can check channel 243MHz.

=== Test 243 ===== F: 243000 kHz Fx: RSSI: Fmod: M: Start - Enter	After pressing Enter the following menu will appear. To start measurements press Enter.
=== Test 243 ===L F: 243000 kHz Fx: 243001.234 RSSI: 17.1 dBm Fmod: 351 1123 Hz M: 97% Start - Enter	Fx: 243001.234 – carrier frequency in kHz; RSSI: 17.1 dBm – signal level in antenna; Fmod: 351 1123 Hz – modulating audio frequency variation limit; modulating frequency must be in range of 300 to 1600 Hz, and variation range must be not less than 700Hz; M: 97% – amplitude modulation depth.

5.5 TEST NAVTEX – collection of NAVTEX Tests

== TEST NAVTEX == Transmitter Receiver	Use Transmitter mode to test vessel NAVTEX receiver. Use Receiver mode to receive NAVTEX system messages.
== TEST NAVTEX == Test message 1 Test message 2	One of two text messages can be selected in this mode: Test message 1: CD00 TEST FROM NGT-200 or Test message 2: CD00 0123456789ABCDE...
== TEST NAVTEX == 518.0 kHz 490 0 kHz 4209.5 kHz	Then select operating frequency: 518.0 kHz : International frequency; 490.0 kHz } 4209.5 kHz } regional NAVTEX frequencies.

Having selected the type of message and operation frequency you get into the following menu:

== TEST NAVTEX ==

CD00 <cr><lf>
TEST FROM NGT-200

Power: -20 dBm
Repeat: 1
Start - Enter

CD00 <cr><lf>

CD – identifier of the transmitting station, it depends on the NAVAREA (navigation area) and the type of message, where **D** – is Search and Rescue Information;

00 – the order number of message dedicated for vitally important messages; in this case its choice is required by necessity of stable receipt of repeated messages; repeated messages with numbers 01 – 99 are neither displayed, nor printed;

<cr> : carriage return character;

<lf> : line-feed character;

TEST FROM NGT-200 : the content of Message 1;

Power: output signal level;

Repeat: number of messages to be sent; can be adjusted by inputting required number of messages to repeat; use numeric keys **1** to **9**;

Start: press **Enter** to start the transmission.

Transmission is confirmed by specific audio signal, on LCD appears notification:

--- Sending ---

== TEST NAVTEX ==

CD00 <cr><lf>
TEST FROM

Power: -20 dBm
Repeat: 1
Repeat - Enter

Repeat: press **Enter** to transmit the NAVTEX message again.

Power level and/or number of repeated messages can be changed.

To exit this menu press **Esc**.

Message transmission time is: 11 sec for **Msg.1** and 14 sec for **Msg. 2**.

5.6 TEST NMEA – collection of NMEA Interface Tests

In this mode Tester allows receiving all information incoming to presentation ports of AIS station, such as pilot plug or from GNSS receiver. If it is necessary to receive the information from pilot plug select the 38400 Baud rate, or select the 4800 Baud rate to check the vessel's sensors (for example, GLONASS, GPS, gyrocompass etc.).

The tester allows connection to interface with RS 422/485 or RS 232.

=== TEST NMEA === Receiver bit rate: > 38400 baud 4800 baud Interface: (F1) > RS-232 RS-422/485	Step 1. Receiver bit rate : select bit rate: 38400 baud: for testing messages from AIS stations; 4800 baud: to test vessel's sensors. Step 2. Interface: (F1) – select interface by pressing F1 key: interfaces are changed sequentially RS232 > RS422/485. Step 3. Press Enter to start receiving NMEA messages.
=== TEST NMEA === Rx: 4800 baud Stop - <Esc> Filter - F2 "\$"	Received messages are displayed immediately. Every new message begins from new line. Press Esc button to stop testing; To continue receive press Enter; To change filtration of messages that begin with symbol "\$" or "!" press F2.

!AIVDO,1,1,,B1au cih000VDdP6H>Ap03 wtTkP06,0*6E Stop - <Esc> Filter - F2 “!”	An example of sentence AIVDO received from AIS station Class B. ! – start symbol for sentences: AIVDO – AIS VHF Data-link Own-vessel message; AIS station sends similarly all the sentences sent on VHF channel; AIVDM – AIS VHF Data-link Message; AIS station sends similarly all the sentences received on VHF channel. For details about AIVDO, AIVDM sentences look IEC 61993-2.
\$GPRMC,130906.00, A,3126.93172,N,12 031.63219,E,0.006 ,,190718,,D*71 Stop - <Esc> Filter - F2 “\$”	An example of sentence transmitted by AIS station Class B built-in GPS-receiver: \$ - start symbol of standard NMEA sentences; GPRMC – RMC sentence, source – GPS; RMC – Recommended minimum specific GNSS data. For more details about NMEA sentences look IEC 61162-1.

6 TEST RESULTS

6.1 VIEW PROFILES MENU

This menu allows viewing all data stored in non-volatile memory. All the measurements data is stored in 100 profiles (memory cells). Use   and   keys to navigate the profiles.

An example of saved measurement results of a VHF radio station with DSC:

Pr:3 15:40 02/08/17 MMSI: 413900000 Format: Individual Categ: Safety CRC: OK To: 413999997 ↓↑ <VHF DSC>	FIRST SCREEN: Pr: 3 – profile number (for example); 15:40 – measurement time; 02/08/2017 – measurement date; MMSI: 413900000 – tested station MMSI; Format: format specifier; Categ: received message category; CRC: CRC check result of received message; To: receiver (Tester) MMSI number; ↓↑: clue to navigate the screens; <VHF DSC> : measurement mode mark.
Pr:3 15:40 02/08/17 Pow: 43,7 dBm Frq:156525070 Hz SHIP: 1 ↓↑ <VHF DSC>	SECOND SCREEN: Pow: signal power level, received on channel 70; Frq: carrier frequency of channel 70.

