



Radio Set RF-10

Technical Description
Part 1

This document contains the following supplements:

- 1.
- 2.
- 3.

INTRODUCTION

This document includes the tactical and technical data of the radio station set, a detailed description of all parts and blocks of the radio station and circuit diagrams.

It also deals with the structure and the principle of activity of all parts and provides detailed instructions for the preparation, operation, tuning and setting up in the field.

The document provides details of basic treatment, technical treatment No. 1 and basic data and battery maintenance. It also provides storage instructions and ways to eliminate common defects.

The text is complemented by photographs of the kit and drawn depictions of antenna systems and their diagrams.

The document is for the commanders and technical bodies of the departments where the radio station is in use.

The document shall take effect on 1 August 1977.

CHAPTER 1

TECHNICAL DATA

1. Basic data

The radio station kit meets the following technical specifications:

- | | |
|----------------------|---|
| 1. Frequency range | 44.00 to 53.975 MHz. |
| Channel spacing | 25 kHz - all 400 channels are directly set by three switches. |
| Operation mode | Single Channel Simplex Telephony Mode - Frequency Modulation. |
| Transmitter power | rated power 1 W at 6 V supply voltage. |
| Audio power output | 0.1 to 30 mW. |
| Receiver sensitivity | better than 0.5 μ V. |

2. Range:

- | | |
|------------------------------|---------------|
| - with 1.5m whip antenna | 5 km; |
| - with 0.5m whip antenna | 0.5 m - 1 km; |
| - with vertical wire antenna | 10 km; |
| - with directional antenna | 20 km. |

(Average range is understood to be in moderately hilly & medium-forested terrain.)

3. Operating temperatures: The normal operating temperature range is -35 °C to +60 °C. Within a temperature range -50 °C to -35 °C and + 60 °C to + 70 °C The radio station is operational with reduced parameters.
4. Power supply: The radio station is powered from the battery cabinet. Five cells of NiCd 4000mAh built into a battery of 6 volts are stored in the cabinet.
5. Operating time: About 10 hours with a 5:1 reception to transmission ratio.

6. **Weight and Dimensions:** The weight of the portable radio set, i.e. the radio set with battery cabinet, antenna, handset and strap, is about 3.1 kg.

The dimensions of the radio set with a battery are 295 x 47 x 191 mm.

The weight of the kit in the shipping container is about 8.1 kg. The dimensions of the kit in the shipping container are 480 x 350 X 160 mm.

2. Electrical parameters

a) Transmitter

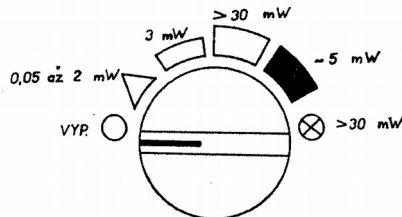
7. Basic features:
- | | |
|---|-----------------------|
| Transmitter power at voltage 6 V (5 V) | more than 1W (0.5 W). |
| Transmitter Frequency Accuracy | ± 500 Hz. |
| Distortion and background noise of transmitter at f_{mod} 1 kHz and deviation $\Delta f \pm 5\text{kHz}$ | better than 30 dB. |
| Maximum frequency deviation | ± 8 kHz. |
| Modulation sensitivity for f_{mod} 1 kHz and deviation $\Delta f \pm 5\text{kHz}$: | |
| - when the dynamic limiter is on | 1 mV; |
| - when the dynamic limiter is off | 6 mV; |
| - data input. | 500MV |
8. Undesirable properties:
- | | |
|--|----------|
| Parasitic amplitude modulation of transmitter at f_{mod} 1 kHz and deviation $\Delta f \pm 5\text{kHz}$ | 3%. |
| Spurious emissions into a load of 50 Ω : | |
| - at harmonic frequencies | - 50 dB; |
| - at other frequencies | - 60 dB. |
9. Modulation characteristics of the transmitter for:
- | | |
|-----------|----------------|
| - 1 kHz | 0 dB; |
| - 3.4 kHz | 0 ± 3 dB; |
| - 300 Hz | -6 ± 3 dB. |

b) Receiver

10. The sensitivity of the receiver for the **SINAD** 12 dB ratio is better than 0.5, μV and is guaranteed in at least 97.5% of all channels. The worsening is allowed up to $1\mu\text{V}$ for 8 channels and up to $2\mu\text{V}$ for 2 channels.

