RST-430 RADIO-COMMUNICATION SERVICE TESTER

Operating Manual
RE 26.51.44-008-86866068-2017

Novosibirsk city
2017
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This document, “RST-430 Radio-Communication Service Tester. Operating Manual” (hereinafter the Manual) is applied to the RST-430 Radio-Communication Service Tester (hereinafter the Tester) and intended for familiarizing the operating personnel with principles of operation, design, operation rules and basic methods for measuring parameters of radio stations.

This Manual contains the basic technical data, description of the Tester operation and design, instructions necessary for correct and safe operation of the product (intended use), maintenance, routine repairs, storage and transportation, assessment of its technical condition when determining necessity for repair, as well as information on disposal of the Tester and its components.

Persons who have gone through safety training and have studied this Manual are allowed to operate the Tester.
1 Description and operation

1.1 Tester description and operation

1.1.1 Purpose

1.1.1.1 RST-430 TU 26.51.44-008-86866068-2017 Tester is designed for maintenance and repair of AM and FM radio communication stations (receivers) for various purposes in stationary or mobile laboratories (workshops).

The Tester can be used for tuning, monitoring and testing of radio stations during their release from production.

1.1.1.2 The Tester is designed for operation in climatic conditions corresponding to Group 2 of GOST 22261.

1.1.1.3 Operating conditions:
- ambient temperature, °C 10 - 35;
- relative humidity at 25 °C temperature, % 40-90;
- atmospheric pressure, kPa (mm Hg) 84 – 106,7; (630-800).

1.1.2 Specifications (features)

1.1.2.1. Power supply of the Tester is DC source with voltage from 10 to 15 V.

1.1.2.2 Climatic design of the Tester is UKhL4.2 in accordance with GOST 15150.

1.1.2.3. The Tester design meets:
- safety requirements in accordance with GOST 22261;
- Ingress protection rating of the Tester - IP40 in accordance with GOST 14254.
- electrical safety requirements in accordance with GOST 12.2.091;
- fire safety requirements in accordance with GOST 12.1.004;
- electromagnetic compatibility requirements in accordance with GOST 30804.4.2, GOST 30804.4.4, GOST 30804.6.2, GOST R 51317.4.6.

1.1.2.5 The Tester is subject to primary and other types of verification, like any measuring instrument.

1.1.2.6 Metrological and main specifications of the Tester are given in Tables 1.1 and 1.2.

Table 1.1 – Metrological specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Setting range of HF output signal frequency, MHz</td>
<td>0.1 to 470</td>
</tr>
<tr>
<td>Setting increment of minimal HF output signal frequency, kHz</td>
<td>1</td>
</tr>
<tr>
<td>Permissible relative basic error limit of setting HF output signal frequency, %</td>
<td>± 3·10^-4</td>
</tr>
<tr>
<td>Setting range of HF output level at load of 50 ± 0.5 Ohm, in frequency</td>
<td>from - 27 to –</td>
</tr>
<tr>
<td>Specification</td>
<td>Value</td>
</tr>
<tr>
<td>------------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td>range from 1.6 to 470 MHz, dBm (mV)</td>
<td>126 (0.11·10^{-3} to 9.99)</td>
</tr>
<tr>
<td>Setting increment of minimal HF signal output level, dB (μV)</td>
<td>1 (0.01)</td>
</tr>
<tr>
<td>Permissible absolute error limit of setting HF signal output level in</td>
<td>± 4</td>
</tr>
<tr>
<td>frequency range from 1.6 to 470 MHz, dB</td>
<td></td>
</tr>
<tr>
<td>In frequency range of output HF signal from 0.1 to 1.599 MHz</td>
<td>not standardized</td>
</tr>
<tr>
<td>Setting range of frequency deviation for HF signals at FM, kHz</td>
<td>0.2 to 20</td>
</tr>
<tr>
<td>Setting step of minimal HF signals frequency deviation, kHz</td>
<td>0.1</td>
</tr>
<tr>
<td>FM modulating frequency range of HF output signal, kHz</td>
<td>0.02 to 20</td>
</tr>
<tr>
<td>Setting step of FM modulating frequency of minimal HF output signal, Hz</td>
<td>1</td>
</tr>
<tr>
<td>Permissible relative error limit of setting HF output signal frequency</td>
<td>± [5 + 5 (D_set/D_upper)]*</td>
</tr>
<tr>
<td>deviation in modulating frequency range from 0.1 to 10 kHz, %</td>
<td></td>
</tr>
<tr>
<td>In modulating frequency range from 0.02 to 0.099 kHz</td>
<td>not standardized</td>
</tr>
<tr>
<td>In modulating frequency range from 10.001 to 20 kHz</td>
<td>not standardized</td>
</tr>
<tr>
<td>Setting range of HF output signal AM coefficient, %</td>
<td>0 to 100</td>
</tr>
<tr>
<td>Setting step of minimal HF output signal AM coefficient, %</td>
<td>1</td>
</tr>
<tr>
<td>AM modulating frequency range of HF output signal, kHz</td>
<td>from 0.2 to 10</td>
</tr>
<tr>
<td>Permissible absolute error limit of setting HF output signal AM coefficient</td>
<td>± (1 + 0.07·M_set)**</td>
</tr>
<tr>
<td>in modulating frequency range from 0.2 to 10 kHz, %</td>
<td>not standardized</td>
</tr>
<tr>
<td>In modulating frequency range from 0.02 to 0.199 kHz,</td>
<td>not standardized</td>
</tr>
<tr>
<td>In modulating frequency range from 10.001 to 20 kHz</td>
<td>not standardized</td>
</tr>
<tr>
<td>Setting range of HF output signal frequency, kHz</td>
<td>0.02 to 20</td>
</tr>
<tr>
<td>Setting step of minimal HF output signal frequency, Hz</td>
<td>1</td>
</tr>
<tr>
<td>Permissible absolute basic error limit of setting HF output signal frequency</td>
<td>± 1</td>
</tr>
<tr>
<td>frequency, Hz</td>
<td></td>
</tr>
<tr>
<td>Setting range of HF signal output voltage, V</td>
<td>0.001 to 2</td>
</tr>
<tr>
<td>Setting step of minimal HF signal output voltage, mV</td>
<td>1</td>
</tr>
<tr>
<td>Permissible absolute error limit of setting HF signal output voltage in</td>
<td>± (0.02 + 0.05·V_set)**</td>
</tr>
<tr>
<td>voltage range from 0.02 to 2 V, in frequency range from 0.1 to 20 kHz, V</td>
<td></td>
</tr>
<tr>
<td>Specification</td>
<td>Value</td>
</tr>
<tr>
<td>-------------------------------------------------------------------------------</td>
<td>--------------------------------------------</td>
</tr>
<tr>
<td>In output voltage range from 0.001 to 0.0199 V</td>
<td>not standardized</td>
</tr>
<tr>
<td>In frequency range from 20 to 99.9 Hz</td>
<td>not standardized</td>
</tr>
<tr>
<td>Nonlinear-distortions factor (NDF) of HF signal output voltage, %, not over</td>
<td>1</td>
</tr>
<tr>
<td>Measurement range of HF input signal frequency, MHz</td>
<td>0.5 to 1000</td>
</tr>
<tr>
<td>Permissible relative error limit of measuring HF input signal frequency</td>
<td>±3·10⁻⁴</td>
</tr>
<tr>
<td>in range from 1.6 to 470 MHz, %</td>
<td></td>
</tr>
<tr>
<td>In frequency range from 0.5 to 1.599 MHz</td>
<td>not standardized</td>
</tr>
<tr>
<td>In frequency range from 470.001 to 1000 MHz</td>
<td>not standardized</td>
</tr>
<tr>
<td>Measurement range of HF input signal frequency deviation at FM, kHz</td>
<td>0.1 to 20</td>
</tr>
<tr>
<td>FM modulating frequency range of HF input signal, kHz</td>
<td>1 to 10</td>
</tr>
<tr>
<td>Permissible relative error limit of measuring HF input signal frequency</td>
<td>± [5 + 5 (D_{set}/D_{upper})]****</td>
</tr>
<tr>
<td>deviation, %</td>
<td></td>
</tr>
<tr>
<td>Measurement range of HF input signal AM coefficient, %</td>
<td>1 to 100</td>
</tr>
<tr>
<td>AM modulating frequency range of HF input signal, kHz</td>
<td>1 to 10</td>
</tr>
<tr>
<td>Permissible relative error limit of measuring HF input signal AM</td>
<td>±10</td>
</tr>
<tr>
<td>coefficient, %</td>
<td></td>
</tr>
<tr>
<td>Measurement range of HF input signal power in frequency band from 0.4</td>
<td>0.2 to 20</td>
</tr>
<tr>
<td>to 470 MHz, W</td>
<td></td>
</tr>
<tr>
<td>Permissible relative error limit of measuring HF input signal power, %</td>
<td>± [10 + (P_{upper} / P_{measure})]*****</td>
</tr>
<tr>
<td>Measurement range of LF input signal frequency, Hz</td>
<td>20 to 1·10⁵</td>
</tr>
<tr>
<td>Permissible absolute basic error limit of measuring LF input signal frequency</td>
<td>± 1</td>
</tr>
<tr>
<td>frequency, Hz</td>
<td></td>
</tr>
<tr>
<td>Measurement range of sinusoidal AC voltage of LF input signal in frequency</td>
<td>0.02 to 15</td>
</tr>
<tr>
<td>range from 0.02 to 20 kHz, V</td>
<td></td>
</tr>
<tr>
<td>Permissible relative error limit of measuring LF input signal AC voltage, %</td>
<td>±2</td>
</tr>
<tr>
<td>NDF measurement of LF input signal, %</td>
<td>1 to 100</td>
</tr>
<tr>
<td>Permissible absolute error limit of measuring LF input signal NDF, Hz in</td>
<td>± [1 + 0.1· NDF_{measure}]*****</td>
</tr>
<tr>
<td>range from 1 to 50 %</td>
<td></td>
</tr>
</tbody>
</table>

