RADIOCOMMUNICATION SERVICE TESTERS
PST-430

Verification procedure

MP 26.51.44-008-86866068-2017

Novosibirsk
2017

CONTENTS

This verification procedure is applied to RST-430 Radio-Communication Service Testers (hereinafter - RST-430) produced according to TU 26.51.44-008-86866068-2017 and determines a primary and periodic verification procedure.

The procedure complies with the requirements of PMG

51-2002. Verification interval is two years.

1 Verification stages

1.1 The operations described in Table 1 should be performed during verification.

Table 1 - Verification operations list

Operation name	Item number	Operation to be performed at	
		initial verification	periodic verification
1 Visual inspection	7.1	Yes	Yes
2 Testing	7.2	Yes	Yes
3 Determination of metrological characteristics			
3.1 HF output signal frequency setting error calculation	7.3.1	Yes	Yes
3.2 HF output signal level setting error calculation	7.3.2	Yes	Yes
3.3 HF signal amplitude modulation factor setting error calculation	7.3.3	Yes	Yes
3.4 HF signal frequency deviation setting error calculation	7.3.4	Yes	Yes
3.5 LF voltage setting error calculation	7.3.5	Yes	Yes
3.6 LF signal frequency setting error calculation	7.3.6	Yes	Yes
3.3 LF voltage measurement error calculation	7.3.7	Yes	Yes
3.8 LF signal frequency measurement error calculation	7.3.8	Yes	Yes
3.9 LF harmonic distortion factor measurement error calculation	7.3.9	Yes	Yes
3.10 HF signal frequency measurement error calculation	7.3.10	Yes	Yes
3.11 HF signal power measurement error calculation	7.3.11	Yes	Yes
3.12 HF signal amplitude modulation factor error calculation	7.3.12	Yes	Yes
3.13 HF signal frequency deviation measurement error calculation	7.3.13	Yes	Yes
4 Software identification	7.4	Yes	Yes
5 Verification results registration	8	Yes	Yes
Notes: 1) The word “Yes” indicates verification necessity, the word “No” - no verification.			

1.2 In case of negative results of any operation, a verification is deceased, and RST-430 is rejected.

2 Verification instruments

2.1 Measuring instruments indicated in Table 2 should be applied at a verification process.

Table 2 - Verification measuring instruments

Verification document section number	Name and type (reference designation) of primary or auxiliary verification instrument; designation of reference document covering technical requirements and (or) metrological and basic technical characteristics of a verification instrument.
7.3.1	1) Frequency standard Ch1-81, output signal frequency 5 MHz, frequency nominal deviation 5 MHz not over $\pm 1 \cdot 10^{-10}$, ROSREESTR No. 13442-03, GOST RV 20.39.301 – GOST RV 20.39.305, GOST RV 8.129, GOST 22261, TU EE2.721.711 2) Multi-purpose frequency counter CNT-90XL, frequency range from 0.001 Hz to 100 MHz, error $5 \cdot 10^{-7}$ with external reference frequency for 1 year, ROSREESTR No. 41567-09 according to current reference documentation
7.3.2	Spectrum analyzer E4402B, frequency range from 0.1 KHz to 3 GHZ, intermediate frequency output, ROSREESTR No. 23670-08, according to current reference documentation
7.3.3	1) Calculating modulation meter SK3-45, Frequency range from 0.1 to 4.0 MHz Modulating frequency range from 0.09 to 6.0 KHz Frequency range from 4.0 to 1000.0 MHz Modulating frequency range from 0.09 to 6.0 KHz ROSREESTR No. 9331-83, GOST RV 20.39.301 – GOST RV 20.39.305, GOST RV 20.39.308, GOST 22261, GOST R 50095, TU vR2.740.008 2) HF amplifier U3-33, Frequency range from 0.1 to 400 MHz. Amplification 25 dB ROSREESTR No. 4150-74, TU Khv.2.030.007
7.3.4	1) Modulation meter SK3-45, Frequency range from 0.1 to 4.0 MHz Deviation range from 0.1 to 10 KHz Modulating frequency range from 0.09 to 6.0 KHz $\Delta abs = 0.03D+0.005$ KHz Frequency range from 4.0 to 1000.0 MHz Deviation range from 0,1 to 500 κKHz Modulating frequency range from 0.09 to 6.0 KHz $\Delta abs = 0.02D+12 \cdot 10^{-8} +0.005$ KHz ROSREESTR No. 9331-83, GOST RV 20.39.301 – GOST RV 20.39.305, GOST RV 20.39.308, GOST 22261, GOST R 50095, TU vR2.740.008 2) Amplifier U3-33, Frequency range from 0.1 to 400 MHz. Amplification 25 dB ROSREESTR No. 4150-74, TU Khv.2.030.007
7.3.5	LF voltmeter V7-34, Frequency range from 20 Hz to 100 KHz, error $\pm$ (0.15+0.05(Uk/Ux - 1)) % ROSREESTR No. 7982-80, TU Tg.2.710.010

Table 2 (continued)

Verification document section number	Name and type (reference designation) of primary or auxiliary verification instrument; designation of reference document covering technical requirements and (or) metrological and basic technical characteristics of a verification instrument.
7.3.6	1) Multi-purpose frequency counter CNT-90XL, frequency range from 0.001 Hz to 100 MHz, error $5 \cdot 10^{-7}$ with external reference frequency for 1 year, ROSREESTR No. 41567-09 according to current reference documentation 2) Frequency standard Ch1-81, output signal frequency 5 MHz ROSREESTR No, 13442-03, GOST RV 20.39.301 – GOST RV 20.39.305, GOST RV 8.129, GOST 22261, TU EE2.721.711
7.3.7	AC voltmeter verification device V1-9 AC output voltage range from 100 μV to 100 V; Output voltage frequency range from 20 Hz to 100 KHz. Error: For voltage range from 10^{-4} to 10 V $\pm [0.02+ (0.002 \cdot Uk+0.001)/U_n]$, where Uk – set sub-range finite value, V; Un – set output voltage nominal value , in ROSREESTR No. 5596-76, TU YAY2.761.005
7.3.8	1) LF signal generator G2-123, Output signal frequency from 1 Hz to 299.9 KHz; Output voltage: 23 V (at load of 50 Ohm); 6.2; 19.5; 68 and 195 V (at loads of 5, 50, 600 Ohm and 5 kOhm accordingly) Error: ± 1% at frequency range from 10 Hz to 20 KHz, from 1 to 10 Hz; ± 1.5% at frequency range from 20 to 299.9 KHz. ±(2+4B/Un) % where Un - HF set level ROSREESTR No. 11189-88, GOST 22261, TU ECh3. 269.l13 2) Multi-purpose frequency counter CNT-90XL, frequency range from 0.001 Hz to 100 MHz, error $5 \cdot 10^{-7}$ with external reference frequency for 1 year, ROSREESTR No. 41567-09 according to current reference documentation 3) Frequency standard Ch1-81, output signal frequency 5 MHz ROSREESTR No. 13442-03, GOST RV 20.39.301 – GOST RV 20.39.305, GOST RV 8.129, GOST 22261, TU EE2.721.711
7.3.9	1) Standardizing machine K2S-57, Frequency range from 10 Hz to 200 KHz; Harmonic factor set values range from 0.003 % to 100 %; Set output signal fundamental frequency r.m.s. voltages in Kg mode (“Kr”): 1 V; 1.5 V; 2 V; 2,5 V; 3 V; Error: 0.01 Kg+0.001 % (from 0.1 KHz to 19.9 KHz); Maximum permissible values of fundamental frequency output voltage setting intrinsic fractional error in Kg mode - not over ±15 %. ROSREESTR No. 11671-88, TU DLI2.749.004

Verification document section number	Name and type (reference designation) of primary or auxiliary verification instrument; designation of reference document covering technical requirements and (or) metrological and basic technical characteristics of a verification instrument.
	2) Multi-purpose frequency counter CNT-90XL, frequency range from 0.001 Hz to 100 MHz, error $5 \cdot 10^{-7}$ with external reference frequency for 1 year, ROSREESTR No. 41567-09 according to current reference documentation 3) Frequency standard Ch1-81, output signal frequency 5 MHz ROSREESTR No. 13442-03, GOST RV 20.39.301 – GOST RV 20.39.305, GOST RV 8.129, GOST 22261, TU EE2.721.711
7.3.10	1) VHF signal generator SMF100A, From 100 KHz to 43 GHZ with amplitude modulation/frequency modulation/phase modulation (from minus 130 to plus 20) dBmW Error: $\delta U = \pm (0,6 \ldots 1,2)$ dB ROSREESTR No. 39089-08 according to current reference documentation
7.3.11	1) VHF signal generator SMF100A, From 100 KHz to 43 GHZ with amplitude modulation/frequency modulation/phase modulation (from minus 130 to plus 20) dBmW Error: $\delta U = \pm (0,6 \ldots 1,2)$ dB ROSREESTR No. 39089-08 according to current reference documentation 2) Power amplifier OPHIR 5062, Frequency range from 1.0 to 1000.0 MHz Compression point 1 dB 70 W Amplification 50 dB according to current reference documentation 3) Terminating power meter M3-56 from 0 to 17.85 GHz from 10 mW to 20 W ROSREESTR No. 7060-79, TU EE0.140.027
7.3.12	1) VHF signal generator SMF100A, From 100 KHz to 43 GHZ with amplitude modulation/frequency modulation/phase modulation (from minus 130 to plus 20) dBmW Error: $\delta U = \pm (0,6 \ldots 1,2)$ dB ROSREESTR No. 39089-08 according to current reference documentation 2) Power amplifier OPHIR 5062, Frequency range from 1.0 to 1000.0 MHz Compression point 1 dB 70 W Amplification 50 dB according to current reference documentation