Pr:3 15:40 02/08/17 CH6 frq:156300046 CH6 Pow: 43.6 dBm CH9 frq:156450009 CH9 Pow: 43.9 dBm ↓↑ <VHF DSC>	THIRD SCREEN: CH6 frq: carrier frequency of channel 6; CH6 Pow: signal power level, received on channel 6; CH9 frq: carrier frequency of channel 9; CH9 Pow: signal power level, received on channel 9.
Pr:3 15:40 02/08/17 CH13 frq:156650013 CH13 Pow: 43.3 dBm CH16 frq:156800016 CH16 Pow: 43.6 dBm ↓↑ <VHF DSC>	FOURTH SCREEN: CH13 frq: carrier frequency of channel 13; CH13 Pow: signal power level, received on channel 13; CH16 frq: carrier frequency of channel 16; CH16 Pow: signal power level, received on channel 16.

An example of saved test results of an AIS station:

Pr:47 12:59 23/07/18 ID 1 413000333 A: 42,5 dBm 9 Hz B: 42,5 dBm 10 Hz 33°28.85 E 44°35.33 N ↓↑ <AIS-A>	FIRST SCREEN: Pr: 47 – profile number (for example); 12:59 – measurement time; 23/07/2018 – measurement date; ID 1 – data from AIS Message 1; A: 42.5 dBm 9 Hz – Power level and Frequency error for AIS Channel A; B: 42.5 dBm 10 Hz – Power level and Frequency error for AIS Channel B; 33°28.85 E (for example); 44°35.33 N – the AIS station's coordinates; ↓↑ <AIS-A> – saved data type is AIS Class A station.
--	--

Pr:47 12:59 23/07/18 ID 5 413000333 CS: default Name: MARIA ↓↑ <AIS-A>	SECOND SCREEN: Pr: 47 – profile number (continued); ID 5 – data from AIS Message 5 (Static data); CS: default – Call Sign is default value; Name: MARIA – Ship’s Name is MARIA (for example); ↓↑ <AIS-A> – saved data type is AIS Class A station.
Pr:47 12:59 23/07/18 DSC: OK NMEA: n/a Ship emul: n/a ↓↑ <AIS-A>	THIRD SCREEN: Pr: 47 – profile number (continued); DSC: OK – DSC request confirmed successfully; NMEA: n/a – NMEA interface – not applicable because it is not connected; Ship emul: n/a – Ship emulation – not applicable because there is no feedback from the AIS station under test (NMEA is not connected); ↓↑ <AIS-A> – saved data type is AIS Class A station.

An example of saved test results of an EPIRB:

Pr:14 14:18 08/10/18 406 data: Freq: 406025662 Hz Pow: 41.44 dBm FFFD053F4186186 18668F5146D00000 9FD2 ↓↑ <EPIRB>	FIRST SCREEN: Pr: 14 – profile number (<i>as an example only</i>); 14:18 – measurement time; 08/10/18 – measurement date; And further all received parameters are displayed, you can toggle between the screens using buttons ▲ and ▼. 406 data: first and second screens show the parameters on channel 406MHz: Freq: 406025662 Hz – carrier frequency; FFFD053F4186186 – full information; 18668F5146D00000 in HEX; 9FD2 format.
--	---

Pr:14 14:18 08/10/18 406 data: TTT: 439.7 ms UNC: 160.1 ms Ph+: 62° Ph-: -64° ↓↑ <EPIRB>	SECOND SCREEN: TTT – Total Transmission Time; UNC – unmodulated carrier time; Ph+ , Ph- – phase deviation.
Pr:14 14:18 08/10/18 Sweep 121.5 MHz Freq: 121502000 Hz Pow: 4.5 dBm Fmod: 333 1234 Hz M: 98% ↓↑ <EPIRB>	THIRD SCREEN: Sweep 121.5 MHz - displays 121.5MHz signal parameters (if any): Freq – carrier frequency; Pow – power level; Fmod – frequency modulation; M – amplitude modulation depth.
Pr:14 14:18 08/10/18 Sweep 243 MHz NO DATA ↓↑ <EPIRB>	FOURTH SCREEN: Sweep 243 MHz - displays 243MHz signal parameters, if any.

7 SETTINGS

This menu item allows adjusting general tester settings.

All settings are stored in nonvolatile memory and will remain after tester is turned off.

<pre> ===== SETTINGS ===== Edit MMSI SHIP ID Test config LCD contrast Setup date/time Clear profiles General info U-battery Self test </pre>	This menu contains the following submenus: Edit MMSI – editing MMSI to/from; SHIP ID – add ship ID marker; Test config: select the measurement configuration; LCD contrast – LCD contrast adjustment; Setup date/time – date/time, date format setup; Clear profiles – clear profiles menu; General info – firmware / hardware and activated function revision; U-battery – internal Li-Ion battery voltage; Self test – self test of NGT-200 tester.
---	---

7.1 SETTINGS > EDIT MMSI

You can check the current MMSI number of device under test and of the Tester in this menu. You can either accept the current number or enter a new MMSI, if required. Press , ,  and  to move the cursor and ,  keys to change the value. Or simply use numeric keys to input the MMSI number. The data will be saved automatically by exiting the menu.

<pre> === Edit MMSI === To: 413999333 From: 413999997 F2 - Clear 'To' </pre>	To : 413999333 – MMSI number of DUT; From: 413999997 –MMSI number of NGT-200 tester. Press F2 to clear MMSI number of DUT.
---	--

7.2 SETTINGS > SHIP ID

SHIP ID: this option allows set up additional parameter on start of operation with Tester – SHIP ID. With help of this parameter one can collect all saved results of all equipment on a vessel (*i.e. VHF radio station with DSC, MF/HF radio station, several portable VHF radio stations, NAVTEX receiver etc.*) in one group. This will make the report creating procedure easier. Please turn your attention that managing

the results on the computer with software for NGT-200 one may find and group all test results of all equipment on the vessel using vessel's MMSI number.

BUT! As portable VHF radio stations and NAVTEX receiver don't have MMSI number the test results of these devices cannot be grouped by MMSI code. Thus, Ship ID is the only marker that will allow group test results of all the equipment on the vessel. True to say Ship ID is a measurement group label making usage more convenient.