Note. **SINAD** is an abbreviation that expresses the ratio of signal, noise & to noise and distortion and is reported in dB. This is the ratio of audio-frequency output power at the receiver output when the modulated RF signal is received to the audio frequency output power at the receiver output without the audio-frequency signal.

11. The sensitivity for transition from so-called "low power" (intermittent) receiver operation to so-called "normal" operation is better than $1\mu\text{V}$.
12. Selectivity of receiver for adjacent channels:
 $\pm 25\text{ kHz}$ is at least 60 dB;
 $\pm 50\text{ kHz}$ is at least 76 dB.
13. Suppression of unwanted signals for:
 - the 6 MHz and 100 kHz if frequencies is greater than 80 dB;
 - other unwanted frequencies greater than 70 dB;
 - third order inter-modulation is greater than 60 dB.
14. Audio frequency output for Modulation Frequency $f = 1\text{ kHz}$, frequency deviation $\pm 5\text{ kHz}$ and an input signal of 1 mV are different According to the operating mode switch positions:



15. Background noise of the receiver at $f_{\text{mod}} 1\text{ kHz}$ and deviation $\Delta f \pm 5\text{ kHz}$ and 1 mV radio-frequency signal is suppressed more than

30 dB

16. Receiver frequency response:

- | | |
|-----------|-------------------|
| - 1 kHz | 0 dB; |
| - 3.4 kHz | -6 dB \pm 3 dB; |
| - 300 Hz | -6 dB \pm 3 dB. |

c) Other parameters

17. The radio station is operable in the temperature range of -35°C to +60°C with the stated parameters. For temperatures outside the range -35°C and 60°C the performance will be derated:

- Output of the transmitter by -3dB
- receiver sensitivity by -6dB
- audio output by -3 dB;
- Frequency deviation by -3dB

18. The radio station kit can be stored for long periods in well-ventilated buildings, in a non-chemical environment and with temperature ranges from -20°C to +35°C and relative humidity up to 75%. During storage, the battery must be treated in accordance with the instructions for use for the battery cabinets. Technical treatment No. 1 is to be carried out once a year.

19. The kit meets the requirements for decontamination, deactivation and disinfection.

20. The radio transmitter is permanently operable at an ambient temperature of +60°C and a maximum supply voltage of 7.8V.

21. The receiver of the radio station is not damaged nor will its parameters deteriorate by connecting a radio-frequency signal with a power of 1 W to its input for 5 minutes. The receiver is tuned to the frequency of this signal.

22. The radio station is equipped with a switchable dynamic frequency-limiter, which provides full output of the signal during the silent call of the operator to the microphone (position "△" of the mode switch).

23. During normal operation, the radio station automatically operates in a so-called "low power" (intermittent) operation where the power consumption is limited to a minimum if there is no signal at the input of the receiver. At the same time, the noise limiter operates. The operator is not disturbed by noise interruptions (positions: "△", "□" and "□" mode switch). Operating and noise limiter can be disabled by the operator according to the mode switch (positions: "■" and "⊗")
24. Radio station RF-10 allows connection to radio stations R-105d, R-107, R-111 and R-123.
25. The radio station is equipped with an indication light for power-on and transmitter control.
26. When using an optional device, it can transfer data with a telegraph rate of up to 600 Baud.

3. Composition of the kit

27. The RF-10 radio set (Figure 1) consist of the following parts:
 - a personal station (3);
 - 2 battery cabinets with batteries (4);
 - a handset (12);
 - whip antenna 1.5 m long (15);
 - whip antenna 0.5 m long (10);
 - the suspension antenna on a spool (7);
 - the directional antenna on a spool (6);
 - suspension rope on a spool (5);
 - 2 carrying straps (11);
 - a transverse strap (13);
 - a radio station bag (1);
 - a storage bag (2);
 - log book (16);
 - Technical Data Sheet (17);
 - operating instructions (18);
 - a list of items in the set;
 - a shipping container (5);
 - padlock with keys (9);
 - Set of backup components (by list) (14).