Table 2 (continued)

Verification document section number	Name and type (reference designation) of primary or auxiliary verification instrument; designation of reference document covering technical requirements and (or) metrological and basic technical characteristics of a verification instrument.
7.3.13	1) VHF signal generator SMF100A, From 100 KHz to 43 GHZ with amplitude modulation/frequency modulation/phase modulation (from minus 130 to plus 20) dBmW Error: δU = ± (0,6…1,2) dB ROSREESTR No. 39089-08 according to current reference documentation 2) Calculating modulation meter SK3-45, Frequency range from 0.1 to 4.0 MHz Modulating frequency range from 0.09 to 6.0 KHz ROSREESTR No. 9331-83, GOST RV 20.39.301 – GOST RV 20.39.305, GOST RV 20.39.308, GOST 22261, GOST R 50095, TU vR2.740.008 2) Power amplifier OPHIR 5062, Frequency range from 1.0 to 1000.0 MHz Compression point 1 dB 70 W Amplification 50 dB according to current reference documentation

Note: it is allowed to use other measuring instruments corresponding to metrological and technical characteristics indicated in Table 2.

Measuring instruments applied during verification should be verified and have valid verification certificates.

3 Requirements for qualification of verification officers

Only trained personnel with electrical safety qualification level not less than III according to Industry-Wide Occupational Safety and Health Requirements for Work with Electrical Installations, who studied RST-430 Radio-Communication Service Tester operation and maintenance manual and has radio-technical measurements field experience is allowed to carry out the verification.

4 Safety requirements

4.1 Safety requirements specified in GOST 12.3.019-80, GOST 22261-94 should be followed during verification.

4.2 Prior to RST-430 switching-on check power-unit output voltage for operation voltage compliance. While operating AC-DC ~220 V/=12 V transducer plug connecting/disconnecting to Power network ~220 V should be performed only with RST-430 power switch in “OFF” position.

4.3 Premises intended for verification should comply with fire safety requirements as per GOST 12.1.004-91.

5 Verification conditions

5.1 During verification, the following conditions must be met:

- ambient temperature .....(20 ± 5) °C;
- relative humidity .....from 30 to 80 %;
- atmosphere pressure.....from 84 to 106 kPa; (from 630 to 795 mm Hg);
- mains voltage.....(220±4.4) V;
- mains frequency.....(50±0.5) Hz.

5.2 Power line should not have voltage dynamic changes.

5.3 Workplace should not be in close vicinity to sources of magnet or electrical fields.

6 Preparation for verification

6.1 Prior to verification RST-430 radio-communication testers to be verified and verifying equipment should be:

- kept in a room where verification is carried out in normal environmental conditions for a period of time specified in the relevant operational documentation;
- grounded;
- prepared for operation and kept in switched on condition according to requirements specified in relevant operational documentation;.

6.2 Prior to verification carefully study operational documentation as well as safety instructions for RST-430 and verification equipment.

7 Execution of verification

7.1 Visual inspection

7.1.1 Visual inspection determines:

- manufacturer's seal presence in RST-430 data sheet;
- absence of mechanical damages on transport case surface and RST-430 housing;
- seals integrity;
- inscriptions and designations legibility and distinctiveness;
- absence of visible deformations, mud traces, oxidation traces of cable connectors;
- serviceability of operation controls and indication elements;
- cleanliness and serviceability of plug and socket units.

RST-430 with one of the defects listed above are rejected.

7.2 Testing

7.2.1 After power-up start up screen with RST-430 name should appear. After a few seconds the start up screen changes to Mode menu in which RST-430 was at the moment of power-off (service functions are disabled):

- radio-station parameter measurements in transmission mode, hereinafter - Transmitter mode (Figure 1);
- testing signals parameters settings in Transmitter mode (Figure 2);
- receiver parameters measurements, hereinafter - Receiver mode (Figure 3);
- testing signals parameters settings in Receiver mode (Figure 4).

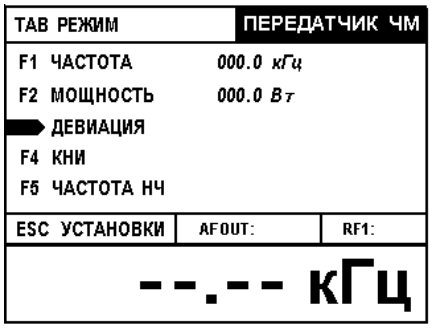


Figure 1 – Mode Transmitter/Measurements

Figure 2 – Mode Transmitter/Settings

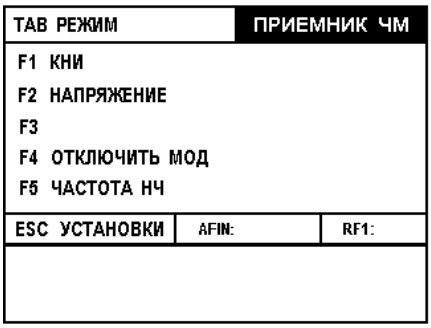


Figure 3 – Mode Receiver/Measurements

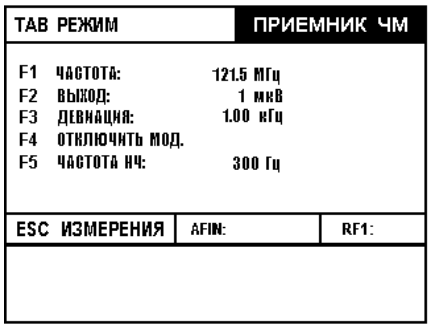


Figure 4 – Mode Receiver/Settings

After 10 seconds approximately (self-testing time) RST-430 is ready for operation.

Metrological parameters are provided within 15 minutes.

Results of this verification phase are considered as satisfactory if start up screen with RST-430 name appears after RST-430 power-up followed by Mode menu.

7.3 Determination of metrological characteristics

7.3.1 HF output signal frequency setting error calculation

7.3.1.1 Connect RST-430 (RF connector) to CNT-90XL frequency counter (Input connector) with a connecting cable. Use HF verification cable (ITTsK418542.005) as a connecting cable with SR-50-424 FV connector, length 125 ± 10 cm. Connect Ch1-81 frequency standard to CNT-90XL as a frequency working standard.

7.3.1.2 Set RST-430 as follows:

- Receiver mode;

- HF maximum level (-27 dBm);

- Deactivate modulation;

- Frequency F_{HF} equal to 155 MHz.

7.3.1.3 Measure HF signal frequency with CNT-90XL frequency counter according to the relevant operational documentation.

7.3.1.4 HF signals formation relative error is calculated with the formula:

$$\delta_{rel} = (1 - F_{meas} / F_{set}) \cdot 100\ \%,\ \% \qquad (7.1)$$

where F_{set} – HF signal frequency set value for RST-430;
F_{meas} – HF signal frequency measured value.

7.3.1.5 Repeat the measurement according to sections 4.2.7.2 - 4.2.7.4 for frequencies 90 and 210 MHz

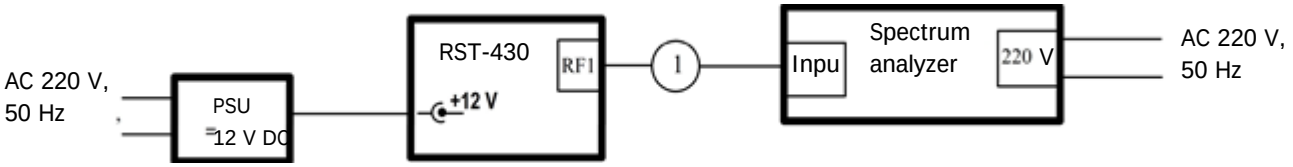
Measurement results are deemed satisfactory if error does not exceed the values specified in Table 3.

Table 3 - HF output signal frequency setting error

HF set level, dBm	Measurement frequency, MHz	Measurement results		Parameter requirement
		Measured frequency,	Error, KHz	
-27	90			±270 KHz
	155			±465 KHz
	210			±630 KHz

7.3.2 HF output signal level setting error calculation

7.3.2.1 HF output signal level setting error calculation is performed according to diagram shown in Fig. 5.



1 – Verification cable ITTsK418542.005, connector SR-50-424 FV, length 125 ± 10 cm.