== Select SHIP == Current SHIP: 37 New SHIP - Ent Keep current - F1 Set other - F2 No SHIP - Esc Show on start--> D	Current SHIP: 37 (example) – current ship number; <i>the ship number is NOT incremented automatically!</i> New SHIP - Ent – press Enter to add new ship with the sequent ship number; Keep current - F1 – press F1 to keep the current ship number, when you continue inspecting the same vessel; Set other - F2 – press F2 to set other ship number (not current number and not the sequent number); one can set any number, for example if you need to check more equipment on the vessel you've inspected before; No SHIP - Esc – press Esc to not use the option “SHIP number”; Show on start--> D(Disable) or E(Enable); this option allows to show or hide this menu on the start before entering main menu.
---	---

7.3 SETTINGS > Test config

<pre> == Test config == > VHF config MFHF config dBm/W - W F2 </pre>	In this menu you can set up the measurement configuration for VHF channels and for MF/HF channels separately: VHF config – submenu for VHF frequencies; MFHF config – submenu for MF/HF frequencies; dBm/W - W F2 – press F2 to toggle between Power level units dBm and Watt;
<pre> == Test config == VHF Direct >VHF Pow. Sensor VHF Att. Ext VHF Antenna ext Att: 40.0 dB </pre>	Select the power configuration for VHF measurements by pressing buttons ▼ and ▲. In result, during the tests the selected configuration will be displayed on the screen with help of symbols: D – direct connection S – power sensor and VSWR meter A – external attenuator ¥ – antenna ext Att: 40.0 dB – Here one can also input attenuation meaning of external VHF attenuator (if you use one) with help of numeric keys. To exit menu press Esc, selected configuration will be saved automatically. More details can be found in Item 9.

<pre> == Test config == >MFHF Direct MFHF Att. Ext MFHF Antenna ext Att: 40.0 dB </pre>	Select the power configuration for MF/HF measurements by pressing  and  keys. In result, during the tests the selected configuration will be displayed on the screen with help of symbols: D – direct connection A – external attenuator ¥ – antenna ext Att: 40.0 dB – Here one can also input attenuation meaning of external attenuator with help of numeric keys. To exit menu press , selected configuration will be saved automatically. Detailed information about how to select a proper configuration of power measurement can be found in Item 9.
---	---

7.4 SETTINGS > LCD contrast

<pre> == LCD contrast == <+>: +1 <->: -1 F2 key - default 23 </pre>	The display contrast is adjusted by pressing ,  keys; Return to default meaning (20) by pressing  key. 23 – current contrast meaning.
--	--

Display Backlight

The display backlight can be switched on/off by help of  /  buttons, but it can be done only in MAIN menu and on logo screen.

7.5 SETTINGS > Setup date/time

=Setup Date/Time = DD/MM/YYYY EUR. 13/05/2021 10:38:00 Change format - F2 Save - Enter	Date and time can be setup here. Date format is also selected in this menu. Use buttons ◀ ▶ ▼ ▲ to navigate the menu. DD/MM/YYYY EUR. – date format, can be selected between American and European; press F2 to change format; 13/05/2021 – date, use ▼ ▲ keys to adjust the date; 10:38:00 – time; use ▼ ▲ keys to adjust the time.
--	--

7.6 SETTINGS > Clear profiles

= Clear profiles = < > 3 Clear profile - F2 Clear all - F1	In this menu one can delete selected profile or all profiles. < > 3 : use buttons ◀ ▶ to select profile that you need to delete and press F2 key. To clear all profiles press F1.
---	--

7.7 SETTINGS > General info

== General info == Firmware - 1.89 AB Hardware - 1.01 Function - 4.00 Calibr. exp: 05/23 Manufact: 02/21	In this menu one can identify current firmware version, hardware version and activated Tester's Function. Calibr. Exp: 05/23 (for example) – date of next calibration; Manufact: 02/21 (for example) – manufacturing date.
---	---

7.8 SETTINGS > U battery

The measured voltage meaning of current power supply source is displayed on LCD:

= Battery voltage = 3.99 V Measure - ENTER	- Voltage of internal batteries, if nothing is connected to USB port; - Voltage supplied to USB-port, if it's connected to PC or network USB-adapter. Tester is automatically switched to USB power supply source when connected! Each pressing of Enter key will measure the voltage again.
---	--

7.9 SETTINGS > Self test

This menu item allows doing the self test of NGT-200. Press **Enter** key to start the test. The example of the test result is shown as below:

=== Self test ===

RAM :

EEPROM :

Flash :

PLL-LD :

RF TX-RX:

Start - ENTER

=== Self test ===

RAM : OK

EEPROM : OK

FLASH : 0X5C7D

PLL-LD : OK

RF TX-RX: OK

Start - ENTER

8 TECHNICAL SPECIFICATIONS

8.1 Technical specifications in transmitting mode

8.1.1 Operational frequencies range:

MF/HF channel 0.4 – 30 MHz

VHF channel 118 – 275 MHz

8.1.2 Frequency step:

MF/HF channel 0.001 kHz

VHF channel 1 kHz

8.1.3 Frequency accuracy at +20°C and during two years after calibration:

$< \pm 0.3 \cdot 10^{-6}$

8.1.4 Frequency accuracy in operational temperature range: $< \pm 1 \cdot 10^{-6}$

8.1.5 Max output level: 0 dBm $\pm$ 1 dB

8.1.6 Min output level: -93 dBm $\pm$ 3 dB

8.1.7 Output level step: 1.0 dB $\pm$ 0.3 dB

8.1.8 Output level in Test AIS mode: 0 dBm $\pm$ 1 dB (on the RF IN/OUT connector).

8.2 Technical specifications of measuring receiver

8.2.1 Max signal level on **RF IN/OUT**: not more than 20 dBm or 100 mW

8.2.2 Attenuation range of input signal by internal attenuator: 93dB

8.2.3 Input signal operational range on **RF IN/OUT**: from -90 dBm to -20 dBm

8.2.4 Operational frequencies range:

MF/HF band 0.4 – 30 MHz

VHF band 118 – 275 MHz

8.2.5 Frequency step:

MF/HF band 0.1 kHz

VHF band 1.0 kHz

8.2.6 Frequency bandwidth on BW_{-3dB}, dB :

MF/HF Receive DSC and NAVTEX 300 $\pm$ 50 Hz

MF/HF Receiver 3000 $\pm$ 70 Hz

VHF band (all modes) 12.0 $\pm$ 0.3 kHz

8.3 Technical specifications of VHF Power sensor SWR-meter VHFPS1

8.3.1 Max allowed input power level: 60W

8.3.2 Operational frequency range: 30 – 410 MHz

8.3.3 Insertion attenuation between RF-IN and NGT-200-Output: 63 dB

9 RECOMMENDED TESTING PROCEDURES

9.1 Typical setup of equipment connection for testing

9.1.1 Testing of VHF radio stations with DSC through vessel's antenna

SETTINGS / Test config : "S" – Power sensor;