* - where D_{upper} = 20 kHz - the upper value of the frequency deviation setting range;  
D_{set} - set value of frequency deviation, kHz.  
** - where M_{set} is set value of amplitude modulation coefficient, %.  
*** - where V_{set} is set value of output voltage, V.  
**** - where D_{upper} = 20 kHz - upper value of frequency deviation measurement range;  
D_{measure} - measured value of frequency deviation, kHz.
Table 1.2 – Basic technical specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrical power specifications:</td>
<td></td>
</tr>
<tr>
<td>- DC voltage, V</td>
<td>10 to 15</td>
</tr>
<tr>
<td>Power consumption, W, not over</td>
<td>25</td>
</tr>
<tr>
<td>Continuous operation time, h/days</td>
<td>8</td>
</tr>
<tr>
<td>Average service life, years, at least</td>
<td>5</td>
</tr>
<tr>
<td>Mean time between failures, h, at least</td>
<td>10000</td>
</tr>
<tr>
<td>Weight without transport case, kg, not over</td>
<td>4</td>
</tr>
<tr>
<td>Complete package weight (in transport case), kg, not over</td>
<td>10</td>
</tr>
<tr>
<td>Overall dimensions, mm, not over</td>
<td></td>
</tr>
<tr>
<td>Device housing:</td>
<td></td>
</tr>
<tr>
<td>- height</td>
<td>155</td>
</tr>
<tr>
<td>- width</td>
<td>300</td>
</tr>
<tr>
<td>- length</td>
<td>165</td>
</tr>
<tr>
<td>Maximum amplitude of the portable handle from the housing surface</td>
<td>65</td>
</tr>
<tr>
<td>transport case</td>
<td></td>
</tr>
<tr>
<td>- height</td>
<td>410</td>
</tr>
<tr>
<td>- width</td>
<td>470</td>
</tr>
<tr>
<td>- length</td>
<td>220</td>
</tr>
</tbody>
</table>

1.1.2.7 Operational functionality of the Tester

The Tester measures basic parameters of radio stations:
- transmitter carrier frequency;
- transmitter carrier power;
- frequency deviation;
- amplitude modulation;
- transmitter amplitude-frequency modulation characteristic (AFMC);
- nonlinear-distortions factor (NDF) of the transmitter modulation characteristic;
- transmitter modulation input sensitivity;
- modulating signal frequency (ringing signal frequency)
- receiver sensitivity (SINAD method, method of switching off modulation)
- receiver output voltage;
- receiver amplitude-frequency characteristic (AFC);
- NDF of receiver LF output signal.

1.1.2.8 The Tester provides:
- measurement of one or more parameters;
- the necessary mathematical processing and display of the acquired parameter in a perceivable form.

1.1.3 Product components

1.1.3.1 RST-430 Tester delivery set is listed in Table 1.3

Table 1.3

<table>
<thead>
<tr>
<th>Name</th>
<th>Designation</th>
<th>Quantity</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>RST-430 Radio-Communication Service Tester</td>
<td>ITTsK468166.002</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Converter AC-DC ~220 V 50 Hz/=12 V</td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>HF cable</td>
<td>ITTsK418542.005</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>LF cable</td>
<td>ITTsK418542.006</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Transport case</td>
<td>ITTsK468976.005</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Operating Manual</td>
<td>RE 26.51.44-008-86866068-2017</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Verification procedure</td>
<td>MP 26.51.44-008-86866068-2017</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Certificate</td>
<td>PS 26.51.44-008-86866068-2017</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

1.1.1 Tester configuration and operation

1.1.4.1 In terms of the principle of operation, the Tester is a measuring and computing device based on programmable microcontrollers. “RST430 Firmware” software (version
04.00.0090) is used to control operating modes of the Tester and to mathematically process the measuring signals, enabling creation of tasks for measurements, controlling the modules operation in measurement process, and displaying the measurement progress. The software is intended only for operating with the RST-430 Radio-Communication Service Tester and can not be used separately from the measuring and computing platform of this device. The software is made inaccessible for reading and modifying the program memories of microcontrollers, is metrologically significant and has a “high” protection level in accordance with R 50.2.077-2014. Metrological specifications of the Tester are standardized taking into account the effect of the software.

1.1.4.2 The Tester functionally consists of:
- HF generator;
- LF generator;
- HF frequency meter;
- LF frequency meter;
- modulation meter (frequency, amplitude);
- LF alternating current voltmeter;
- harmonic distortion factor meter;
- power meter.

1.1.4.3 The Tester configuration is shown in the block diagram (figure 1.1) and includes the following main elements and blocks:
- HF programmable controller;
- HF synthesizer;
- HF commutator switch;
- attenuator-equivalent of load;
- measuring receiver;
- LF programmable controller
- LF synthesizer;
- LF converter-commutator switch;
- reference generator;
- keypad;
- indicator panel;
- power unit.
1.1.4.4 Brief description of the Tester block diagram

**HF programmable controller** is designed to control the HF synthesizer and the HF commutator switch by commands sent from the LF programmable controller. Executable code of the HF programmable controller loaded in the non-volatile memory is inaccessible for reading and modification during operation.

**HF synthesizer** is designed to generate a sinusoidal high-frequency signal ($F_{HF}$), the parameters of which are set by the HF programmable controller. The signal is generated unmodulated with frequency modulation (FM) or with amplitude modulation (AM).

**HF commutator switch** is designed for in-circuit switching of the output and input HF signals, generation of the local-oscillator frequency ($F_{osc}$) and the input HF signal ($F_{inp}$) for the measuring receiver, generation of signals for measuring HF input power and amplitude.
modulation (P/M), power sensor signal generation for automatic switching of the device into TRANSMITTER mode when the HF signal appears on the RF terminal.

**Attenuator-load equivalent** is intended to further attenuate the HF synthesizer signal fed to the high frequency RF terminal. For HF signal from an external source, it executes the function of load equivalent and attenuator.

**Measuring receiver** is designed for FM demodulation of HF signal and for generating a signal for measuring deviation (D). Simultaneously, a signal (F_{measure}) is generated for measuring HF input signal frequency.

**LF programmable controller** is designed to control the device via the control and signal processing bus, as well as to provide a user interface through the display panel and the Tester keypad. Executable code of the HF programmable controller loaded in the non-volatile memory is inaccessible for reading and modification during operation.

**LF synthesizer** is designed to generate a sinusoidal low-frequency signal at the output AF OUT. LF synthesizer signal parameters are set by the LF programmable controller.

**LF converter-commutator switch** is designed for in-circuit switching of LF signals and their conversion into signals that are sent to the LF programmable controller for further processing.

**Reference generator** is designed to generate a highly stable signal (F_{rg}) for timing operation of the HF programmable controller, the HF synthesizer and the LF synthesizer.

**Keypad** is designed to enter parameter values and commands for controlling the RST-430 device by the user.

**Display panel** is designed for generating and displaying measurement results and service information on the display panel screen.

**Power unit** is designed to convert the DC power supply supplied from an external power source to the required voltages for powering the RST-430 device circuits.

1.1.4.5 Description of the Tester operation

**Visual user interface** of the Tester is developed in the form of a menu system and data selection and entry fields displayed on the screen (graphic liquid crystal display) of the display panel. When using the Tester, the user enters the required values of the required parameters and sets the operating modes. The LF programmable controller, based on data received from the keypad, generates control commands in accordance with the selected operating mode, and then sends them to the HF programmable controller, the LF synthesizer and the LF converter-commutator switch on the control bus.

Through commands sent from the LF programmable controller, the HF programmable controller generates control signals for the HF synthesizer and the HF commutator switch.

From the HF synthesizer, the unmodulated signal (or with frequency or amplitude modulation) is sent to the HF commutator switch, from which is sent from the RECEIVER mode, further attenuated in the attenuator-load equivalent, to the RF terminal.

In the TRANSMITTER mode, the HF synthesizer executes the function of a local oscillator, whose unmodulated signal is sent to the mixer of the measuring receiver through the HF commutator switch.