PSU – power supply with voltage 12 V, or AC – DC ~220 V/ =12 V transducer, or rechargeable battery.

Figure 5 - Calculation diagram of HF output signal level setting error

7.3.2.2 Set RST-430 as follows:

- Receiver/Settings mode;
- HF maximum level;
- Frequency F_{HF} equal to 155 MHz;
- Deactivate modulation.

7.3.2.3 Measure HF output level with E4402V spectrum analyzer.

7.3.2.4 Absolute error of HF output level setting is calculated with the formula:

$$\Delta_{abs} = (A_{HF\ set} - A_{HF\ meas}), \text{ dB}, \quad (7.2)$$

where $A_{HF\ set}$ – HF level set value for RST-430, dBm;

$A_{HF\ meas}$ – value measured by spectrum analyzer, dBm.

7.3.2.5 Repeat the measurement at frequencies specified in Table 4 according to sections 7.3.2.2 - 7.3.2.4.

7.3.2.6 Repeat the measurement at output levels specified in Table 4 according to sections 7.3.2.3 - 7.3.2.5.

7.3.2.7 Complete Table 4.

Measurement results are deemed satisfactory if error does not exceed the value of ± 4 dB.

Table 4 - HF output level setting error

HF set level, dBm	Measurement frequency,	Measurement results		Parameter requirement
		HF measured level, dBm	Error, Δ, dB	
-27	1.6			±4 dB
	155			
	315			
	470			
-50	1.6			
	155			
	315			
	470			
-80	1.6			

HF set level, dBm	Measurement frequency,	Measurement results		Parameter requirement
		HF measured level, dBm	Error, Δ, dB	
	155			
	315			
	470			
-100	1.6			
	155			
	315			
	470			
-126	1.6			
	155			
	315			
	470			

7.3.3 HF signal amplitude modulation factor setting error calculation.

7.3.3.1 HF signal amplitude modulation factor setting error calculation is performed according to diagram shown in Fig. 6.

7.3.3.2 Set SK3-45 modulation meter as follows:

- AM mode, “+”

- band pass 0.02 … 200 KHz;

- range 18…1000 MHz

7.3.3.3 Set RST-430 as follows:

- AM Receiver mode;

- Frequency F_{HF} equal to 155 MHz;

- Modulation frequency equal to 1 KHz;

- Amplitude modulation equal to 30 %;

- HF maximum level (-33 dBm);

7.3.3.4 Measure HF signal frequency amplitude modulation with SK3-45 modulation meter. Set a HF signal to SK3-45 through U3-33 HF amplifier.

7.3.3.5 Amplitude modulation setting absolute error is calculated with the formula:

$$\Delta = \pm (M_{set} - M_{meas}), \% \qquad (7.3)$$

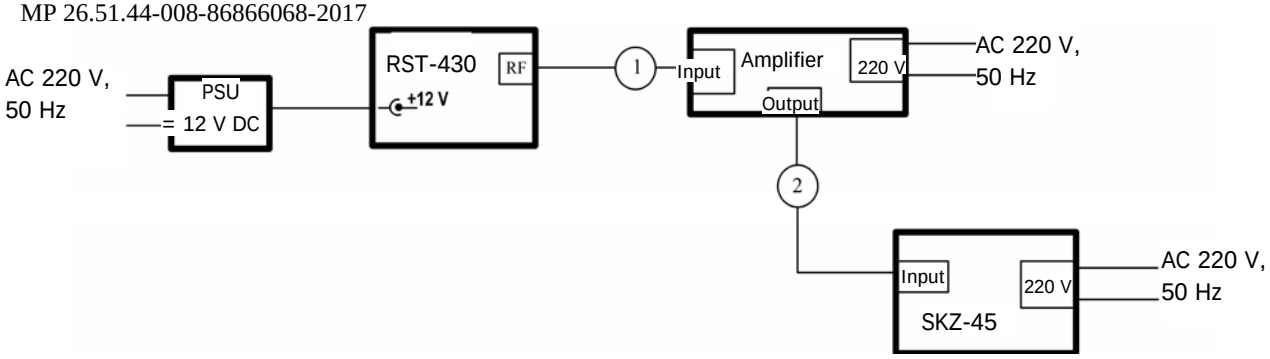
where M_{set} – RST-430 amplitude modulation set value, %.

M_{meas} – amplitude modulation value measured with SK3-45 modulation meter, %.

7.3.3.6 Repeat the measurement at frequency amplitude modulation set values of 70 % and 90 % according to sections 7.3.3.2 – 7.3.3.5.

7.3.3.7 Repeat the measurement at modulation frequency set to 200 Hz and 10 KHz according to sections 7.3.3.3 – 7.3.3.6.

Measurement results are deemed satisfactory if the error does not exceed values specified in Table 5.



1, 2 – Calibration cable ITTsK418542.005, connector SR-50-424 FV/SR-50-74 PV, length 125 ± 10 cm.

PSU – DC power supply with 12 V or AC – DC ~220 V/ =12 V transducer, or rechargeable battery.

Figure 6 – Calculation diagram of HF amplitude modulation factor signal setting error

Table 5 - HF amplitude modulation factor signal setting error.

Preset amplitude modulation factor, %	Modulation frequency, Hz	Measurement results		Parameter requirement, Δ, %
		Measured amplitude modulation factor, %	Error, Δ, %	
30	200			± 2.55
	1000			
	10000			
70	200			± 5.95
	1000			
	10000			
90	200			± 7.65
	1000			
	10000			

7.3.4 HF signal frequency deviation setting error calculation

7.3.4.1 HF signal frequency deviation setting error calculation is performed according to diagram shown in figure 6.

7.3.4.2 Connect the RST-430 “RF” connector through the amplifier to modulation meter.

7.3.4.3 Connect the RST-430 “RF” connector through the amplifier to SKZ-45 modulation meter.

7.3.4.4 The following settings shall be applied for RST-430:

- enable “FM RECEIVER” mode;
- disable «EXTERNAL ATTENUATOR/RECEIVER» function;
- enable modulation;

- set HF signal level of minus -33 dBm;

- set HF signal frequency of 155 MHz;

- set deviation of 3 kHz;

- set deviation frequency of 1 kHz.

7.3.4.5 According to operational documentation the following settings shall be applied for SKZ-45:

- “FM” operation mode, “ + “

- band pass 0.02 … 3.4 kHz;

- range 18…1000 MHz

7.3.4.6 Measure RST-430 preset deviation by means of modulation meter.

7.3.4.7 Calculate deviation setting absolute error according to the formula:

$$\Delta_{abs} = D_{preset} - D_{meas}, \text{ kHz}, \quad (7.4)$$

where D_{preset} - RST-430 preset deviation value, kHz;

D_{meas} - SKZ-45 measured deviation value, kHz.

7.3.4.8 Repeat measurement in accordance with sections 7.3.4.3 – 7.3.4.7 using preset deviation values of 5 and 20 kHz.

7.3.4.9 Repeat measurement in accordance with sections 7.3.4.3 – 7.3.4.8 using preset modulation frequency values of 3 kHz and 10 kHz.

7.3.4.10 Measurement results are deemed satisfactory if deviation setting absolute error does not exceed the value specified in Table 6.

Table 6 - HF signal frequency deviation setting error

Preset deviation, kHz	Modulation frequency, kHz	Measurement results		Parameter requirement
		Measured deviation, kHz	Error, Δ, Hz	
3	1			172 Hz
	3			
	10			
5	1			312 Hz
	3			
	10			
20	1			2000 Hz
	3			
	10			

7.3.5 LF voltage setting error calculation

LF output voltage setting error calculation is carried out as follows:

7.3.5.1 Connect RST-430 (“AF OUT” connector) to V7-34 voltmeter by means of ITTsK418542.006 connecting calibration cable with SR-50-74 PV connector, length 125 ± 10 cm.

7.3.5.2 Set the following for PST-430:

- “Transmission” mode;

- output voltage U_{lf} equal to 0.25 V;

- frequency F_{hf} equal to 1 kHz.

7.3.5.3 Measure output voltage U_{lf} by means of V7-34 voltmeter in accordance with its operational documentation.

7.3.5.4 Output voltage U_{lf} setting absolute error is calculated according to formula (7.5) :

$$\Delta_{abs} = (U_{lf\ preset} - U_{lf\ meas}),\ V \qquad (7.5)$$

where $U_{lf\ preset}$ – RST-430 output voltage preset value, V;

$V_{lf\ meas}$ - output voltage value measured by theV7-34 voltmeter, V.