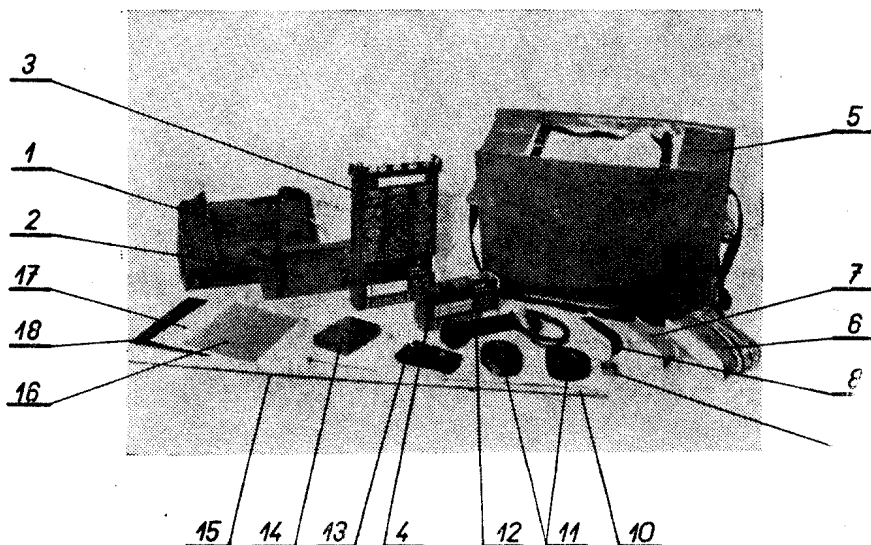


Fig. 1. The radio station kit

1 - radio station bag; 2 - Battery bag; 3 - radio station RF-10; 4 - battery box (including batteries); 5 - transport packaging; 6 - directional antenna with spool; 7 - suspension antenna with spool; 8 - rope with spool; 9 - padlock with keys; 10 - Rod antenna 0.5 m long; 11 - strap; 12 - Handset; 13 - the transverse strap; 14 - Set of backup components; 15 - rod antenna 1.5 m long; 16 – log book; 17 - technical sheet; 18 - operating instructions.

CHAPTER 2

Construction

28. The RF-10 radio set is designed as a portable device. The lightweight, size and ease of use make it easy to connect in the field as well as on the spot. The design of the radio station and its accessories gives the possibility of a dual-mode wearing according to the combat conditions. Four different antennas allow full utilization of its parameters under various field and combat conditions.

1. The radio station

a) Cabinet

29. The radio station is secured in it's cabinet by two screws located on the front panel of the radio station. The cabinet is made of aluminium sheets. At the upper side of the narrow side walls, 2 mouldings of aluminium alloy with M4 threads are used to attach the box to the front panel. Two pairs of steel suspension points are strung beneath these brackets to attach the radio station to straps. On the inside of the bottom of the cabinet there is a pin serving to guide the station when it is installed into it's cabinet. On the outside of the bottom of the cabinet are 2 clips for connecting the cabinet of the station with the battery box and locking in the working position, a two-pole plug for supplying the voltage from the battery box to the radio station and a ceramic vent (screwed into a M22 x 0.75 threaded hole). The function of this vent is to equalize the internal air pressure in the cabinet with changing atmospheric pressure in the surroundings while maintaining the water-tight seal of the cabinet.

30. The side of the cabinet lists the instructions for operating the radio station itself, including illustrations. There is also radio station data, using different antenna types, and how to disconnect the radio station's battery box (Figure 2).

31. The actual radio station consists of three basic mechanical parts, the front panel with controls, the PCB chassis and the frequency switchboard (Figures 10, 11).

b) Front panel

32. The front panel (cast aluminium alloy) is connected to the radio station chassis by six M3 screws in one fixed unit. The functions of each of the controls and connectors are shown in Figure 80. The panel surrounds a frame that protects the controls from damage while increasing the strength of the panel.

On both narrow sides there are suitable holes in the frame to attach the radio station to the carrying case.