In the same mode, the HF signal from an external source RF terminal is sent to the attenuator-load equivalent. Then, before attenuating, the signal enters the HF commutator switch, where the F_{inp} signal is generated, which is sent to the mixer of the measuring
receiver. From the mixer output, the signal with an intermediate frequency is fed to the
demodulator of the FM signal to generate a modulating signal, whose amplitude is
proportional to the frequency deviation. From it, signal D is generated for measuring
deviation.

Simultaneously, from signal $F_{\text{inp}}$, a signal $F_{\text{measure}}$ is generated for measuring the HF
input signal frequency.

From the HF voltage received at the load equivalent, in the HF commutator switch, a
P/M signal is generated for measuring the HF input signal power and amplitude modulation.

When HF specified power appears from the external source on the RF terminal, a
signal is generated from the power sensor, which is sent to the programmable controller
through the LF converter-commutator switch, where the force switching into the
TRANSMITTER mode command is generated.

Signals from the measuring receiver, the HF commutator switch, the AF IN terminal
and the LF synthesizer are sent to the LF converter-commutator switch for switching and
conversion to the required format and subsequent transmission to the programmable
controller. The signal from the LF synthesizer also sent to the AF OUT terminal.

Set parameter values, measurement results and service information are displayed on
the display panel screen in real time. The Tester does not have electrical interfaces for
information exchange with external devices.
1.1.4.6 Design

The Tester is an all-in-one device. It has a metallic housing.
The front panel appearance of the Tester is shown in Figure 1.2.
The left side view of the Tester is shown in Figure 1.3.

1 - Display panel screen;
2 - "AF OUT" terminal (LF device output);
3 - "AF IN" terminal (LF device input);
4 - "RF" terminal (HF device input/output);
5 - Keypad;

Figure 1.2 - Appearance of the Tester.
1.1.4.7 The Tester is controlled using the keypad buttons (Figure 1.2 pos.5) through the menu system, which is displayed on the display panel screen (Figure 1.2 pos.1).

1.1.4.8 Measured and measuring signals are sent to the connectors located at the bottom of the front panel (Figure 1.2 pos.2...4).

1.1.4.9 Connection to the power source, switching on the Tester and earthing is done through the controls located on the left side panel.

1.1.4.10 The display panel screen is divided into windows as shown in Figure 1.4.

a) Window 1 - 1) informs that in order to enter the menu mode, press the TAB button.

b) Window 2 - displays the Tester operation mode (RECEIVER or TRANSMITTER) and the applied modulation type (AM or FM).

c) Window 3 - displays the functions menu, set and measured parameter values, the smooth tuning step of the set value.

d) Window 4 - displays the value of the external attenuator connected to the RF terminal, depending on the operation mode.

Figure 1.3 - View of the Tester from the left side panel

e) Window 5 - displays the state of the **AF IN** low frequency measuring input or the **AF OUT** low frequency generator output and the value of the external attenuator connected to the **AF IN** connectors.

e) Window 6 - informs that the Tester is in the SETUP mode and to enter the MEASUREMENT mode, press the **ESC** button. If the Tester is in the MEASUREMENT mode, in order to enter the INSTALLATION mode, repeat the same actions.

g) Window 7 - displays the result of the measurement of the activated parameter of the activated mode, the values of the entered parameters, the values of the set step, the measurement units to be applied, reference information.

1 - Window 1, informative.
2 - Window 2, activated mode display.
3 - Window 3, function menu.
4 - Window 4, informs about the state on the high frequency RF terminal.
5 - Window 5, informs about the state on the high frequency AFIN and AFOUT connectors.
6 - Window 6, informative.
7 - Window 7, result display.

Figure 1.4 - Display panel screen

1.1.4.11 Purpose of the connectors on the Tester front panel is described in Table 1.4.
Table 1.4

<table>
<thead>
<tr>
<th>Terminal designation</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>AF OUT</td>
<td>LF output generator.</td>
</tr>
<tr>
<td>AF IN</td>
<td>LF input.</td>
</tr>
<tr>
<td>RF</td>
<td>HF input/output.</td>
</tr>
</tbody>
</table>

1.1.4.12 Purpose of the keypad on the Tester front panel is described in Table 1.5.

Table 1.5

<table>
<thead>
<tr>
<th>Button designation</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>F1</td>
<td>Function button 1.</td>
</tr>
<tr>
<td></td>
<td>1) DEVICE TRANSMITTER or DEVICE RECEIVER modes are activated in the main menu.</td>
</tr>
<tr>
<td></td>
<td>2) In the DEVICE TRANSMITTER mode, it activates the output voltage setting function of the LF (VOLTAGE MODE) output.</td>
</tr>
<tr>
<td></td>
<td>3) When setting the LF output voltage value in the DEVICE TRANSMITTER / VOLTAGE MODE, the display unit displays the millivolt voltage (mV).</td>
</tr>
<tr>
<td></td>
<td>4) When setting the frequency value of the LF output signal in the DEVICE TRANSMITTER / FREQUENCY MODE, it specifies frequencies in Hertz (Hz) on the display unit.</td>
</tr>
<tr>
<td></td>
<td>5) In the DEVICE TRANSMITTER / FREQUENCY MODE, when the smooth frequency tuning step setting option is on, it specifies frequencies in Hertz (Hz) on the display unit.</td>
</tr>
<tr>
<td></td>
<td>6) In the DEVICE TRANSMITTER / RECEIVING FREQUENCY mode with FM, it enables the function of setting the frequency of the local-oscillator signal from the measured signal frequency from an external source (MEASURED).</td>
</tr>
<tr>
<td></td>
<td>7) In the MEASURING TRANSMITTER mode, it enables the HF frequency measurement (FREQUENCY) from an external source.</td>
</tr>
<tr>
<td></td>
<td>8) In the MEASURING TRANSMITTER mode, when measuring the frequency of the HF signal ≥ 100 MHz, pressing the button repeatedly switches the display format of the measured value in the form XXXXXXXX, XX or XXXXXXXX, X. When measuring the HF signal frequency up to 100 MHz, the display format of the measured value does not change and has the form XXXXXX, XX.</td>
</tr>
<tr>
<td></td>
<td>9) In the DEVICE RECEIVER mode, it activates the function of setting</td>
</tr>
</tbody>
</table>
the HF synthesizer signal frequency (FREQUENCY).

10) When setting the frequency value of the HF output signal in the DEVICE RECEIVER / FREQUENCY mode, it specifies frequencies in kilohertz (kHz) on the display unit.

11) In the DEVICE RECEIVER / FREQUENCY mode, when the smooth frequency tuning step setting option is on, it specifies frequencies in kilohertz (kHz) on the display unit.

12) When setting the output level of the HF output signal in the DEVICE RECEIVER / OUTPUT mode, it specifies on the display unit, the decibel level display in relation to one milliwatt (dBm).

13) When setting the deviation of the HF signal in the DEVICE RECEIVER / DEVIATION mode, it specifies the deviation in hertz (Hz) on the display unit.

14) When setting the modulation frequency of the HF signal in the DEVICE RECEIVER / LF FREQUENCY mode, it specifies modulation frequencies in Hertz (Hz) on the display unit.

15) In the MEASURING RECEIVER mode, it enables the sensitivity measuring function according to the SINAD method (SINAD) or, by repeated pressing, the non-linear distortion factor (NDF).

16) In OSCILLOGRAPH mode, consistent pressing enables the measured signal type (from the AF IN input, the AF OUT output, the LF signal in the power measurement and the amplitude modulation, the POWER, the LF signal when measuring the frequency modulation of the FM Detector).

17) In the TUNING mode, it enables the FM or AM modulation type (FM ON or AM ON).

18) In the TUNING \ ATTENUATOR mode, it enables the option to connect an external attenuator with a set value (RF1 TRANSMITTER) to the RF terminal in the TRANSMITTER mode.

Function button 2.

1) MEASURING TRANSMITTER or MEASURING RECEIVER modes are activated in the main menu.

2) In the DEVICE TRANSMITTER mode, it activates the function of setting the frequency of the LF output signal (FREQUENCY MODE).

3) When setting the LF output voltage value in the DEVICE TRANSMITTER / VOLTAGE MODE, the display unit displays the voltage in (V).

4) When setting the frequency value of the LF output signal in the DEVICE TRANSMITTER / FREQUENCY MODE, it specifies frequencies in kilohertz (kHz) on the display unit.

5) In the DEVICE TRANSMITTER / FREQUENCY MODE, when the smooth frequency tuning step setting option is on, it specifies frequencies in kilohertz (kHz) on the display unit.
6) In the DEVICE TRANSMITTER \ RECEIVING FREQUENCY modes with FM, it enables the function of manually setting the frequency of the local oscillator signal (CONFIGURED TRANSMITTER).

7) In the MEASURING TRANSMITTER mode, it enables the power measurement of an HF signal (POWER) from an external source.

8) In the DEVICE RECEIVER mode, it activates the function of setting the HF synthesizer output signal (OUTPUT).

9) When setting the frequency value of the HF output signal in the DEVICE RECEIVER / FREQUENCY mode, it specifies frequencies in megahertz (MHz) on the display unit.