7.3.5.5 Repeat the measurement in accordance with 7.3.5.1- 7.3.5.4, setting the RST-430 output voltage values to 1 V and 2,0 V;

7.3.5.6 Repeat the measurement in accordance with 7.3.5.2- 7.3.5.5, setting the RST-430 frequency values F_{lf} to 5 kHz and 20 kHz.

Measurement results are deemed satisfactory if error does not exceed values specified in Table 7.

Table 7 - LF voltage setting error

Preset voltage, V	Frequency, kHz	Measurement results		Parameter requirement, V
		Measured voltage, V	Error, Δ, V	
0.25	1			0.0325
	5			
	20			
1	1			0.07
	5			
	20			
2	1			0.12
	5			
	20			

7.3.6 LF \setting error calculation

LF output signal setting error calculation is carried out as follows:

7.3.6.1 Connect RST-430 ("AF OUT" connector) to CNT-90XL frequency counter (Input connector) with a connecting cable. Use high-frequency verification cable ITTsK418542.006 as a connecting cable with SR-50-74 PV connector, length 125 ± 10 cm. Connect Ch1-81 frequency standard to CNT-90XL as a frequency working standard.

7.3.6.2 Set the following for PST-430:

- “Transmission” mode;

- output voltage U_{lf} equal to 2 V;

- Frequency F_{LF} equal to 1 KHz;

7.3.6.3 Measure LF output signals frequency (F_{lf}) by means of CNT-90XL frequency meter.

7.3.6.4 Absolute error for generating frequency F_{LF} is calculated according to the formula:

$$\Delta=(F_{lf\ preset} – F_{lf\ meas}), \text{ kHz}, \quad (7.6)$$

where $F_{lf\ preset}$ – LF output signal frequency preset value for RST-430, kHz;

$F_{lf\ meas}$ - LF output signal frequency value measured by the CNT-90XL frequency meter.

7.3.6.5 Repeat measurement in accordance with sections 7.3.6.1 – 7.3.6.4 using RST-430 preset frequency values of 200 kHz and 20 kHz. Complete Table 8

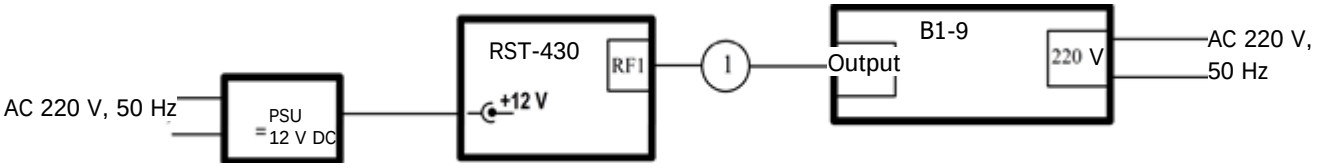
Table 8 - LF signal frequency setting error

Voltage U_{lf}, V	Preset frequency, Hz	Measurement results		Parameter requirement
		Measured frequency value, Hz	Error Δ_{abs}, Hz	
2	200			±1 Hz
	1000			
	20000			

Measurement results are deemed satisfactory if the error does not exceed the value of ± 1 Hz.

7.3.7 LF voltage measurement error calculation

7.3.7.1 LF voltage measurement error calculation is performed according to diagram shown in Fig. 7.



1 - Calibration cable ITTsK418542.006, connector SR-50-74 PV, length 125 ± 10 cm.
PSU – DC power supply with 12 V or AC – DC ~220 V/ =12 V transducer, or rechargeable battery.

Figure 7 - Calculation diagram of LF voltage measurement error

7.3.7.2 Connect the RST-430 "AF IN" connector to output of the V1-9 alternating current voltmeters testing unit.

7.3.7.3 The following settings shall be applied for RST-430:

- enable FM RECEIVER/MEASUREMENTS mode;

- enable LF voltage measurement mode;

- select measurements input “AF IN”

7.3.7.4 set V1-9 frequency to 1.0 KHz

7.3.7.5 Measure the values set for V1-9 with RST-430:

- 15.0 V;

- 1.00 V;

- 0.20 V;

- 0.02 V

7.3.7.6 Repeat measurements according to section 7.3.7.5 for frequencies set for B1-9:

- 0.02 kHz;

- 1 kHz;

- 20.0 kHz.

7.3.7.7 Calculate LF voltage measurement absolute error according to the formula:

$$\Delta_{abs} = U_{preset} - U_{meas}, V, \quad (7.7)$$

where U_{set} - value set for V1-9, V; U_{meas}- value

measured with RST-430, V.

7.3.7.8 Measurement results are deemed satisfactory if LF voltage measurement absolute error does not exceed values specified in Table 9.

Table 9 - LF voltage measurement error

Preset voltage, V	Frequency, Hz	Measurement results		Parameter requirement, Δ, V
		Measured voltage, V	Error, Δ, V	
0.02	200			± 0.0106
	1000			
	20000			
0.2	200			± 0.016
	1000			
	20000			
1	200			± 0.04
	1000			
	20000			
15	200			± 0.31
	1000			
	20000			

7.3.8 LF signal frequency measurement error calculation

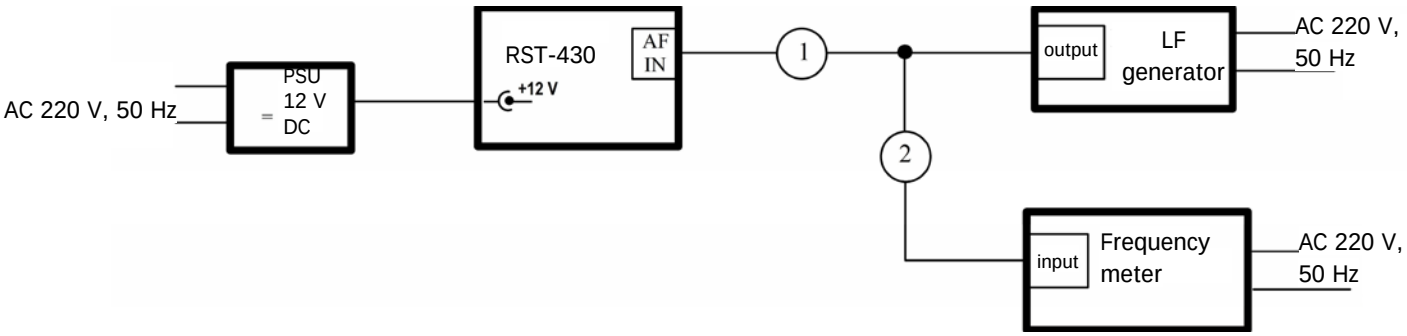
7.3.8.1 LF signal frequency measurement error calculation is performed according to diagram shown in Fig. 8.

7.3.8.2 According to operational documentation the following settings shall be applied for GZ-123 LF generator:

- output voltage U_{lf} equal to 1 V;

- frequency F_{hf} equal to 1 kHz.

7.3.8.3 Monitor frequency by means of CNT-90XL frequency meter. Connect frequency standard Ch1-81 to CNT-90XL as a frequency working standard.



1, 2 - Calibration cable ITTsK418542.006, connector SR-50-74 PV, length 125 ± 10 cm.
PSU – DC power supply with 12 V or AC – DC ~220 V/ =12 V transducer, or rechargeable battery.

Figure 8 - Calculation diagram of LF signal frequency measurement error

7.3.8.4 Set RST-430 to Transmission/Frequency mode.

7.3.8.5 Take the reading of RST-430.

7.3.8.6 LF signal measurement (F_{lf}) absolute error is calculated according to the formula:

$$\Delta_{abs} = (F_{lf\ preset} - F_{lf\ meas}),\ KHz, \qquad (7.8)$$

where $F_{lf\ preset}$ – frequency preset value, KHz;

$F_{LF\ meas}$ – measured frequency value, kHz.

7.3.8.7 Repeat measurement in accordance with sections 7.3.8.2 – 7.3.8.6, setting frequency values of LF generator to 10 kHz, 100 KHz.

7.3.8.8 Complete Table 10.

Measurement results are deemed satisfactory if frequency measurement error does not exceed ± 1 Hz.

Table 10 - LF signal frequency measurement error

LF voltage, V	Preset frequency, kHz	Measurement results		Parameter requirement
		Measured frequency value, kHz	Error, Hz	
1	1			±1 Hz
	10			
	100			

7.3.9 LF harmonic distortion factor measurement error calculation.

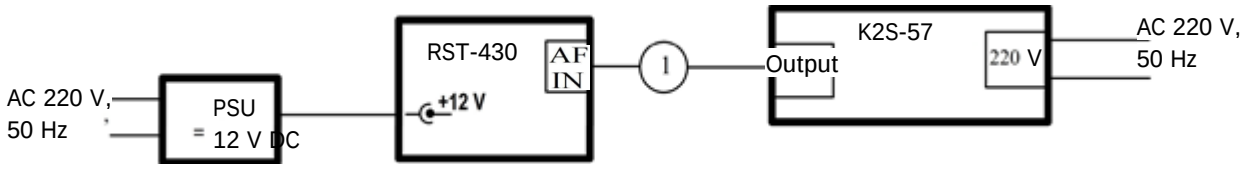
7.3.9.1 HF harmonic distortion factor measurement error calculation is performed according to diagram shown in Fig. 9.