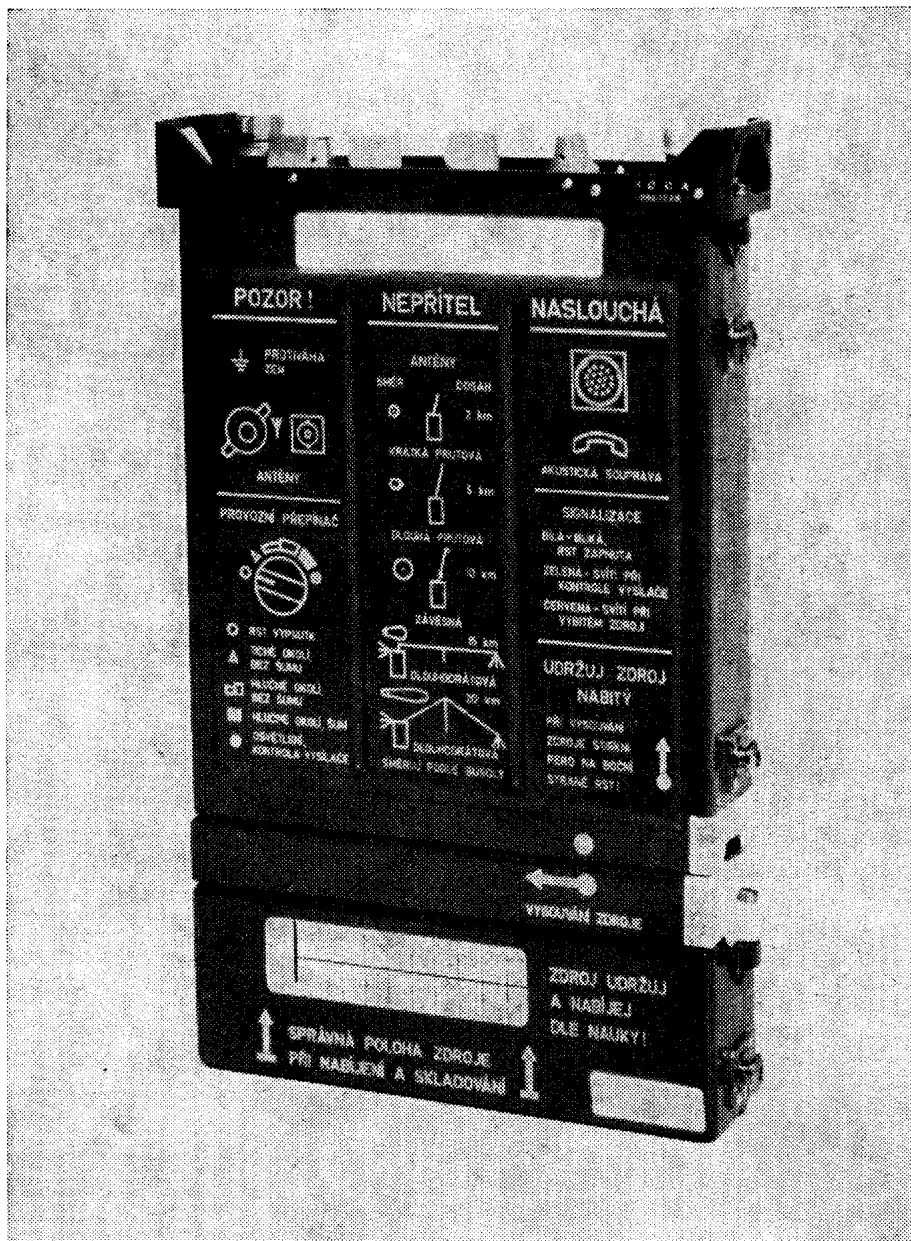


Fig. 2a. The radio station box from the front with connected battery box.