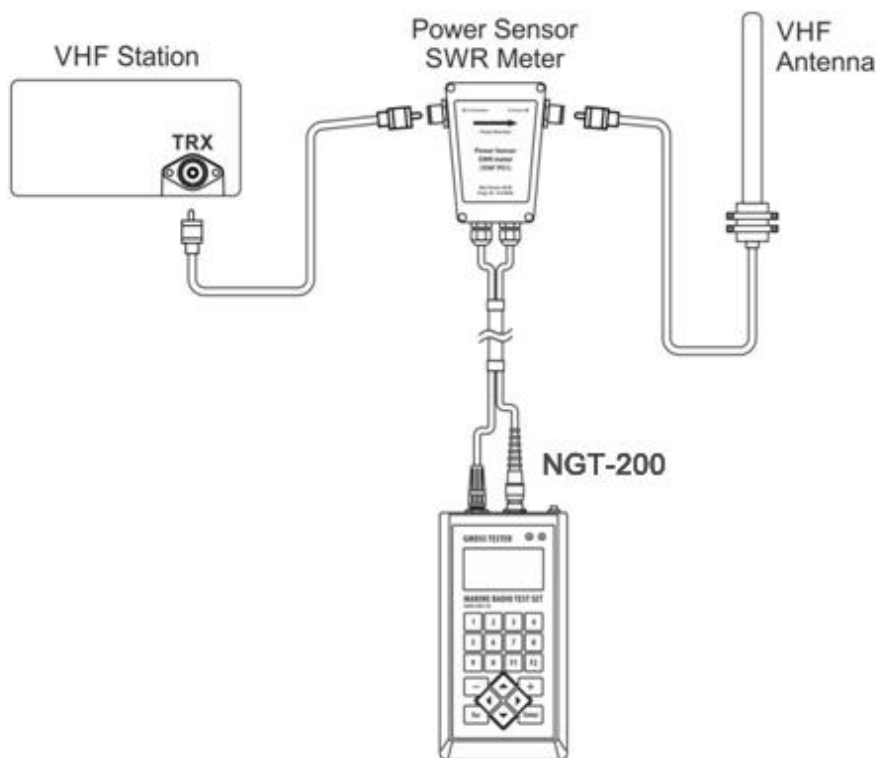


Fig. 9.1 Connection setup of NGT-200 for testing the VHF radio station with DSC through vessel's antenna

Tester automatically detects connected VHF Power sensor SWR meter, thus there is no need to set up configuration in menu: **SETTINGS > Test config**.

This setup allows to test with the most accuracy the output power level of transmitter and the SWR of antenna feeder in real circumstances on the vessel. Besides the transmitter, antenna and antenna feeder route are checked as well.

Due to transmitted signal is sent by antenna in broadcast and can be accepted in radius of tens of nautical miles, this setup has to be used with precaution – carry out testing on channels 6, 9, 13 and 16 as fast as possible.

It is absolutely forbidden send *DISTRESS* signal in this setup (fig. 9.1)!

To check DSC messages transmission to antenna use **Individual Call – Test** or **Routine**.

9.1.2 Testing of VHF radio stations with DSC through external attenuator or an equivalent load

SETTINGS / Test config : “S” – Power sensor;

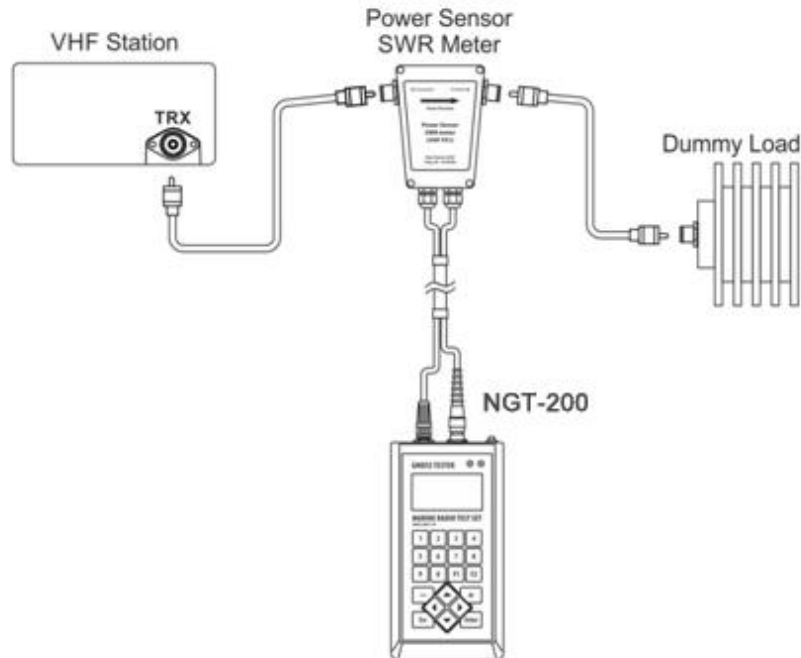


Fig. 9.2 NGT-200 connection setup for testing VHF radio station with DSC through the external attenuator or an equivalent load.

The given setup uses attenuator of high power level or another equivalent load. Signal isn't emitted to antenna or broadcast which allows sending the **DISTRESS** signal.

But anyway this checking must be carried out with precautions to avoid false distress alert!

Tester automatically detects connected *VHF Power sensor SWR meter*, thus there is no need to set up configuration in menu: **SETTINGS > Test config**.

Setup allows checking both transmitting and receiving channels. Attenuation from VHF Power sensor SWR meter input to Tester IN/OUT is 63dB and it's automatically taken into account during conductive measurements of power level of transmitter and during conductive measurements of receiver response level.