7.3.9.2 Set RST-430 to Transmission/HDF mode.

7.3.9.3 Set the K2S-57 **measurement unit for** harmonic factor meters verification as follows:

- frequency equal to 1 kHz ± 0.1 Hz (monitor by means of CNT-90XL frequency meter). Use frequency standard Ch1-81 as a working standard;

- harmonic distortion factor (HDF) equal to 10 %.



1 - Calibration cable ITTsK418542.006, connector SR-50-74 PV, length 125 ± 10 cm.
PSU – DC power supply with 12 V or AC – DC ~220 V/ =12 V transducer, or rechargeable battery.

Figure 9 - Calculation diagram of harmonic distortion factor measurement error

7.3.9.4 Take the reading of RST-430.

7.3.9.5 Harmonic distortion factor (HDF) measurement absolute error is calculated with the formula:

$$\Delta_{aabs} = (HDF_{set} - HDF_{meas}), \% \qquad (7.9)$$

where HDF_{set}– HDF value set for K2S-57, %;

HDF_{meas}–HDF value measured by RST-430, %.

7.3.9.6 Repeat measurement according to sections 7.3.9.2 - 7.3.9.5, setting HDF values of K2S-57 according to Table 11.

7.3.9.7 Complete Table 11

Measurement results are deemed satisfactory if HDF measurement error does not exceed the value specified in Table 11.

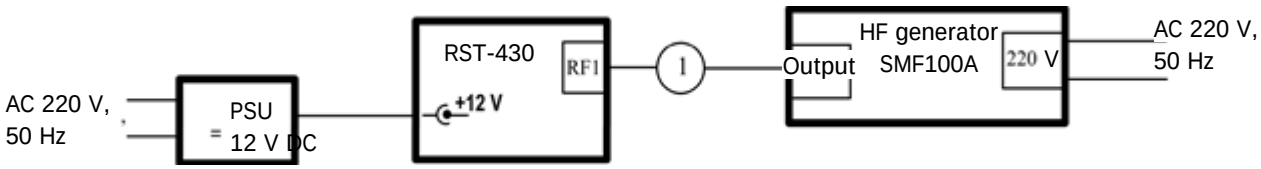
Note - HDF measurement error in the range 50 %-100 % is not standardized.

Table 11 - Harmonic distortion factor measurement error

Preset HDF, %	Frequency, Hz	Measurement results		Parameter requirement 1) $\delta=\pm(1+0.1\cdot HDF_{meas})$,%
		Measured HDF, %	Error, Δ, %	
1	200			±1.1
	1000			
	10000			
3	200			±1.3
	1000			
	10000			
25	200			±3.5
	1000			
	10000			
50	200			±6
	1000			
	10000			

7.3.10 HF signal frequency measurement error calculation

7.3.10.1 HF signal frequency measurement error calculation is performed according to diagram shown in Fig. 10.



1 – Calibration cable ITTsK418542.005, connector CP-50-424 FV/SR-50-74 PV, length 125 ± 10 cm.
PS – DC power supply with 12 V or AC – DC ~220 V12 V transducer,
or rechargeable battery.

Figure 10 - Calculation diagram of HF signal frequency measurement error

7.3.10.2 Set SMF100A HF generator as follows:

- voltage equal to 1 V;

- F_{hf} frequency equal to 155 MHz.

7.3.10.3 Set RST-430 to Transmission/Frequency mode.

7.3.10.4 Take the reading of RST-430.

6.3.6.5 HF signal frequency measurement relative error (F_{HF}) is calculated with the formula:

$$\delta_{rel} = (F_{HF\ meas} / F_{HF\ set} - 1)\cdot 100\ \%,\ \% \qquad (7.10)$$

6.3.6.6 Repeat measurement in accordance with sections 7.3.10.2.2 – 7.3.10.5.5, setting frequency values of SMF100A generator to 90 MHz, 210 MHz .

Measurement results are deemed satisfactory if HF signal frequency relative error does not exceed the values specified in Table 12.

Table 12 - HF signal frequency measurement error

Preset frequency, MHz	Voltage, V	Measurement results		Parameter requirement
		HF signal frequency measured value, MHz	Error, Δ, kHz	
90	1			±270 KHz
155				±465 KHz
210				±630 KHz

7.3.11 HF signal power measurement error calculation

7.3.11.1 HF signal power measurement error calculation is performed according to diagram shown in Fig. 11.

7.3.11.2 Set RST-430 as follows:

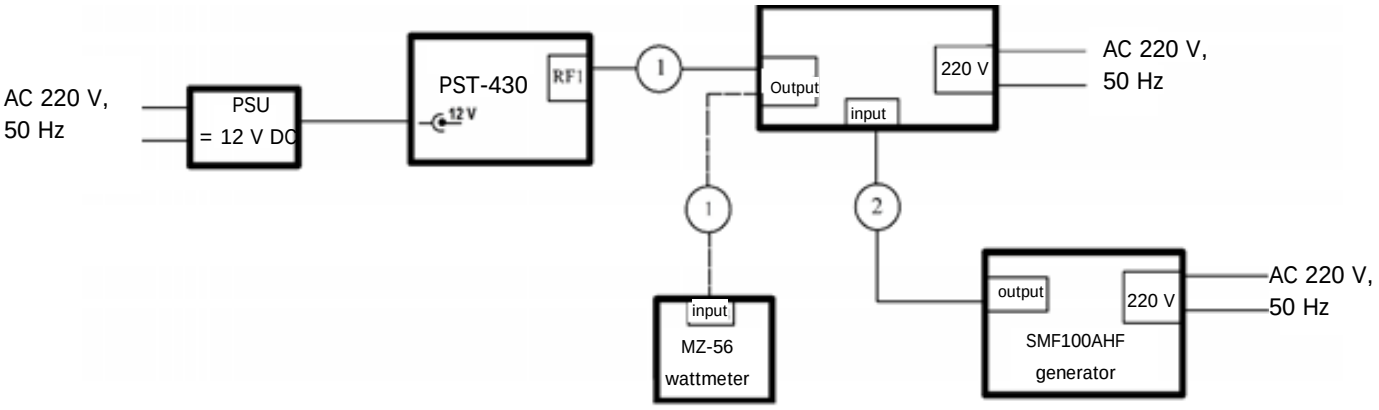
- enable “FM RECEIVER/MEASUREMENTS” mode;

- disable «EXTERNAL ATTENUATOR/TRANSMITTER» function;

- enable power measurement mode.

7.3.11.3 Set HF generator frequency to 5 MHz.

7.3.11.4 Connect amplifier output to standard power meter. Set power of OPHIR 5062 amplifier output to 20.0 W changing output voltage of HF generator.



1, 2 – Calibration cable ITTsK418542.005, connector SR-50-424 FV/SR-50-74 PV, length 125 ± 10 cm.
PSU – DC power supply with 12 V or AC – DC ~220 V/ =12 V transducer, or rechargeable battery.

Figure 11 - Calculation diagram of HF signal power measurement error

7.3.11.5 Connect RST-430 to power amplifier instead of standard power meter. Measure set power of RST-430.

7.3.11.6 Repeat measurement, setting power 2 and 100 W at frequencies given in Table 13.

7.3.11.7 Calculate HF power measurement relative error according to the formula:

$$\delta_{rel} = (P_{meas} / P_{set} - 1)\cdot 100\ \%;\ \%, \qquad (7.11)$$

where P_{meas} - HF power value measured by RST-430, W;
P_{set} - HF power value measured by standard power meter, W.

7.3.11.8 Verification results are deemed satisfactory if HF power measurement relative error does not exceed the value given in Table 13.

Table 13 - HF signal power measurement error

Preset power, W	Measurement frequency, MHz	Measurement results		Parameter requirement ±(10+20 W/P_{meas}), %
		Measured power, W	Error, Δ, W	
2	5			20% (0.4 W)
	50			
	155			
	300			
	470			
10	5			12% (1.2 W)
	50			
	155			
	300			
	470			
20	5			11% (2.2 W)
	50			
	155			
	300			
	470			

7.3.12 HF signal amplitude modulation factor error calculation.

7.3.12.1 Configure diagram according to figure 12.

7.3.12.2 Set SMF100A HF generator as follows:

- voltage level equal to 100 MW;

- frequency F_{HF} equal to 155 MHz;

- frequency modulation - internal;

- modulation frequency – 1 kHz:

- amplitude modulation equal to 10 %;

7.3.12.3 Connect RST-430 to OPHIR 5062 power amplifier output. Take value set for SMF100A HF generator as the amplitude modulation factor reference value.