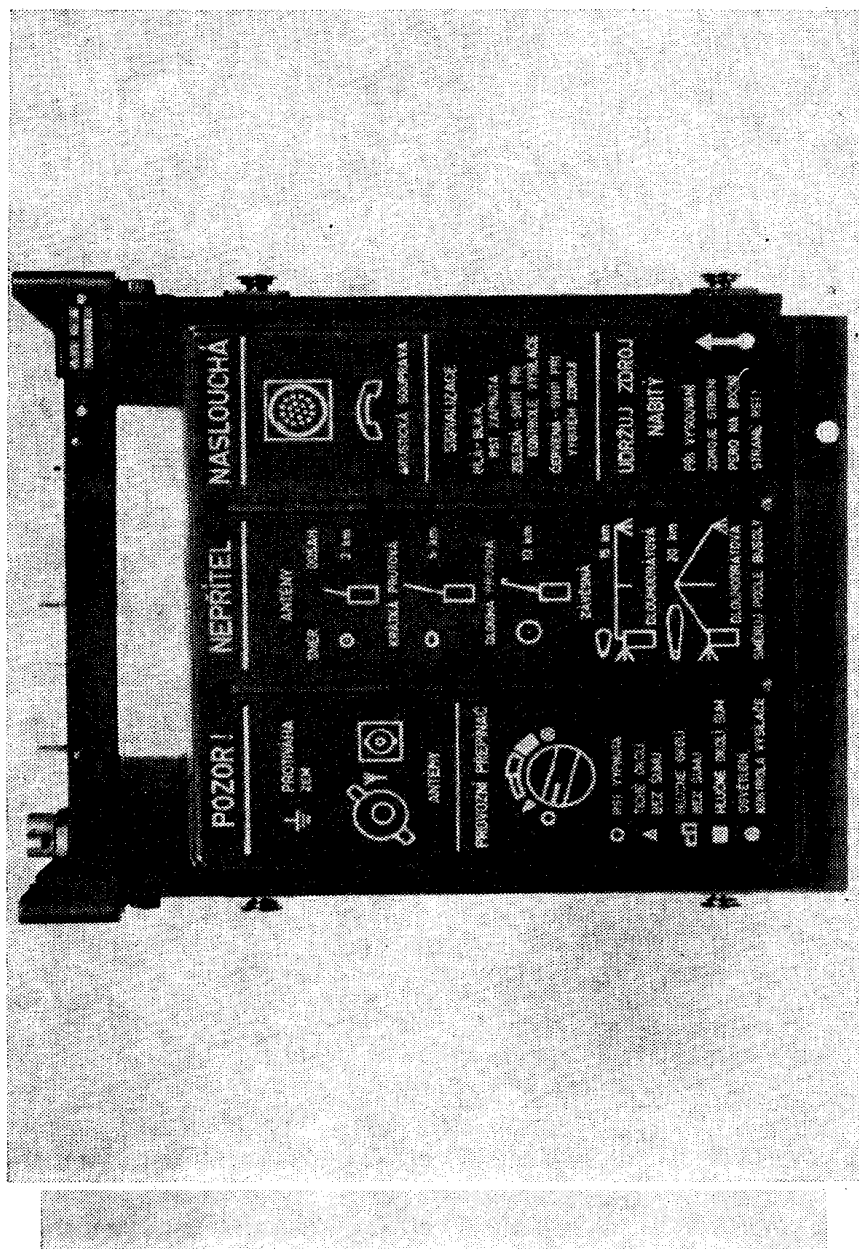


Fig. 2b. The front of the radio station cabinet.