* conductive measurements – measurements done by direct connection of equipment by means of RF-cable.

9.1.3 Testing of mobile duplex VHF radio stations

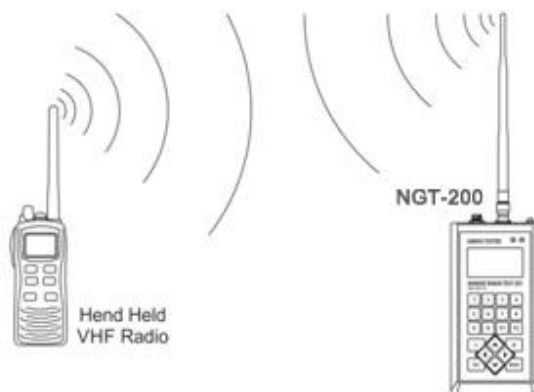


Fig. 9.3 Connection configuration of NGT-200 for testing mobile duplex VHF radio station.

Select **“VHF Antenna”** configuration in menu **SETTINGS > Test config > VHF config**. This configuration is used to measure received signal level (RSSI), calibrated in dBm at the Tester’s RF IN/OUT.

Power level of radio station under test can be only estimated as it depends on a number of the factors: on distance and position of the Tester and the radio station; on surrounding objects – their forms, composition, their relative position, etc. Nevertheless, in fixed test circumstances one can estimate rather precise the condition of radio station under test.

9.1.4 Testing of MF/HF radio stations with DSC including power level measuring

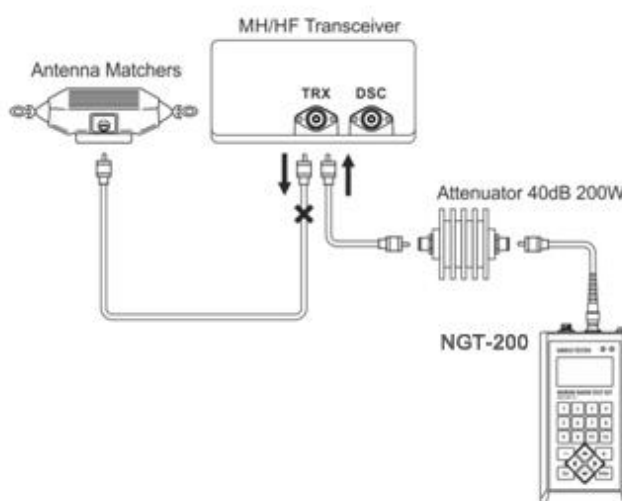


Fig. 9.4 Configuration of connection NGT-200 for MF/HF radio station with DSC testing and power level of transmitter measuring.

Select configuration “**MFHF Att. ext**” (*External Attenuator*) in menu **SETTINGS** > **Test config** > **MFHF config**. Configuration allows to measure the output power level of transmitter can be measured with taking into account attenuation value of external attenuator. Attenuation value set up by default is 40dB. Fixed Attenuator 40dB, 250W is supplied optionally.

Note 1: while measuring power level of MF/HF radio station in SSB-mode please use audio-frequency oscillator, for example 1kHz, or say loudly “A” into radio station’s microphone. Otherwise power level measurements will be incorrect.

Note 2: this configuration is false-distress-safe while testing the receiving route of MF/HF radio stations, because even in case of accidental sending of signal, signal power level on Tester’s input will not surpass maximum permitted limit.

Please avoid direct connection of RF IN/OUT to antenna of the station under test, this may cause permanent damage to the Tester!

9.1.5 Testing of MF/HF radio stations with DSC through vessel’s antenna

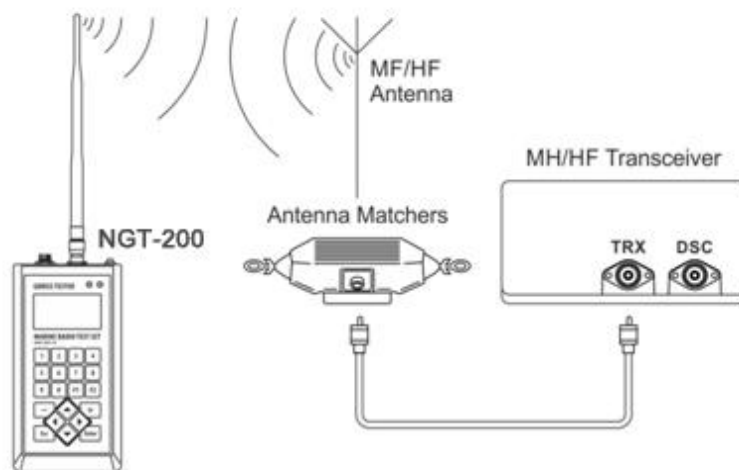


Fig. 9.5 Configuration of connection NGT-200 for testing MF/HF radio station with DSC through vessel’s antenna

Select configuration “**MF/HF Antenna**” in menu **SETTINGS** > **Test config**. Power level of radio station under test can be only estimated as it depends on a number of the factors: on distance and position of the Tester and the radio station; on surrounding objects – their forms, composition, relative position, etc. For testing of MF/HF radio station in this configuration, it is recommended to pull out the telescopic antenna to the maximum length.

9.1.6 Testing of DSC Watch receiver of radio stations

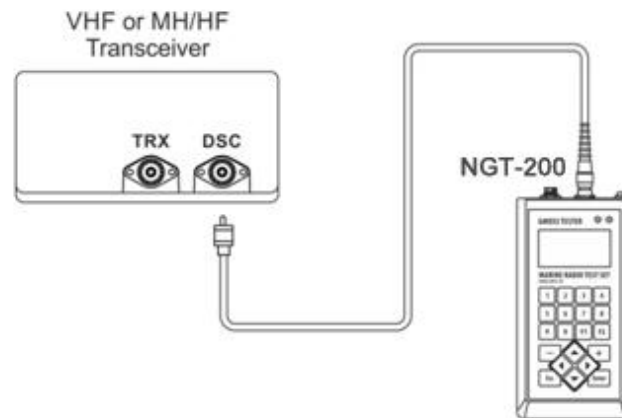


Fig. 9.6 Configuration of connection NGT-200 for testing DSC Watch receiver of radio station with DSC

Select configuration “**VHF direct**” in menu **SETTINGS > Test config> VHF config** if you are testing VHF Transceiver or select “**MF/HF direct**” in menu **SETTINGS > Test config> MFHF config** if you are testing MF/HF one.