7.3.12.4 Set power of OPHIR 5062 amplifier output to 2.0 W changing output voltage of HF generator.

7.3.12.5 Set RST-430 to Transmission/Modulation mode.

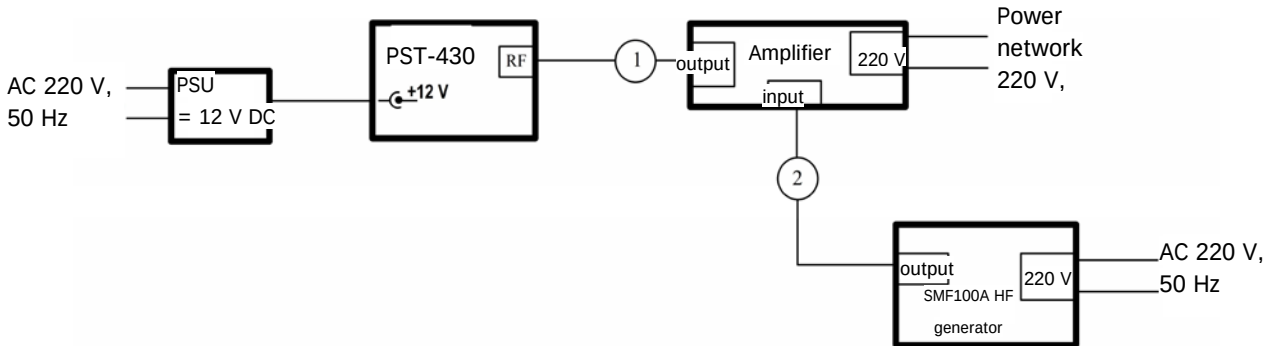
7.3.12.6 Take the reading of RST-430.

7.3.12.7 HF signals frequency amplitude modulation measurement relative error is calculated with the formula:

$$\delta_{rel} = (K_{meas} / K_{preset} - 1)\cdot 100\ \%,\ \% \qquad (7.12)$$

7.3.12.8 Repeat measurement in accordance with sections 7.3.12.2 – 7.3.12.7, setting modulation frequency of SMF100A generator to 3 KHz, 10 KHz

7.3.12.9 Repeat measurement in accordance with sections 7.3.12.2 – 7.3.12.8, setting amplitude modulation factor of SMF100A generator to 30% and 90 %.



1, 2 – Calibration cable ITTsK418542.005, connector SR-50-424 FV/SR-50-74 PV, length 125 ± 10 cm.
PSU – DC power supply with 12 V or AC – DC ~220 V/ =12 V transducer, or rechargeable battery.

Figure 12 - Calculation diagram of HF signal amplitude modulation factor error calculation.

7.3.12.10 Set power of OPHIR 5062 amplifier output to 20.0 W changing output voltage of HF generator. Repeat measurement applying frequencies given in Table 14.

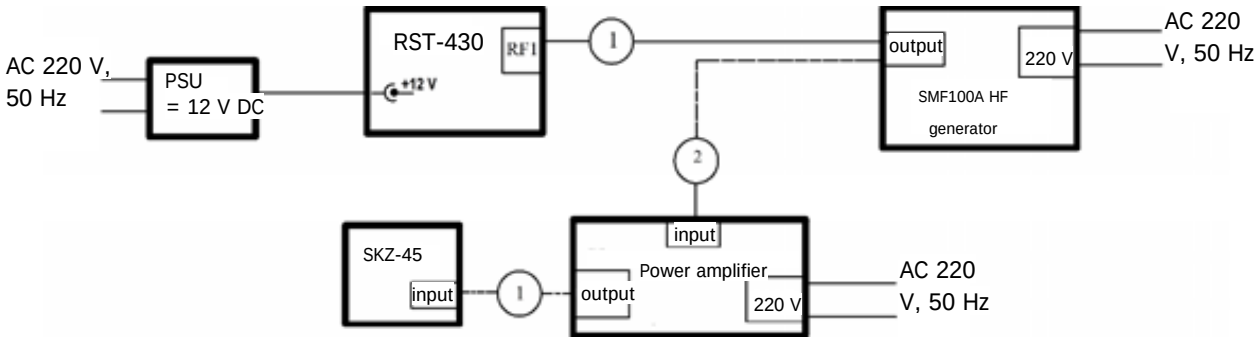
Measurement results are deemed satisfactory if measurement error of amplitude modulation factor does not exceed the values specified in Table 14.

Table 14 - HF signal amplitude modulation factor error.

Preset modulation factor K_{set}, %	Modulation frequency, kHz	Measurement results				Parameter requirement, Δ, %
		Modulation factor measured value K_{meas}, %		Error, Δ, %		
		P_{input}=2 W	P_{input}=20 W	P_{input} =2 W	P_{input}= 20 W	
10	1					± 10
	3					
	10					
30	1					
	3					
	10					
90	1					
	3					
	10					

7.3.13 HF signal frequency deviation measurement error calculation

7.3.13.1 HF signal frequency deviation measurement error calculation is carried out according to diagram shown in figure 13.



1, 2 – Calibration cable ITTsK418542.005, connector SR-50-424 FV/SR-50-74 PV, length 125 ± 10 cm
PS – DC power supply with 12 V or AC – DC ~220 V/ =12 V transducer, or rechargeable battery.

Figure 13 - Calculation diagram of HF signal frequency deviation measurement error

7.3.13.2 Set SMF100A HF generator as follows:

- voltage level equal to 0.5 V;

- frequency F_{HF} equal to 155 MHz;

- frequency modulation - internal;

- modulation frequency – 1 kHz:

- deviation equal to 1 kHz.

7.3.13.3 Connect SMF100A output to SKZ-45 through a power amplifier. Monitor deviation value set for SMF100A generator by means of SK3-45 modulation meter.

7.3.13.4 Connect RST-430 to ϕ generator instead of SKZ-45.

7.3.13.5 Set RST-430 to Transmission/Deviation mode.

7.3.13.6 Take the reading of RST-430.

7.3.13.7 HF signal frequency deviation relative error is calculated with the formula:

$$\delta_{rel} = (D_{meas} / D_{set} - 1)\cdot 100\ \%,\ \% \qquad (7.13)$$

7.3.13.8 Repeat measurement in accordance with sections 7.3.13.2 – 7.3.13.7, setting frequency values of SMF100A generator according to Table 4.9.

7.3.13.9 Repeat measurement in accordance with sections 7.3.13.2 – 7.3.13.8 setting deviation values of SMF100A generator to 5.0 and 20 kHz according to Table 15.

Measurement results are deemed satisfactory if HF signal deviation measurement error does not exceed the value specified in Table 15.

Table 15 - HF signal frequency deviation measurement error

Preset deviation, kHz	Measurement frequency, MHz	Measurement results		Parameter requirement, Hz
		Measured deviation value, kHz	Error, Δ, Hz	
1	1.6			52 Hz
	50			
	155			
	300			
	470			
5	1.6			312 Hz
	50			
	155			
	300			
	470			
20	1.6			2 kHz
	50			
	155			
	300			
	470			

7.4 Software Identification

All metrologically significant software modules of radio-communication service testers use executable code inaccessible for reading and recording. RST-430 design excludes the ability of unauthorized impact on measurement units software and measurement data.

To check software ID (version number) switch on RST-430 while F5 button is pressed on indication panel screen. After 10 seconds the software version number will be displayed on the display panel screen (Figure 14).

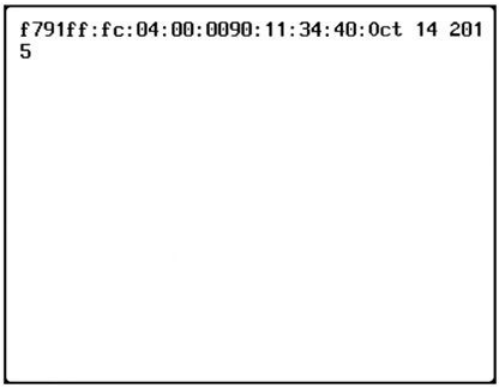


Figure 14 - Displaying the software identification number of the Tester on the display panel screen

8 Verification results registration

8.1 Verification results are formalized according to the Procedure for Verification of Measuring Instruments, Requirements for Verification Sign and Contents of the Verification Certificate, approved by Order No. 815 of the Ministry of Industry and Trade of the Russian Federation dated July 2, 2015.

8.2 Positive results of periodic verification must be formalized by a verification certificate, previous verification stamp is canceled and a new stamp is printed.

8.3 If the results are negative, unsuitability report is formalized. Previous verification stamp and certificate are canceled.