10) In the DEVICE RECEIVER / FREQUENCY mode, when the smooth frequency tuning step setting option is on, it specifies frequencies in megahertz (MHz) on the display unit.

11) When setting the level of the HF output signal in the DEVICE RECEIVER / FREQUENCY mode, it specifies the level in microvolts (μV) on the display unit.

12) When setting the deviation of the HF signal in the DEVICE RECEIVER / DEVIATION mode, it specifies the deviation in kilohertz (kHz) on the display unit.

13) In the DEVICE RECEIVER / DEVIATION mode, when the smooth frequency tuning step setting option is on, it specifies frequencies in megahertz (MHz) on the display unit.

14) When setting the modulation frequency of the HF signal in the DEVICE RECEIVER / LF FREQUENCY mode, it specifies modulation frequencies in kilohertz (kHz) on the display unit.

15) In the MEASURING RECEIVER mode, the function of measuring the voltage of the LF signal (LF voltmeter) (VOLTAGE) is enabled.

16) In the MEASURING RECEIVER mode, when measuring the voltage of the LF signal, pressing the button repeatedly switches the display format of the measured value in the form X, XX or X, XXX.

17) In the OSCILLOGRAPH mode, sets the oscillogram in the center of the screen along the Y axis (Y CENTER), at the same time it enables the scale interval of 0.1 V.

18) In TUNING mode, it enables the option of connecting external attenuators (ATTENUATORS) to the RF and AFIN connectors.

19) In the TUNING \ ATTENUATOR mode, it enables the option to connect an external attenuator with a set value (RF1 RECEIVER) to the RF terminal in the RECEIVER mode.

F3

Function button 3.

1) The OSCILLOGRAPH mode is activated in the main menu.

2) In the DEVICE TRANSMITTER mode, it enables the selection of a signal source, which sets the local oscillator frequency for measuring the HF frequency deviation (RECEIVING FREQUENCY) for the FM
modulation type. AM modulation is not used.

3) In the **DEVICE TRANSMITTER / RECEIVING FREQUENCY** mode with FM, it enables the function of setting the frequency of the local-oscillator signal from the set frequency of the HF output signal (CONFIGURED RECEIVER).

4) In the **MEASURING TRANSMITTER** mode, it enables the deviation measurement function (**DEVIATION**) for the FM modulation type or the amplitude modulation factor (**MODULATION**) for AM modulation of the HF signal from an external source.

5) In **DEVICE RECEIVER** mode, it activates the function of setting the deviation value of the HF synthesizer signal for the FM modulation (**DEVIATION**) or the amplitude modulation factor for the AM modulation type (**MODULATION**).

6) It is not used in the **MEASURING RECEIVER** mode.

7) When setting the level of the HF output signal in the **DEVICE RECEIVER / OUTPUT** mode, it specifies the level in millivolts (mV) on the display unit.

8) In the **TUNING \ ATTENUATOR** mode, it enables the option to connect an external attenuator with a set value (**AFIN**) to the AFIN terminal.

9) In the **TUNING \ SYSTEM** mode, it enables a window with information about the system. In this RST-430 is not utilized.

---

**Function button 4.**

1) The **TUNING** mode is activated in the main menu.

2) In the **DEVICE TRANSMITTER** mode, enables or disables the LF synthesizer signal on the **AFOUT** terminal.

3) In the **MEASURING TRANSMITTER** mode, the function of measuring the non-linear distortion factor (NDF) of the modulating signal of the external HF signal source is enabled.

4) In the **DEVICE RECEIVER** mode, it enables or disables the modulation of the HF synthesizer signal.

5) In **MEASURING RECEIVER** mode, it enables or disables the modulation of the HF synthesizer signal.

6) In the **TUNING / TRANSMITTER/RECEIVER SWITCHING** mode, it enables the option of automatically switching to the TRANSMITTER mode when an HF signal from an external source with a power of about 30 mW appears on the RF terminal. If there is no signal from an external source, the Tester switches back to RECEIVER mode.

---

**Function button 5.**

1) In the main menu in the **RECEIVER** mode, it connects the LF measurement input (**MEASUREMENT INPUT**) to the AFIN terminal for measuring the LF external signal or AFOUT signal to monitor the
<table>
<thead>
<tr>
<th>Button</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>START</strong></td>
<td>It is not used.</td>
</tr>
<tr>
<td><strong>TAB D</strong></td>
<td>Open the main menu.</td>
</tr>
</tbody>
</table>
| **ESC N** | 1) Returns to the mode from which the transition was made into any functional state.  
2) Switches the DEVICE / MEASUREMENT modes. |
| **SHIFT** | It activates the option of smooth tuning of the parameter with the ← and → buttons with the specified step in the DEVICE (TRANSMITTER or RECEIVER) mode. Other buttons do not work under this option. To exit this option, press this button again. |
| **SPACE** | In the DEVICE (TRANSMITTER or RECEIVER) mode:  
1) when setting a parameter value, it removes the wrongly set character;  
2) for the activated function of the set parameter, it enables the option of setting the step for smooth tuning. |
| **,** | Selects the separating character between integer and fractional parts of a number. |
| **ENTER** | 1) Inputs the entered values in the parameter value settings mode.  
2) Records in the user settings non-volatile memory, under the selected number.  
3) In MEMORY mode, the selected setting option is enabled. |
| **0** | 1) Types digit "0".  
2) In the main menu in the TRANSMITTER or RECEIVER modes, it
<table>
<thead>
<tr>
<th></th>
<th>Enables/disables the operation mode with the user settings stored in the non-volatile memory (<strong>ENABLE MEMORY / ENABLE SETTING</strong>).</th>
</tr>
</thead>
</table>
| 1 | 1) Enters digit "1".  
2) In the main menu in the **TRANSMITTER / RECEIVER** modes, it enables the writing mode in the non-volatile memory of the user settings from 0 to 9. |
| 2 | 1) Enters digit "2".  
2) In the **OSCILLOGRAPH** mode, it switches the scale interval of the Y-axis upwards (0.01V, 0.02V, 0.05V, 0.1V, 0.2V, 0.5V, 1V, 2V, 5V, 10V). |
| 3 | 1) Enters digit "3".  
2) In **OSCILLOGRAPH** mode, it moves the oscillogram down. |
| 4 | 1) Enters digit "4".  
2) In **OSCILLOGRAPH** mode, it switches the scale interval of the X-axis upwards (0.05ms, 0.1ms, 0.2ms, 0.5ms, 1ms, 2ms). |
| 5 | Enters digit "5". |
| 6 | 1) Enters digit "6".  
2) In **OSCILLOGRAPH** mode, it switches the scale interval of the X-axis downwards (2ms, 1ms, 0.5ms, 0.2ms, 0.1ms, 0.05ms). |
| 7 | Enters digit "7". |
| 8 | 1) Enters digit "8".  
2) In the **OSCILLOGRAPH** mode, it switches the scale interval of the Y-axis downwards (10V, 5V, 2V, 1V, 0.5V, 0.2V, 0.1V, 0.05V, 0.02V, 0.01V). |
| 9 | 1) Enters digit "9".  
2) In **OSCILLOGRAPH** mode, it moves the oscillogram upwards. |
| - | Buttons are not used. |
| / | |
| * | |
1.1.4.13 Purpose of the controls on the left sidewall is described in Table 1.6.

Table 1.6

<table>
<thead>
<tr>
<th>Designation</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\text{\S}$</td>
<td>Power terminal for connection of a +12 V direct current source.</td>
</tr>
<tr>
<td>$\parallel$</td>
<td>Earthing terminal of the Tester for connection to the earthing device.</td>
</tr>
<tr>
<td>Power on button.</td>
<td>For switching on/off the Tester.</td>
</tr>
</tbody>
</table>

1.1.5 Measuring instruments, instruments and accessories

1.1.5.1 The Tester delivery kit includes all necessary accessories required for its operation.

1.1.5.2 The list of measuring instruments, monitoring, auxiliary devices and materials required for Tester verification is given in Table 2 Verification Procedure VP 26.51.44-008-86866068-2017.

1.1.6 Marking and sealing

1.1.6.1 The Tester marking contains:
a) the company trade mark;  

b) Tester conventional name;  
c) serial number of the Tester according to the manufacturer's numbering system (factory number);  
d) production year;  
e) State Register mark in accordance with PR 50.2.107-09 and national standards.  
f) unified sign of product circulation on the Member States of the Customs Union market (EAC sign), in accordance with the regulations on the unified sign of product circulation on the Member States of the Customs Union market No. 711 of June 15, 2011.

1.1.6.2 Conventional name marking, serial number and production year are applied in accordance with the set of documentation.

1.1.6.3 Transport case marking contains the conventional name of the Tester.

1.1.6.4. Transport case marking is done through a label secured on the case wall.

1.1.6.5 Transport package marking is made in accordance with GOST 14192. Unified sign of product circulation on the Member States of the Customs Union market (EAC sign), in accordance with regulations on the unified sign of product circulation on the Member States of the Customs Union market No. 711 of June 15, 2011 shall be applied on the transport packaging.