This configuration is used to check DSC Watch receiver and DSC controller of VHF or MF/HF Radio stations.

9.2 Table of configurations and modes

Transmitter route check			Measurement			
Config.	Band	Mode	Power level	SWR	Frequency	Target
Fig.9.1	VHF	DSC / TEST signal	yes	yes	yes	Radio st. w/DSC
Fig.9.2	VHF	DSC / DISTRESS signal	yes	yes	yes	Radio st. w/DSC
Fig.9.3	VHF	Telephony	estimate	no	yes	Mobile radio st.
Fig.9.4	MF/HF	DSC / TEST signal	yes	no	yes	Radio st. w/DSC
Fig.9.4	MF/HF	DSC / DISTRESS signal	yes	no	yes	Radio st. w/DSC
Fig.9.5	MF/HF	DSC / TEST signal	estimate	no	yes	Radio st. w/DSC

Receiver route check			Measurement	
Config.	Band	Mode	Output level, dBm	Target
Fig.9.1	VHF	DSC signals receive	-63 ... -130 (1)	Radio stations w/DSC
Fig.9.2	VHF	DSC signals receive	-63 ... -130 (1)	Radio stations w/DSC
Fig.9.3	VHF	Telephony	0 ... -93 (2)	Mobile radio stations
Fig.9.4	MF/HF	DSC signals receive	-40 ... -103 (3)	Radio stations w/DSC
Fig.9.5	MF/HF	DSC signals receive	0 ... -93 (2)	Radio stations w/DSC

1 – signal level on input of DUT with attenuation in VHFPS1;

2 – signal level sent to Tester's antenna;

3 – signal level at radio station's input with attenuation in external attenuator (40dB).

9.3 Step-by-step plan of checking of VHF radio station with DSC

Step 1: connect Tester and Power sensor SWR meter according to fig.9.1 or fig.9.2.

Step 2: select measurement mode: **Test VHF > Receive DSC**; Att: 00 dB.

Step 3: send test DSC message from radio station under test (DUT).

Step 4: check correctness of received DSC message and measured parameters; save results in offered memory slot (for example profile No. 5) by pressing **F2** key.

Step 5: select measurement mode: **Test VHF > VHF Receiver FM**; select channel CH-06 and start measurement by pressing **Enter**.

Step 6: select channel CH-06 and press PTT (push to talk) on device under test; You will see measured of frequency, power level and frequency deviation on Tester's screen. With PTT (push to talk) pressed save measured results by pressing **Esc**.

Step 7: save measurement results on channel 6, by pressing **Enter**; on screen you will see menu with profile number to save results – 6 (next empty profile), but for saving all measurement results of one radio station it is recommended to select the same profile number used for saving DSC measurement before (in our example it's No. 5).

Repeat randomly Steps 5 -7 for channels 09, 13, 16. Consequently, all measurement results of one radio station on channels 06, 09, 13 and 16 will be saved in profile No.5. This will allow you to make and print Test Report.

Note. Testing of radio stations with DSC on channels 70 (DSC), 06, 09, 13, 16 is regulated by requirements of International Maritime Registry (IMO).

9.4 Step-by-step plan of checking the duplex VHF radio station

Testing of duplex VHF radio station mainly the same as for VHF Radios with DSC (Item 9.3). Due to absence in such radio stations DSC, start measurements from the Step 5 and all results save in a next free profile number.

Step 1: connect Tester and Power sensor SWR meter according to fig.9.1 or fig.9.2 or make measurement trough broadcast as shown on fig. 9.3.

Step 2: select measurement mode: **Test VHF > VHF Receiver FM**; select channel CH-06 and start measurement by pressing **Enter**.

Step 3: select channel CH-06 and press PTT (push to talk) on device under test; You will see measured of frequency, power level and frequency deviation on Tester's screen. With PTT (push to talk) pressed save measured results by pressing **Esc**.

Step 4: save measurement results on channel 06, by pressing **Enter**; on screen you will see menu with profile number to save results – 7 (next empty profile), but for saving all measurement results of one radio station it is recommended to select the same profile number used for saving DSC measurement before (in our example it's No. 6).

Repeat randomly Steps 2 -4 for channels 09, 13, 16. Consequently, all measurement results of one radio station on channels 06, 09, 13 and 16 will be saved in the same profile (*as in example – prof. No.6*). This will allow you to make and print Test Report.

9.5. Measurement of AIS station or AIS-SART parameters

9.5.1 General notes of AIS testing

In this section is described logical operation and criteria set, which are to use during the checking AIS station A and B classes. They are based upon IMO / IALA recommended guideline – so, only in this case user can get single-valued and unambiguous results while using the GMDSS Tester NGT-200.

By the primary testing of the just mounted station make sure that AIS equipment is installed in proper way according to this guidance and manufacturer demands to get the successful operation of the AIS.

One of the important AIS aspects is its mobility. Together with requesting some certain operation of NGT-200 Tester (**which is expected operation**), AIS carries out an action, according to AIS protocol of current navigation circumstances (**which are unexpected operation**).