APPENDIX A
(recommended)

Examples of RST-430 Radio-Communication Service Tester control

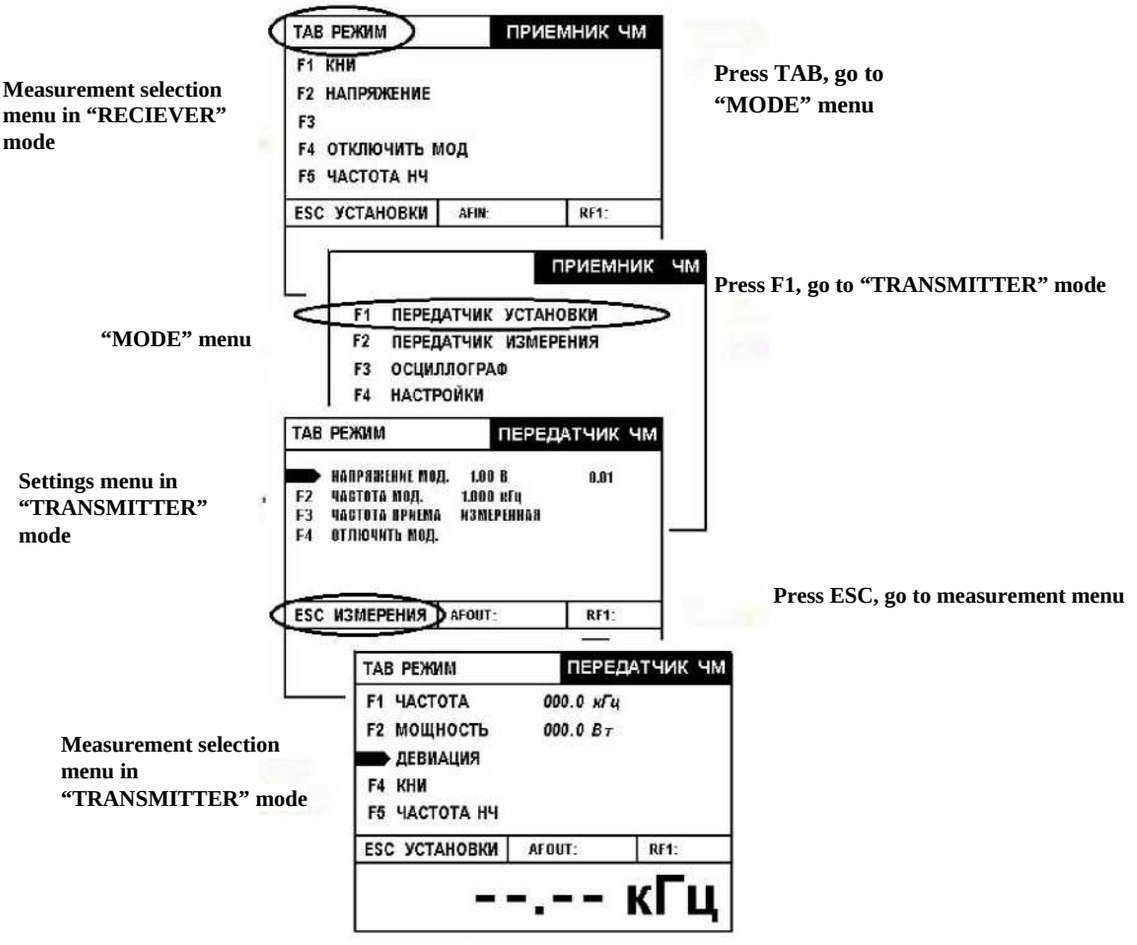


Figure A.1 - Operation mode switching

APPENDIX A (continued)

Press TAB, go to “MODE” menu

Press F4, go to “SETTINGS” menu

Press F1, select AM modulation

Figure A.2 – AM modulation selection

APPENDIX A (continued)

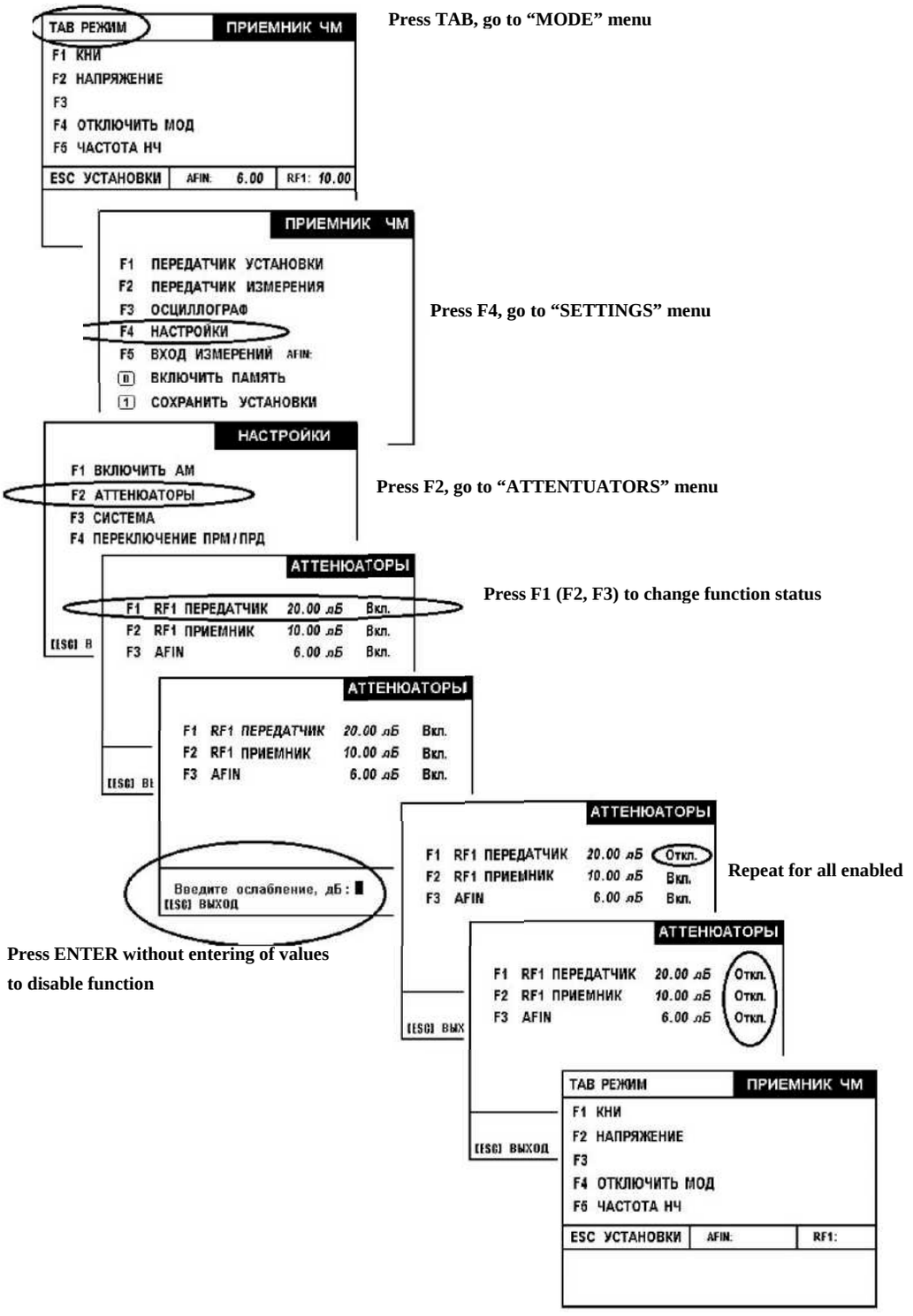


Figure A.3 - Disabling of "Attenuator" function

APPENDIX A (continued)