1.1.6.6 The Tester and the transport case are sealed before being delivered to the customer.

1.1.6.7 Positions for placing seals on the Tester are shown in Figure 1.5.
Seals on the packaging are removed by the customer when receiving the product and when setting up the product for operation. Seals on the Tester during the warranty period are removed only when the product is being repaired by the manufacturer. After repair, the product is resealed.

1.1.7 Packaging

1.1.7.1 The Tester kit is packed in a transport case, protection class is IP67 (Figure 1.6). The figure does not show the documentation set that is laid on top of the Tester.
1.1.7.2 The transport package is a box in accordance with GOST 9142, that is made of corrugated cardboard of T3 or T4 GOST R 52901 grades, conforming with ITTsK468976.002UCh packing drawing.

1.1.7.3 An accompanying document is enclosed in the transport package, containing:

a) Tester conventional symbol;
b) contents of delivery;
c) packaging date (date, month, year);
D) name and signature of the person responsible for packaging.

---

1 - Tester.
2 - Case.
3 - Cable kit.
4 - AC-DC converter ~ 220 V/= 12 V.

Figure 1.6 - Placement of the Tester in the transport case
2 PURPOSE

2.1 Operational limits

2.1.1 When operating the Tester, the following conditions must be observed:

- the Tester is designed for operation in stationary or mobile laboratories (workshops) at ambient temperature of plus 10 to plus 35 °C, in conditions of high humidity not over 90% at temperature not over 25 °C;
- power supply is provided by a DC external source with voltage from 10 to 15 V with maximum current of 2.08 A, permissible ripple level of 80 mV from peak to peak through a pin connector. Polarity of the electric current of the power source must be “plus in the center”. Power output pin connector type 5.5/2.1. A laboratory DC voltage source, an AC-DC converter of 220 V 50 Hz/= 12 V or a battery with a rated voltage of 10.8 V to 15.6 V can be used as a power source;
- HF input/output wave impedance of RF Tester is 50 Ohm;
- LF input/output rated resistance of the Tester is 600 Ohm.

2.2 Preparing the Tester for operation

2.2.1 Safety precautions when preparing the Tester

2.2.1.1. Safety regulations must be observed when preparing the Tester for operation and during repair. Each service unit must have a safety instruction. In addition, periodic assessment of the radio specialists’ knowledge on safety regulations when operating radio-electronic equipment and the steps in providing first aid in case of electrocution, should be conducted.

There are no hazardous voltages in the Tester, however, devices used in measuring parameters during device verification and repair can be operated from an AC ~ 220 V network.

2.2.1.2. Persons who have been instructed on safety precautions when working with electrical and radio measuring devices and have studied this Operating Manual are allowed to operate the Tester. During operation, maintenance and repair, the requirements of GOST 12.3.019, current regulations on occupational safety during operation of electrical installations must be observed.

2.2.1.3 During the Tester verification using measuring devices and equipment powered with 220 V 50 Hz, service personnel must comply with the safety regulations provided for operation with these devices.

All electrical appliances must be grounded. When power is switched on, do not disconnect connecting cables.

2.2.1.4 The Tester external surface temperature during operation in normal conditions, at contact position of the operator with the controls, does not exceed plus 40 °C.

2.2.1.5 During operation, storage and transportation, the Tester doesn't exert a harmful environmental impact.
2.2.2 Volume and sequence of visual inspection of the Tester

2.2.2.1. Before using the Tester, conduct visual inspection. Inspection is conducted in the following sequence:
- inspecting the packaging status of the Tester;
- inspection of availability of accompanying documentation;

2.2.2.2 Remove the transport case with the Tester from transport packaging, remove packaging materials and visually check seals on the case, absence of mechanical damages and signs of exposure to harsh environments.

2.2.2.3 Remove the Tester from the transport case, conduct visual inspection making sure that the seals on the Tester are undamaged, there are no mechanical damages and signs of exposure to harsh environments. Inspect the delivery for completeness according to the operational documentation.

2.2.2.4 If the packaged Tester was in climatic conditions that did not correspond to the operating conditions, it must be kept in the package for at least 1 hour in the conditions corresponding to the operating conditions.

2.2.2.5 If the Tester was in climatic conditions that did not correspond to the operating conditions for the Tester operation, it must be kept for at least 2 hours in conditions corresponding to the operating conditions.

2.2.2.6 Before beginning operation, carefully study this Operating Manual, as well as position and purpose of controls and terminals.

2.2.3 Installing and verification of the Tester's readiness for use

2.2.3.1. Normal operation of the Tester is ensured if the external conditions correspond to the operating conditions, as well as when there are no shocks and vibrations in the workplace.

2.2.3.2 Install the Tester in the workplace, ensuring convenience of operations and free ventilation.

2.2.3.3 Verify condition of the used power cable and HF and LF connecting cables as well as conformance of the supply voltage to the operating voltage.

2.2.4 Description of controls and settings statuses

2.4.1 Make sure the power button is set to off state.

2.2.5 Verifying the readiness for use, connection and testing of the Tester

2.2.5.1 Make sure that the earth terminal of the Tester is connected to the earthing circuit.

2.2.5.2 Assemble the measuring circuit shown in Figure 2.1.
1 - ITTsK418542.005 calibration cable;
2 - ITTsK418542.006 calibration cable;

Figure 2.1 - Standard wiring and connection diagram of the Tester

This diagram is standard for main operation of the Tester. It is possible to use other necessary wiring diagrams to provide normal operation of the Tester.

An adapter may be required for connecting the AFOUT and AFIN low-frequency outputs with ITTsK418542.006 calibration cable to the radio station, the adapter circuit and design depends on the type of radio station and is determined by the customer.

It is permissible for the Tester to be connected to a device under test with customer’s cables similar to the calibration cables.

2.2.5.3 Connect the Tester to a power source (laboratory power unit, AC-DC converter ~ 220 V 50 Hz / = 12 V or, in case of operation in absence of 220V AC mains voltage, connect to a battery with the required specifications).

2.2.5.4 Turn on the power button. A title screen with the Tester name should appear on the screen of the Tester's display panel screen. After a few seconds, the title screen will go to the menu of one of the four main operation modes the Tester was at the moment the power was switched off (In the diagrams given, the FM option is enabled, Additional functions are disabled).

- **MEASURING TRANSMITTER** mode for measuring parameters of radio station transmitter signals under test (Figure 2.2);
- **DEVICE TRANSMITTER** mode for setting the parameters of test signals for the radio station transmitter (Figure 2.3);
- **MEASURING RECEIVER** mode for measuring parameters of radio station receiver signals under test (Figure 2.4);
- **DEVICE TRANSFORMER** mode for setting the parameters of test signals for the radio station receiver (Figure 2.5).
All other modes are additional.

To view the software identification number, turn on the Tester while pressing the button \( F_5 \). After 10 seconds, the software version number will be displayed on the display panel screen (Figure 2.6).
2.2.5.5 After about 10 seconds (self-test time), the Tester is ready for operation. The Tester metrological parameters are given in or before 15 minutes from the moment it’s switched on.

2.2.6 List of possible malfunctions in preparation of the product for use and recommendations for their elimination

2.2.6.1 List of possible malfunctions and methods to eliminate them are presented in Table 2.1.

Table 2.1

<table>
<thead>
<tr>
<th>Malfunction sign</th>
<th>Possible cause of malfunction</th>
<th>Method of elimination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Display panel screen is not lighting up when the Tester is switched on.</td>
<td>Tester is not receiving supply voltage.</td>
<td>Verify output voltage of the external power supply. Replace power supply, if necessary.</td>
</tr>
<tr>
<td>No image on the display panel screen. There is a backlight of the display panel screen.</td>
<td>Failed to load the program</td>
<td>Reload the Tester. If it doesn't work, send it to the manufacturer for repair.</td>
</tr>
<tr>
<td>After appearance of the title screen on the display panel screen, an error message about ADC is displayed.</td>
<td>Reference generator doesn't work correctly.</td>
<td>Send to the manufacturer for repair.</td>
</tr>
<tr>
<td>Ambiguous readings of measured value appearing on the display panel screen.</td>
<td>Poor contact in connections or faulty cable.</td>
<td>Wash the connector contacts with first grade ethanol according to GOST 5962 or replace the cable.</td>
</tr>
</tbody>
</table>

2.3 Operating the Tester

2.3.1 Procedure for maintenance personnel when performing tasks using the Tester

2.3.1.1 Verify that the functions and options of additional modes are disabled in the Tester.

Options of the ATTENDUATOR function of the TUNING mode should be disabled (subunit 2.3.1.18b).

**AUTO TRANSMITTER/RECEIVER SWITCHING** option of the TUNING mode should be switched off (subunit 2.3.1.18d).

Operation mode with set parameters stored in the memory must be switched off (subunit 2.3.1.17).
In the function of setting the local oscillator signal frequency of the measuring receiver in the DEVICE TRANSMITTER \ RECEIVER FREQUENCY mode, MEASURED option should be enabled (subunit 2.3.1.12).