9.5.2 AIS Stations test procedure

9.5.2.1 Test Configuration or Test Setup

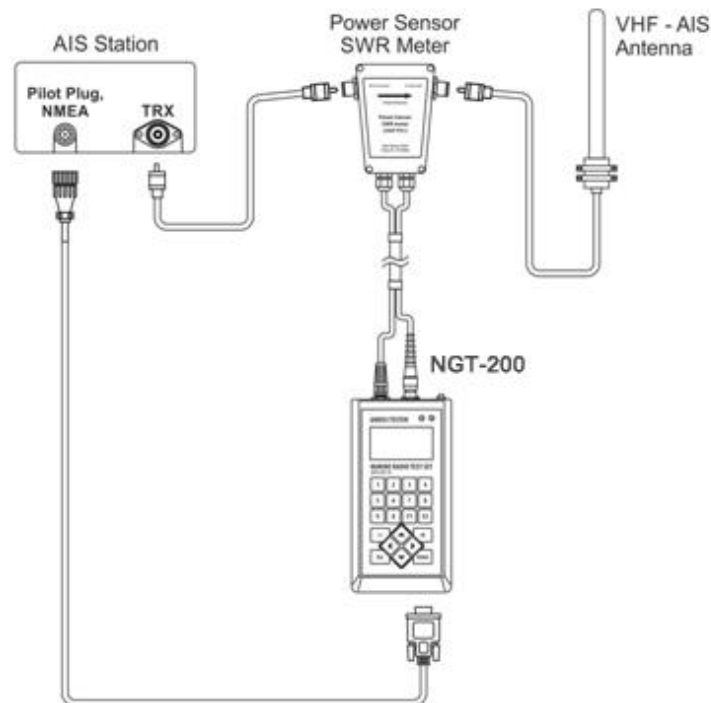


Fig. 9.7 Connection setup of NGT-200 for testing AIS station Class A/B through the vessel's antenna

9.5.2.2 Step-by-step plan of checking the AIS station (Class A or Class B)

Use the **TEST VHF / TEST AIS** menu section to do all the checking!

Step 1 -----

Enter **TEST AIS / TEST AIS CLASS A** or **TEST AIS / TEST AIS CLASS B** Menu depending on AIS station under test.

In common AIS station A class is to transfer location report – message 1 at about 10 seconds interval, alternating A and B channels, and AIS station class B – message 18 with about 3 minutes interval, alternating A and B channels. Besides, the station has to transfer static information – message 5(Class A) and message 24a/24b(class B) at about 6 minutes interval, also alternating A and B channels.

For each of the received messages the tester DSP controller calculates the deviation of the frequency (frequency error) and power level;

The operation algorithm in this case is as follows:

- a) Tester performs slot synchronization, measures power level of received signals and frequency deviation.
- b) Tester transmits the request to AIS station for message 5 (In TEST AIS/TEST AIS Class A mode) and for message 24 (In TEST AIS/TEST AIS Class B mode) in one minute.
- c) After the message 5 or message 24 is received by tester the tester transmits the “virtual ship” message with increased relatively to AIS station coordinates on 0.1 nautical mile and with MMSI 413999998.
- d) After all these operations the status bar will be completed and tester will ask to save the data by pressing F2 key for further processing.
- e) Tester sends the request 111 in CH70 – **“Report ship’s name”** in TEST AIS/Test AIS Class A mode and waits for 20 seconds for AIS Station respond, if the respond is received, the DSC note will be displayed on line 6.

Data processing is shown on the screen in sixth line by means of four-cells line. Each status bar item corresponds to the following information:

- 1 - Channel A (161.975 MHz) power output and frequency;
- 2 - Channel B (162.025 MHz) power output and frequency;
- 3 - Message 1 or Message 18 - transient data, transferred according to the station inner time schedule;
- 4 - Message 5 or Message 24 – static vessel’s data.

The result of “virtual ship” message transmitting will be displayed in AIS station LCD in view of new vessel with MMSI 413999998.

As a rule the AIS stations has LED indicators of signal transmission (Tx) or reception (Rx). So, it is necessary to pay attention to these LEDs during checking. Each Tx LED illumination should be confirmed by short sound signal and LCD data update in **TEST AIS/Test AIS class A** or **TEST AIS/Test AIS class B** modes. The signal transmission by tester is followed by sound signal too and AIS station Rx LED should illuminate.

If the “virtual ship” message is not received by AIS station, no new vessel with MMSI 413999998 is appeared on AIS station screen, it is necessary to repeat the request from TEST AIS/ Ship emulation menu, as described in STEP 2. If the “virtual ship” message is received the next operation step is 3.

Step 2 -----

Choose the <TEST AIS/Ship emulation> menu item and select the channel, for example – Channel A.

Press **Enter** two times – after the sound signal the message 1 with MMSI 413999998 and increased relatively to AIS station coordinates on 0.1 nautical mile will be sent in 2-4 seconds.

As a result the “virtual ship” / object with MMSI 413999998 should appear on AIS station LCD screen (MKD).

It will confirm the following:

1. The tested AIS station is able to receive the VDL messages in selected channel;
2. The tested AIS station has correctly connected MKD.

Step 3 -----

The next step is intended only for AIS station class A – checking of DSC channel polling information on 70 channel.

Enter **Polling DSC** menu section and press **Enter** twice.

After a sound signal the tester will transfer request 111 – “**Report ship’s name**” and AIS station should respond in 20 seconds. All the requested information will appear on the screen.

If there’s no respond from the station user can see the following: **No respond** - no respond from the tested station.

NOTE: The last ITU-R M.1371-5 review, as opposed to previous reviews, supposes the DSC-channel usage only to control the regional AIS station channels. The respond to DSC requests is not supported.

9.5.3 AIS-SART test procedure

Almost all AIS-SARTs have internal antenna, so we recommend to carry out the measurement through broadcast, by means of antenna.

Connect the Tester's antenna to RF IN input of the tester. Go to **TEST AIS/TEST AIS SART** menu and enter manually the AIS-SART USER ID – it should be marked on the AIS-SART case. Now tester is ready to start measurements.

Turn on the AIS-SART to test mode and place it at 3-5 meters from tester approximately at the same level corresponding to tester or a little bit lower.

Please note that it can take up to 15 minutes before AIS-SART starts transmission of test messages. It depends on the AIS-SART capability to determine the coordinates fast by means of internal GPS receiver.

Most general it will require about 5 minutes if the GPS receiver can't determine the coordinates (closed room) and 2-3 minutes if the GPS receiver determines the coordinates (test in open places).

The AIS SART test signal in accordance with IEC 61097-14 consists of 8 messages transmitted in determined order both in A and B channels (4 messages in every channel):

1. AIS A, Msg 14 "SART TEST"
2. AIS B, Msg1
3. AIS A, Msg1
4. AIS B, Msg1
5. AIS A, Msg1
6. AIS B, Msg1
7. AIS A, Msg1
8. AIS B, Msg 14 "SART TEST"

Note that it is permissible to start the sequence on AIS B.

IMPORTANT: DO NOT TURN ON THE AIS-SART TO EMERGENCY MODE WITHOUT REAL NECESSITY!