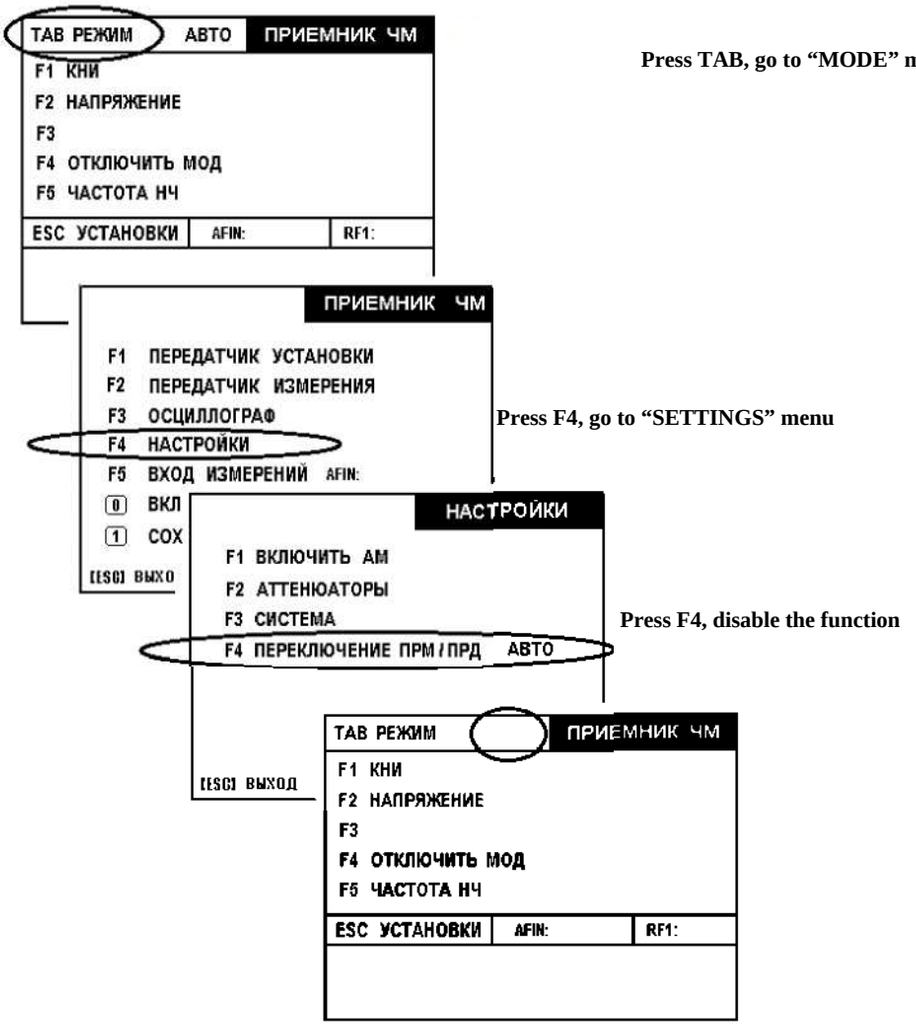
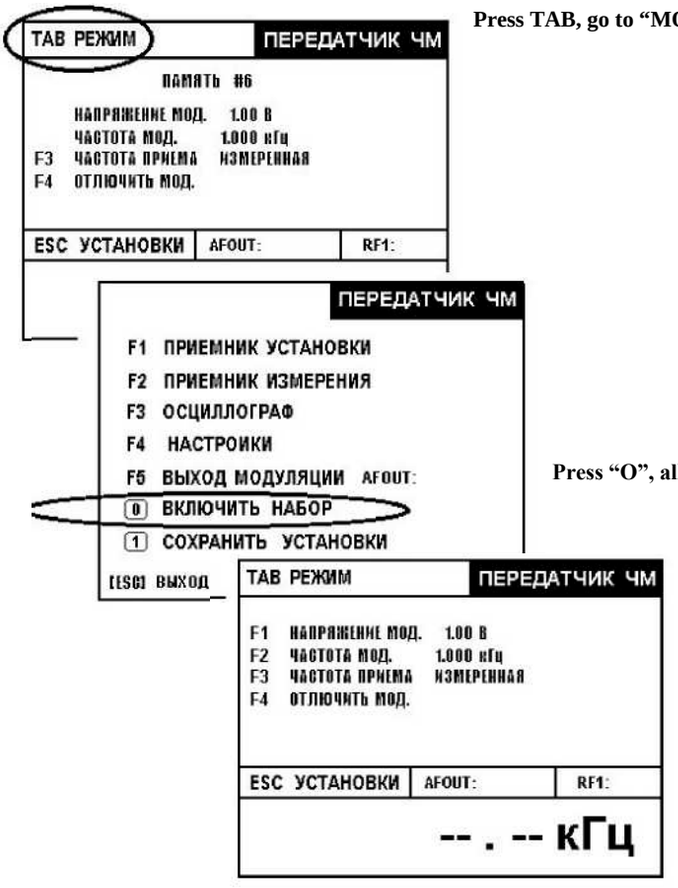


Figure A.4 - Disabling of "Automatic Switching" function

APPENDIX A (continued)



Press TAB, go to “MODE” menu

Press “O”, allow typing by buttons

Figure A.4 - Disabling of “Settings Memory” function

APPENDIX A (continued)

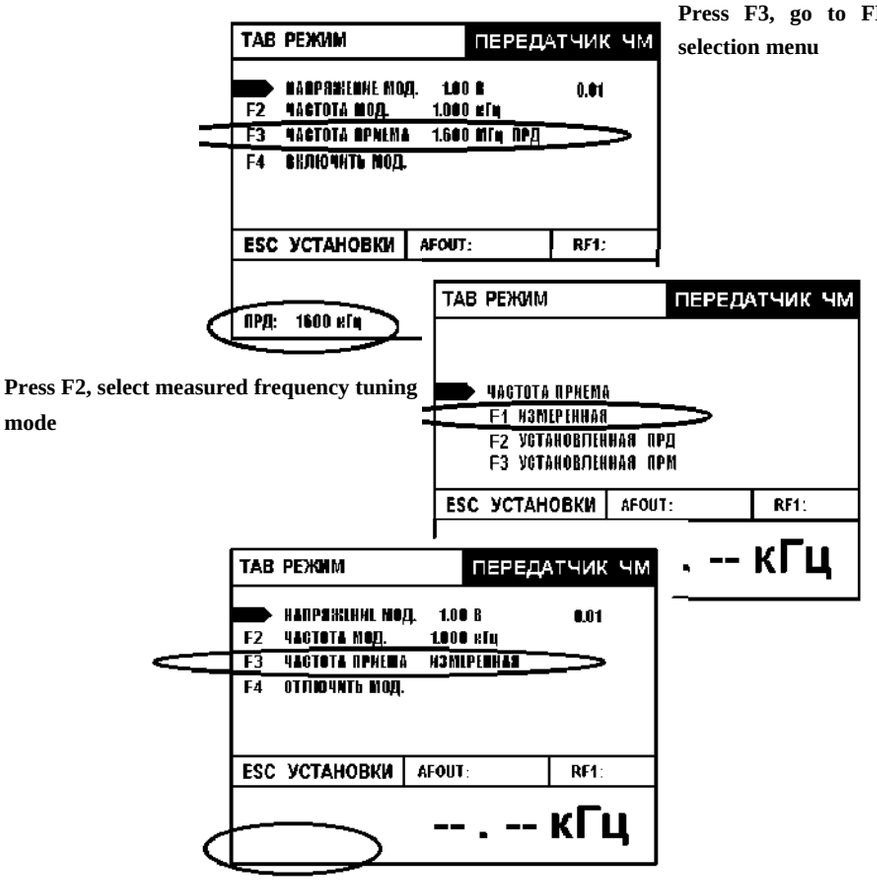
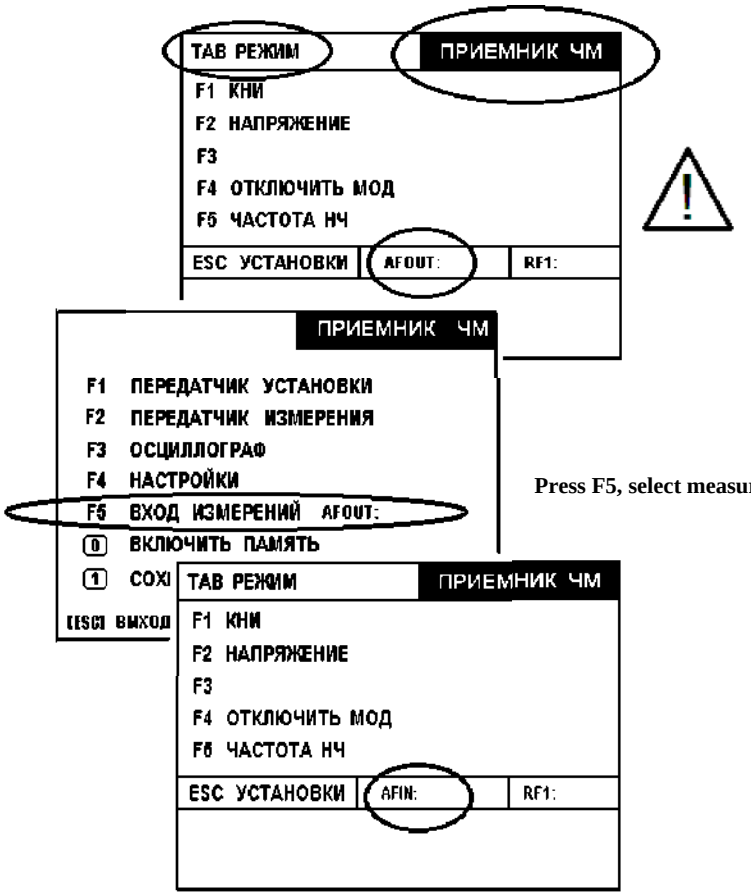


Figure A.5 - FM receiver tuning selection

APPENDIX A (end)



Press TAB, go to “MODE” menu

“MODE” menu shall be called from “RECEIVER” mode.

Press F5, select measurement input “AF IN”

Figure A.6 - Measurement input selection in “Receiver” mode