Input of LF signal measurement in the RECEIVER mode must be connected to the AF IN connector (subunit 2.3.1.14).

2.3.1.2 Enable the required mode or option of the Tester.

The Tester modes and options are enabled through the main menu, which is opened from the operation modes with transmitter (TRANSMITTER) or receiver (RECEIVER).

TRANSMITTER and RECEIVER modes can be in settings (SETTINGS) or measurements (MEASUREMENT) state of parameter values of the selected signal. Consequently, the Tester implements four main modes (Figures 2.2, 2.3, 2.4 and 2.5). The remaining modes are additional.

From any additional mode, pressing the button \[ \text{ESC} \] will open the initial main mode. Entering the mode opens menu of functions to be executed.

Enter the main menu from any main mode using button \[ \text{TAB} \].

Enabling of measurement or setting states is done through the main menu or within one of the main modes (TRANSMITTER or RECEIVER) of the Tester using the button \[ \text{ESC} \].

2.3.1.3 The main menu of modes and options, enabled from the TRANSMITTER mode, is shown in Figure 2.7. FM option is enabled.

![Main menu of the TRANSMITTER mode](image)

- To switch to the DEVICE RECEIVER main mode, press the button \[ F1 \].
- To switch to the MEASURING RECEIVER main mode, press the button \[ F2 \].
- To enable the oscillographic probe mode OSCILLOGRAPH, press the button \[ F3 \].
- To activate the TUNING mode, press the button \( F4 \).
- The menu item **F5 OUTPUT AF OUT MODULATION** is not used in this Tester version.
- To enable the operation mode with set parameter options saved in the **TRANSMITTER** mode in non-volatile memory, press the button \( 0 \).
- To save set parameter options in the non-volatile memory in the **TRANSMITTER** mode, press the button \( 1 \) and then assign the option digit from 0 to 9. To close the save operation after entering the option digit, press the button \( \text{ENTER} \).
- To exit to the mode from which the switching was made into this menu, press the button \( \text{ESC} \).

2.3.1.4 The main menu of modes and options, enabled from the **RECEIVER** mode, is shown in Figure 2.8. **FM** option is enabled.

![Figure 2.8 - Main menu of the **RECEIVER** mode](image)

- To switch to the **DEVICE TRANSMITTER** main mode, press the button \( F1 \).
- To switch to the **MEASURING TRANSMITTER** main mode, press the button \( F2 \).
- To enable the oscillographic probe mode **OSCILLOGRAPH**, press the button \( F3 \).
- To enable the **TUNING** mode, press the button \( F4 \).
- To connect the Tester's measurement input to the **AF OUT** connector (to the synthesizer LF output) or the **AF IN** connector, press the (MEASUREMENT INPUT) button.

- To enable the operation mode with set parameter options saved in the **RECEIVER** mode in non-volatile memory, press the button.

- To save set parameter options in the non-volatile memory in the **RECEIVER** mode, press the button and then assign the option digit from 0 to 9. To close the save operation after entering the option digit, press the button.

- To exit to the mode from which the switching was made into this menu, press the button.

2.3.1.5 Setting the parameter value of the selected function.

Setting the parameter value for all test signals in **DEVICE TRANSMITTER** and **DEVICE RECEIVER** modes is identical.

a) Enter the **DEVICE TRANSMITTER** or **DEVICE RECEIVER** mode (Figures 2.2 and 2.4) and activate the required function using function key with the corresponding digit, while in window 3 of the display panel screen the *F* sign will be highlighted with a one-sided arrow cursor. Line structure of the activated function is shown in Figure 2.9.

b) Enter the required parameter value in the integer format or with a decimal point using the digit buttons. When you press the first digit, window 7 (result display window) will be activated, displaying the set parameter, which is located in the center and highlighted with a rectangular flashing cursor.

The result display window when setting the parameter value for various test signals is shown in Figures 2.10 - 2.14.
Figure 2.10 - HF synthesizer signal frequency value (FREQUENCY) entered in the RECEIVER mode.

Figure 2.11 - HF synthesizer signal output level value (OUTPUT) entered in the RECEIVER mode.

Figure 2.12 - Deviation values (DEVIATION) and modulating LF signal frequency values (LF FREQUENCY) entered in the RECEIVER mode, synthesizer LF signal frequency values entered in the TRANSMITTER mode (FREQUENCY MODE).

Figure 2.13 - AM coefficient value (MODULATION) entered in the RECEIVER mode.

Figure 2.14 - HF synthesizer signal voltage value (VOLTAGE) entered in the TRANSMITTER mode.
NOTE - 1) A range within which the parameter value of the selected test signal can be set, is displayed on the left side for reference purposes.

2) On the right side is information about the purpose of buttons for selecting the measurement unit.

c) Select the measurement unit of the set parameter with the buttons \( F_1 \), \( F_2 \) or \( F_3 \). For the parameter of the MODULATION function, the measurement unit is not selected, but the button \( \text{ENTER} \) is pressed. The values are entered by pressing the specified buttons.

The entered parameter value is displayed in the activated function line.

d) From the connectors, apply the set signal to the device under test through the appropriate cable.

2.3.1.6 Setting the step value of smooth tuning of the set parameter.

Setting the step value for all test signals in DEVICE TRANSMITTER and DEVICE RECEIVER modes is identical. The only difference is in assigning the step measurement unit.

a) Enter the DEVICE TRANSMITTER or DEVICE RECEIVER mode and activate the required function using \( F \) function key with the corresponding digit, while in window 3 of the display panel screen the \( F \) sign will be highlighted with a one-sided arrow cursor \( \text{F} \).

b) Press the button \( \text{SPACE} \). By doing so, window 7 (result display window) will be activated, displaying the set step, which is located in the center and highlighted with a rectangular flashing cursor.

The result display window when setting the smooth tuning step parameter value for various functions is shown in Figures 2.10 - 2.14.

![Table](image)

Figure 2.15 - HF synthesizer signal frequency step value (FREQUENCY) entered in the RECEIVER mode.
c) Select the step measurement unit of the smooth tuning parameter. If there are two measurement units, press F1 or F2 for selection. If the measurement unit is one, press ENTER. Values are entered by pressing the specified buttons.

In the activated function line, the entered step value is displayed next to the displayed parameter value (Figure 3.3).

NOTE - A range within which the parameter step value of the selected function can be set, is displayed on the left side for reference purposes.

2.3.1.7 Enable smooth adjustment mode of the selected function parameter value.
a) Enter the **DEVICE TRANSMITTER** or **DEVICE RECEIVER** mode and activate the required function using F function key with the corresponding digit, while in window 3 of the display panel screen the F sign will be highlighted with a one-sided arrow cursor.

b) Press the button **SHIFT**. The cursor becomes a two-sided arrow (Figure 2.20). In this mode, only the 4 and 6 buttons will be functional.

c) Execute smooth tuning of the set parameter value using the button in downward direction or with the button in upward direction.

d) To exit from the smooth tuning mode, press the button again.

NOTE - The parameter smooth tuning mode for the selected test signal is retained when switching to another function. To disable it, return to the selected function and press the button **SHIFT**.

2.3.1.8 Measuring the parameter value of the selected function.

Measuring the parameter value for all functions in **MEASURING TRANSMITTER** and **MEASURING RECEIVER** modes is identical.

a) Enter the **MEASURING TRANSMITTER** or **MEASURING RECEIVER** mode (Figures 2.21 and 2.22) and activate the required function using F function key with the corresponding digit, while in window 3 of the display panel screen the F sign will be displayed with a one-sided arrow cursor.

b) Apply a measured signal to the appropriate connector of the selected function.
In window 7 (result display window), the measured parameter value and the measurement unit will be displayed.

c) Read the measured parameter value of the selected function on the display panel screen.

2.3.1.9 Enable or disable modulation of the HF synthesizer signal.

For enabling or disabling modulation of the HF synthesizer signal, open the menu of MEASURING RECEIVER or DEVICE RECEIVER mode and press the button F4. Inscription in this menu item offers to perform the specified action (Figure 2.23).
2.3.1.10 Measurement of non-linear distortion factor (NDF).

The NDF measurement is based on measurement of the ratio of the voltage rms value of the LF combined signal at the receiver output (main signal harmonic, noise harmonic and nonlinear distortion harmonic) to the rms value of signal voltage without main harmonic. This method allows to measure the non-linear distortion factor of LF signal at excess voltage over noise voltage, when these noises can be ignored.

When signal voltage is comparable to noise voltage, this method enables measuring the signal ratio over noise, which can be used to measure sensitivity of the receiver.

To measure the nonlinear distortion factor, enter the DEVICE RECEIVER mode and press the button , and the function of setting modulation frequency of the HF synthesizer signal is activated. Enter main harmonic frequency value by pressing the buttons or . This will set main harmonic frequency for measuring the non-linear distortion factor or the signal-to-noise ratio.

To enter the MEASURING RECEIVER mode press the button and activate the NDF/CINAD function with the button . Measure the NDF or signal-to-noise ratio depending on the task being executed.