10 TESTER'S CALIBRATION

The tester is a complex special-use electric device. Thus only authorized laboratories by means of specialized equipment should calibrate it.

The tester should be calibrated every two years.

11 ENVIRONMENTAL AND MAINTENANCE GUIDELINE

The device should be stored in package in warehouse locations defending it from atmospheric precipitation, fumes of acid, alkali and other aggressive substances.

Temperature in warehouse should be from 278 K (5°C) up to 313 K (about 40°C) and relative humidity of air no more than 80%.

It is necessary to keep the device in package for three hours minimum at normal conditions after it was at temperature variations.

After storage in conditions of high humidity keep the Tester in package at normal conditions for at least 12 hours before turning ON.

The tester is designed to operate in range of + 0° C to + 45° C external environments and 95% relative humidity which is connected with LCD display implementation.

Before operating with the Tester please read this user's manual, and attend safety training.

12 POWER SUPPLY

The tester can be power supplied by internal Li-Ion accumulator (2000mA*h, 3.7V), as well as by external direct current source with approximate voltage 4.5...7V and current load not less than 500mA connected to micro-USB input of the tester by means of standard connector (e.g. of PC USB connector or network USB adaptor).

Once external power source is connected – the Tester is charging, no difference if it turned ON or OFF.

If the Tester's accumulator is discharged, connected external power source will give the drain to the Tester operation, charging of accumulator is effected residually.

Maximum current consumption from external power source is 500mA, which is determined by charging controller.

Charging time makes 4.5 – 5 hours for fully discharged accumulator.

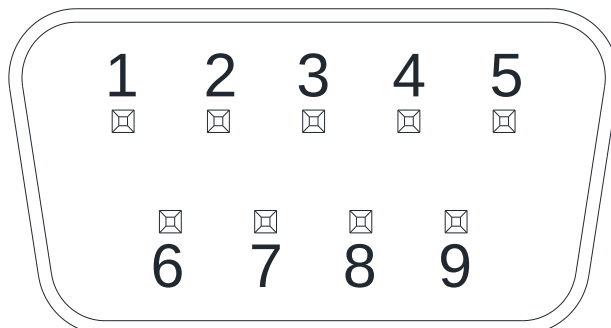
Appendix 1

UNIT CONVERSION (dBm to W)

dBm	0	0,1	0,2	0,3	0,4	0,5	0,6	0,7	0,8	0,9
30	1,00	1,02	1,05	1,07	1,10	1,12	1,15	1,17	1,20	1,23
31	1,26	1,29	1,32	1,35	1,38	1,41	1,45	1,48	1,51	1,55
32	1,58	1,62	1,66	1,70	1,74	1,78	1,82	1,86	1,91	1,95
33	2,00	2,04	2,09	2,14	2,19	2,24	2,29	2,34	2,40	2,45
34	2,51	2,57	2,63	2,69	2,75	2,82	2,88	2,95	3,02	3,09
35	3,16	3,24	3,31	3,39	3,47	3,55	3,63	3,72	3,80	3,89
36	3,98	4,07	4,17	4,27	4,37	4,47	4,57	4,68	4,79	4,90
37	5,01	5,13	5,25	5,37	5,50	5,62	5,75	5,89	6,03	6,17
38	6,31	6,46	6,61	6,76	6,92	7,08	7,24	7,41	7,59	7,76
39	7,94	8,13	8,32	8,51	8,71	8,91	9,12	9,33	9,55	9,77
40	10,00	10,23	10,47	10,72	10,96	11,22	11,48	11,75	12,02	12,30
41	12,59	12,88	13,18	13,49	13,80	14,13	14,45	14,79	15,14	15,49
42	15,85	16,22	16,60	16,98	17,38	17,78	18,20	18,62	19,05	19,50
43	19,95	20,42	20,89	21,38	21,88	22,39	22,91	23,44	23,99	24,55
44	25,12	25,70	26,30	26,92	27,54	28,18	28,84	29,51	30,20	30,90
45	31,62	32,36	33,11	33,88	34,67	35,48	36,31	37,15	38,02	38,90
46	39,81	40,74	41,69	42,66	43,65	44,67	45,71	46,77	47,86	48,98
47	50,12	51,29	52,48	53,70	54,95	56,23	57,54	58,88	60,26	61,66
48	63,10	64,57	66,07	67,61	69,18	70,79	72,44	74,13	75,86	77,62
49	79,43	81,28	83,18	85,11	87,10	89,13	91,20	93,33	95,50	97,72
50	100,0	102,3	104,7	107,2	109,6	112,2	114,8	117,5	120,2	123,0
51	125,9	128,8	131,8	134,9	138,0	141,3	144,5	147,9	151,4	154,9
52	158,5	162,2	166,0	169,8	173,8	177,8	182,0	186,2	190,5	195,0
53	199,5	204,2	208,9	213,8	218,8	223,9	229,1	234,4	239,9	245,5
54	251,2	257,0	263,0	269,2	275,4	281,8	288,4	295,1	302,0	309,0
55	316,2	323,6	331,1	338,8	346,7	354,8	363,1	371,5	380,2	389,0
56	398,1	407,4	416,9	426,6	436,5	446,7	457,1	467,7	478,6	489,8
57	501,2	512,9	524,8	537,0	549,5	562,3	575,4	588,8	602,6	616,6
58	631,0	645,7	660,7	676,1	691,8	707,9	724,4	741,3	758,6	776,2
59	794,3	812,8	831,8	851,1	871,0	891,3	912,0	933,3	955,0	977,2

Appendix 2

SIGNALS PLACING ON RS232/RS422 IN/OUT OUTLET



№ connector pin RS232/RS422 IN/OUT on NGT-200 (connector pin type DSUB 9 male)	Type of signal sent to outlet	While connecting to external equipment connect to
1	Not connected	Don't connect
2	RS232 RX	RX232 Tx
3	RS232 TX	RX232 Rx
4	Not connected	Don't connect
5	GND	GND
6	RS485/422 TxA	RS485/422 RxA
7	RS485/422 TxB	RS485/422 RxB
8	RS485/422 RxB	RS485/422 TxB
9	RS485/422 RxA	RS485/422 TxA