2.3.1.11 LF synthesizer signal enabling/disabling at the AF OUT connector.

For enabling or disabling HF synthesizer signal, open menu of the DEVICE TRANSMITTER mode and press the button . Inscription in this menu item offers to perform the specified action (Figure 2.24).
When the signal is disabled in the window informing about status of LF connectors, disable notification is displayed for the **AF OUT** connector.

2.3.1.12 Selecting the method of setting the local oscillator signal frequency of the measuring receiver in the **FM DEVICE TRANSMITTER** mode (Figure 2.25). For **AM DEVICE TRANSMITTER** mode, this function is not available.

a) To select the frequency setting method, press the **F3** button (**RECEIVER FREQUENCY**).

b) In the window that appears, using the buttons **F1**, **F2**, or **F3**, enable the required option to set the local oscillator signal frequency.
The menu item **MEASURED** enables the function of setting the local oscillator signal frequency according to the measured frequency of a signal from an external source.

The menu item **CONFIGURED TRANSMITTER** enables the function of manually setting the local oscillator signal frequency, which is executed when the **RECEIVER FREQUENCY** function is activated by entering the value and then selecting measurement unit.

The menu item **CONFIGURED RECEIVER** enables the function of setting the local oscillator signal frequency according to the HF output signal frequency set in the **FM DEVICE RECEIVER** mode on the RF connector.

The display of the local oscillator frequency in the lower left part of the measurement result display window occurs for the **CONFIGURED TRANSMITTER** and **CONFIGURED RECEIVER** options with active deviation measurement functions (**DEVIAITION**), non-linear distortion factor (**NDF**) and frequencies (**LF FREQUENCY**) of the demodulated signal in **FM MEASURING TRANSMITTER** mode.

With active functions for measuring HF frequency (**FREQUENCY**) and power (**POWER**) of an external source, this display is unavailable.

2.3.1.13 Oscillographic probe mode (**OSCILLOGRAPH**).

a) Enter the oscillographic probe mode from the main menu by pressing the button **F3**. The oscilloscope screen image will appear on the display panel screen (Figure 2.26).

![Figure 2.6 - Oscillographic probe mode](image)

b) To select the source of the monitored signal, which is in-circuit connected to the probe input, press the **F1 (INPUT)** button consistently until an inscription appears on the top left of the screen with the name of this signal. A probe can monitor four signal sources:

1) **AF IN** - signal applied to the **AFIN** connector;
2) **AF OUT** - signal arriving at the **AFOUT** connector from the LF synthesizer tester;

3) Power - signal from the AM detector output;

4) **FM Detector** - signal from the FM detector output.

c) To set the optimal oscillogram image in the center of the probe screen, press the **F2 (Y CENTER)** button. In this case, the amplitude scale will automatically switch to the optimal value, which will allow observing the oscillogram waveform without limitations.

d) To move the oscillogram in vertical direction (up or down) press the buttons **9** (up) or **3** (down).

e) Set 0.05 V, 0.1 V, 0.2 V, 0.5 V, 1 V or 2 V grid scale interval of the probe screen along the Y (amplitude) axis using buttons **8** or **2**.

f) Set 0.02 ms, 0.05 ms, 0.1 ms, 0.5 ms, 1 ms or 2 ms grid scale interval of the probe screen along the X (time) axis using buttons **4** or **6**.

g) To exit the oscillographic probe mode, press the button **ESC**.

2.3.1.14 Switching the measurement input to the **AF IN** or **AF OUT** connector.

a) To switch the measurement input of the Tester to the **AF OUT** connector (to the LF synthesizer output) or the **AF IN** connector, enter the **RECEIVER** mode (**DEVICE** or **MEASURING**) in the main menu by pressing the button **TAB**.

b) Press the (MEASUREMENT INPUT) button **F5** (Figures 2.27 and 2.28). Pressing the button switches the measurement input returning to the mode from which the main menu was entered. Name of the connected LF connector is displayed in the connector status window.

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Figure 2.27 - Tester measurement input connected to the **AFIN** connector.
Figure 2.28 - Tester measurement input connected to the LF synthesizer output.

2.3.1.15 Enable non-linear distortion factor measurement of the LF signal (NDF) or the signal-to-noise ratio without disabling modulation (SINAD).
   a) Enable the main mode DEVICE RECEIVER.
   
   b) To switch between NDF and SINAD modes, press the button $F_1$ (Figure 3.16).

2.3.1.16 Save mode settings.

The Tester has a function that enables the user to save ten parameter values in the DEVICE TRANSMITTER mode and ten parameter values in the DEVICE RECEIVER mode in the non-volatile memory. Option of setting the parameter values for each mode is assigned a number from 0 to 9.

The following are saved in the DEVICE TRANSMITTER mode:
- voltage signal value of the LF synthesizer (VOLTAGE MODE);
- frequency signal value of the LF synthesizer (FREQUENCY MODE);
- frequency value of the local oscillator HF signal of the measuring receiver, set in the DEVICE TRANSMITTER \ RECEIVING FREQUENCY \ CONFIGURED TRANSMITTER (option to manually set the frequency of the local oscillator).

The DEVICE RECEIVER mode saves:
- frequency signal value of the HF synthesizer (FREQUENCY);
- HF synthesizer signal level value (OUTPUT);
- deviation value or the HF synthesizer AM coefficient (DEVIATION or MODULATION);
- LF modulating frequency value for the HF synthesizer signal (LF FREQUENCY).

Possibility to change parameter values in this mode is disabled except for the option to enable/disable modulation.

   a) For saving current settings in the Tester's non-volatile memory, enter the main menu by pressing the button $\text{TABD}$.
   
   b) Press the button $1$ to activate this function. A cursor appears in the form of a flashing vertical rectangle.
   
   c) Enter the number under which you want to save the current option
   
   d) Click the button $\text{ENTER}$ to close and save the result (Figure 2.29).
2.3.1.17 MEMORY mode.

a) Enter the MEMORY mode from the main menu by pressing the ENABLE MEMORY button (Figure 2.30).

![Figure 2.30 - MEMORY enabling/disabling mode]

The window shows the settings option from which the previous output was made (Figures 2.31 and 2.32).

![Figure 2.31 - Setting option for TRANSMITTER mode]
![Figure 2.32 - Setting option for RECEIVER mode]

NOTE - The menu bar F3 RECEIVING FREQUENCY in Figure 3.25 is not used in this Tester version.

b) Press the button with the digit of the desired setting option. The window shows the selected option (Figure 2.33 and 2.34).
c) To enable the selected setting option, press the button \( \text{[ENTER]} \). The window will look similar to Figures 2.30 and 2.31 but with values corresponding to the new options.

d) To exit the MEMORY mode enter the main menu by pressing the button \( \text{[TAB]} \), then press the button \( \text{[F4]} \) that offers to switch to the entering settings mode (Figure 2.29).

2.3.1.18 TUNING mode.

Open the functions menu and options in TUNING mode. To do this, enter the main menu by pressing the button \( \text{[TAB]} \), then press the F4 button. The window shown in Figure 2.35 will be opened.

To return to the initial mode, press the button \( \text{[ESC]} \).
a) Switching the modulation type between FM and AM (ENABLE AM/FM option).

To enable the required modulation type, press the button \[ \text{F1} \] (Figure 2.36). Pressing this button enables the offered modulation type for measurement and settings with switching to one of the main modes from which you entered the TUNING mode.

![Figure 2.36 - Selecting the modulation type](image)

In this case, the display window of the enabled mode displays the enabled modulation type (Figure 2.37).

![Figure 2.37 - Display of the enabled modulation type.](image)

b) Connection of external attenuators (ATTENUATORS function).

The function of connecting attenuators in RST-430 device is intended for automatic correction of the measured value, when external attenuators are connected to the AFIN and RF connectors.

To enable this function, press the button \[ \text{F2} \], this will open the menu shown in Figure 2.38.

![Figure 2.38 - Attenuators function menu](image)
This figure shows attenuation values previously set.

The “F1 RF1 TRANSMITTER xx, xx dB Off” option is used when connecting an external attenuator to the RF connector to reduce the measured signal from an external power source. This may be required for operations with a signal source with a higher power exceeding that permissible for RST-430 device.

The “F2 RF1 RECEIVER xx, xx dB Off” option is used when connecting an external attenuator to the RF connector to reduce the HF generator signal level of RST-430 device from an external receiver.

The “F3 AFIN x, xx dB Off” option is used when connecting an external attenuator to the AFIN connector to reduce the LF signal supplied from an external source. This may be required for measuring the LF signal with a level exceeding the permissible level for RST-430 device.

NOTE - xx, xx and x, xx is the attenuation level of the attenuator used in dB.

For changing the attenuation value of the selected attenuator, press the F1, F2 or button F3. The result display window offers to enter the attenuation value, and a flashing cursor will appear. Enter the required attenuation and press the button ENTER. In the corresponding menu bar, the attenuation value will change to the input value, and a notification about the selected enabled option will appear (Figure 2.39).

Figure 2.39 - Enter the attenuation value of the external attenuator
To enable or disable the option of the selected attenuator, press the button F1, F2, or F3, and if the cursor is flashing without entering the attenuation value, press the button ENTER.

When the option is enabled or disabled, a message appears in the status window of the corresponding connector about the value of enabling the external attenuator and its value (Figure 2.40 and 2.41).

![Figure 2.40 - Status display of connected external attenuators](image)

![Figure 2.41 - Status display of disconnected external attenuators](image)

To return to the initial mode, press the button ESC.

c) Viewing information about the system (SYSTEM function).

NOTE - This is not used in this Tester version.
d) Automatic switching to the **TRANSMITTER** mode (**RECEIVER/TRANSMITTER SWITCHING** option).

The option is intended to automatically switch to the **TRANSMITTER** mode when RF signal from an external source with a power of about 30 mW appears on the RF connector. If there is no signal from an external source, the Tester stays in the **RECEIVER** mode.

When this option is enabled, manual switching between the **TRANSMITTER** and **RECEIVER** modes is unavailable.

To enable or disable the option, enter the **TUNING** mode and press the button **F4**. When this button is pressed, it enables/disables transferring to one of the main modes from which you entered the **TUNING** mode.

Display of this option status in the main modes menu is shown in Figure 2.42, and in the **TUNING** mode menu in Figure 2.43.

![Figure 2.42 - Display of the enabled/disabled **TRANSMITTER/RECEIVER SWITCHING** function in the main mode](image1)

![Figure 2.43 - Display of the enabled/disabled **TRANSMITTER/RECEIVER SWITCHING** function in the **TUNING** mode menu](image2)

**2.3.2 Tester’s efficiency monitoring procedure**

**2.3.2.1** The efficiency of the Tester is monitored during its execution of tasks (subunit 2.3.1.1 - 2.3.1.18).

**2.3.3 List of possible malfunctions of the Tester**

**2.3.3.1** Possible malfunctions and recommended actions for their elimination are listed in Table 6.

**2.3.3.2** The Tester is maintained and repaired by the manufacturer.

**2.3.4 List of operating modes**

**2.3.4.1** The Tester has four main modes:

- **MEASURING TRANSMITTER** mode (subunit 2.2.5.4, Figure 2.2);
- **DEVICE TRANSMITTER** mode (subunit 2.2.5.4, Figure 2.3);
- **MEASURING RECEIVER** mode (subunit 2.2.5.4, Figure 2.4);
- **DEVICE RECEIVER** mode (subunit 2.2.5.4, Figure 2.5).

In the **MEASUREMENT** mode, the transmitter and receiver measure the parameter values of monitored signals.

In the **SETTINGS** mode for the transmitter and receiver, the operator sets test signal parameter values and enables the Tester options for specific measurement and outputting information in a convenient form.

2.3.4.2. The remaining modes are additional and are intended for expanding the operational capabilities of the Tester:

- oscillographic probe mode **OSCILLOGRAPH** (subunit 2.3.1.13);
- **TUNING** mode (subunit 2.3.1.18);
- **MEMORY** operation mode with saving setting options (subunit 2.3.1.17);
- mode of saving setting options (subunit 2.3.1.16).

2.3.4.3 Self-test mode - short-run test mode for the Tester efficiency after switching on.

2.3.5 **Procedure for resetting the Tester to its initial state**

2.3.5.1 To reset the Tester to its initial state:

a) turn the power switch to “off” position;

b) disconnect the laboratory DC voltage source or the AC-DC converter ~ 220 V 50 Hz / = 12 V from the AC network (if using a battery, disconnect the Tester from it);

c) disconnect all connecting cables;

d) put the Tester in the transport case.

2.3.6 **Inspection procedure after switching off**

2.3.6.1 Visual inspection after switching off the power is for inspecting the state of the Tester controls, display and all components included in the kit.

Pay special attention to connecting cables. In case of detecting scuff marks, take measures to eliminate such impacts on the cables, and to restore the damaged places on the cables. Pay special attention to the state of the HF cable, avoid twisting, as well as rolling of the cable in the connector. This leads to breakage of the braided screen and the center conductor.

2.3.6.2 Remove dust or traces of moisture from the surface of all components with a soft cloth or compressed air.

2.3.6.3 Periodically check the state of the connectors to prevent oxidation or moisture.

2.3.6.4 Do not leave the Tester for a long time under influence of solar radiation.

2.3.7 **Safety precautions when using the Tester**

2.3.7.1 The Tester does not pose a hazard during its operation.

2.3.7.2 When using a source powered by 220 V 50 Hz, observe the safety requirements for working with electrical installations.
2.4 Actions in extreme conditions

2.4.1 In the event of any unexpected situations, switch off the Tester and disconnect the laboratory DC voltage source or AC-DC converter ~ 220 V 50 Hz / = 12 V from the AC network (if using a battery, disconnect the Tester from it).
3 Maintenance

3 Tester maintenance

3.1.1 General guidelines

3.1.1.1. Maintenance is conducted by persons directly operating the Tester to ensure its efficiency during operation.

3.1.2 Safety precautions

3.1.2.1 All maintenance operations must be conducted in accordance with safety regulations. Maintenance should be permitted for persons who have gone through safety training and have the corresponding certification.

3.1.2.2 During parameter measurements using measuring equipment powered by 220 V 50 Hz, observe safety requirements when working with electrical installations.

3.1.2.3 Before switching on the product and measuring equipment for measuring its parameters, verify:
   - state, integrity and correctness of the grounding connections;
   - state, integrity and correctness of the connection of power cables to the measuring devices and to the power supply sockets.

   When the power is switched on, do not connect or disconnect the connecting cables.

3.3 Tester maintenance procedure

1.3.1 Maintenance includes:
   - verifying the completeness of the product;
   - inspecting external state of the Tester;
   - device cleaning;
   - verifying the overall efficiency.

   Verifying completeness is done by comparing the Tester kit with its certificate.

   Inspection of external state is done before using the Tester (during storage at least once a year), as well as before verification, before and after repair. Verify: button functionality, paint coating condition, state of the cables from the device kit, strength of connectors, keypad functionality.

   Remove dust and dirt from all component housings and connecting cables with a cloth. Cleaning with compressed air is permissible.

   Verication of the overall efficiency is done through measuring in accordance with subunit 2.3.1.1-2.3.1.18 of this Manual.
4 PRESERVATION (DEPRESERVATION, REPRESERVATION)

4.1 Preservation of the Tester before storage is done through packaging in accordance with the requirements of subunit 1.1.7.1-1.1.7.3 of this Manual.
5 STORAGE

5.1 RST-430 storage conditions in warehouses, in terms of impact of the environment, must correspond with storage group 3 (Zh3) of GOST 15150.
6 TRANSPORTATION

6.1 Transportation conditions, in terms of mechanical impacts, must be in accordance with GOST 22261, group 3.

6.2 Transportation conditions of RST-430 in terms of impact of the environment must comply with storage conditions 3 (from minus 50 to plus 50) according to GOST 15150.

6.3 When preparing the device for transportation by air, open the pressure valve located on the carrying case under the case handle by turning it in counterclockwise direction.

6.4 To eliminate possibility of accidental opening of the case locks during transportation, secure the case cover using special lugs with wire or plastic fastenings.
7 DISPOSAL

7.1 RST-430 disposal after the end of its service life is done in accordance with the user enterprise instructions for disposal of waste electrical and electronic equipment of the country of operation.
8 ABBREVIATIONS USED

8.1 The following abbreviations are used in the Manual:

- SW - software;
- M - maintenance;
- OM - Operation Manual
- DCS - direct current source;
- HF - high frequency;
- LF - low frequency;
- AM - amplitude modulation;
- FM - frequency modulation;
- PDUD - persons directly using the device;
- PM - periodic maintenance;
- UM - unscheduled maintenance;
- NDF - non-linear distortion factor.
9 LIST OF REFERENCE NORMATIVE DOCUMENTS

GOST 12.1.004-91 Occupational safety standards system (OSS). Fire safety. General requirements.

GOST 12.2.007.0-75 Occupational safety standards system (OSS). Electrical products. General safety requirements.


GOST 12.3.019-80 Occupational safety standards system (OSS). Electrical testing and measurement. General safety requirements

GOST 14192-96 Cargo marking.


GOST 15150-69 Machinery, devices and other technical products. Designs for different climatic regions. Categories, operating conditions, storage and transportation in terms of impact of environmental climatic factors.


GOST 5962-2013 Rectified ethyl alcohol from edible raw materials. Technical regulations.

GOST 9142-2014 Corrugated cardboard boxes. General technical regulations.

GOST R 51317.4.6-99 (IEC 61000-4-6-96) Electromagnetic compatibility of technical equipment. Resistance to conducted interference induced by radio frequency electromagnetic fields. Test requirements and methods.


PR 50.2.107-09 Metrology regulations. National Uniform Measurement Assurance System. Requirements to approval marks for standard samples or measuring instruments and procedure for their application.
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