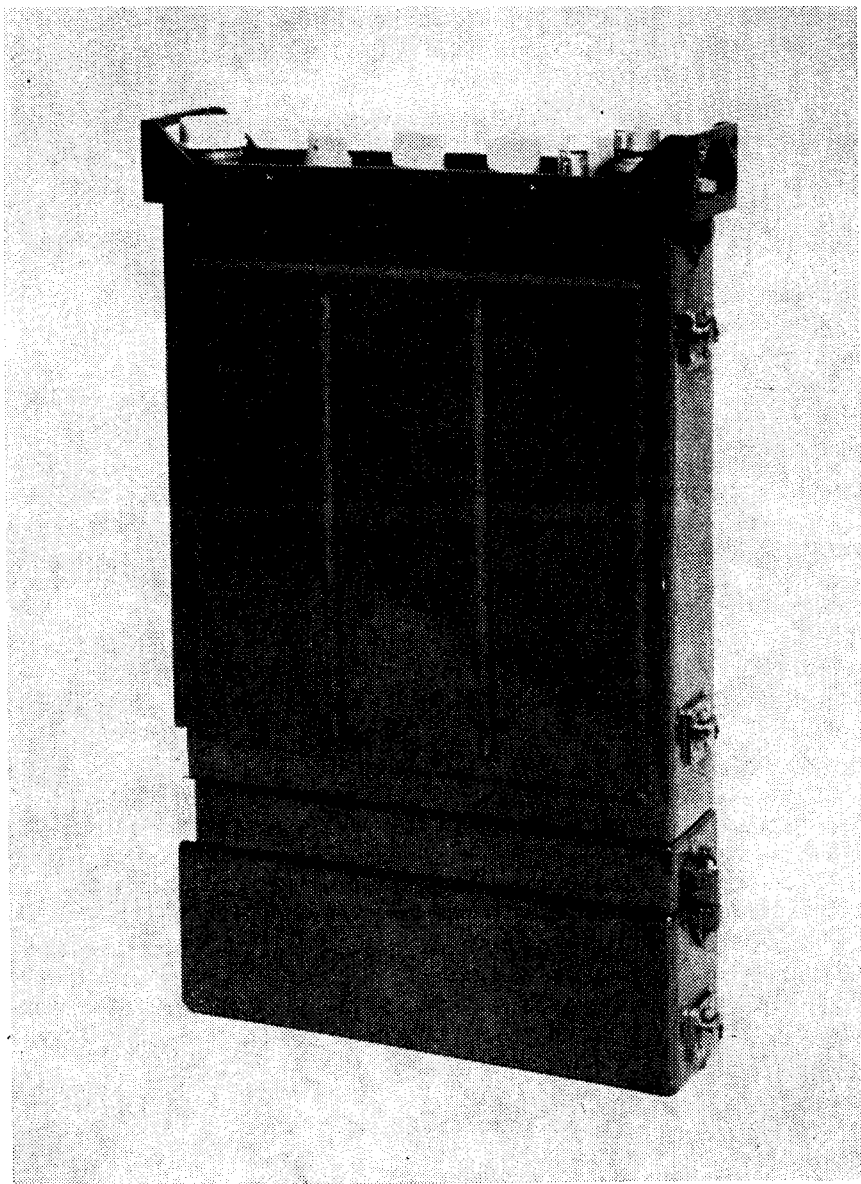


Fig. 3. Radio station with battery box - rear view.

33. All controls are sealed with rubber seals. All knobs are equipped with stops in their extreme positions. Frequency selection knobs will show the digits of the selected frequency in the apertures above them.
34. On the underside of the panel there is a groove in which a rubber seal is inserted to ensure a water-tight seal between the panel and the radio station cabinet. On both shorter sides of the panel are captive screws to attach the radio station to the chassis. Under one screw head there is a sealing cup to seal the radio station.

c) Chassis

35. The radio station chassis is a sheet-metal structure. The main part consists of a support plate made of aluminium alloy, on which there are threaded posts for the holding the printed circuit boards on both sides of the chassis, as are the separate partitions and the two side channels, which serve to guide the wiring. In order to provide electrical conductivity, all parts are welded together.
36. The printed circuit boards are screwed to the radio station chassis by means of locking screws, and some of them are conductively connected to the body of the radio station. In order to strip the soldering points of the chassis, the chambers are covered with tempered paper plates.
37. The individual PCBs are connected with pins that are inserted into the boards. All interconnections between the PCBs are made with wiring consisting of thin wires with Teflon insulation, miniature shielded wires and coaxial wires in the side channels.
38. On the lower part of the chassis is an insulating plate with two contact pins, which is used to connect the chassis with a two-pole connector at the bottom of the instrument cabinet. To prevent damage to the radio station due to accidental short circuit in cabling or circuits, there are 2 fuses made of silver wire on this board.

d) Frequency switchboard

39. For ease of repairs, the frequency switchboard is manufactured as a separate unit, removable from the radio station chassis after unscrewing 4 screws and disconnecting the cabling. The channel selection switches are equipped with brushes to enable removal without disassembling the control elements (Figure 39). In order to achieve good shielding, the frequency switchgear is equipped with two covers attached to the chassis and the panel of the PCB. When the frequency switch is removed, a 3-piece bracket remains in the panel with the light bulbs for frequency code lights.

2. Battery cabinet with cells

40. The battery cabinet (Figure 4) is made of aluminium alloy sheets. The interior of the cabinet is provided with a varnish that prevents corrosion in the event of electrolyte vapour leakage from accumulator cells.

The battery cabinet consists of its own cabinet and lid. The lid is screwed to the bottom with 2 x M4 captive screws.

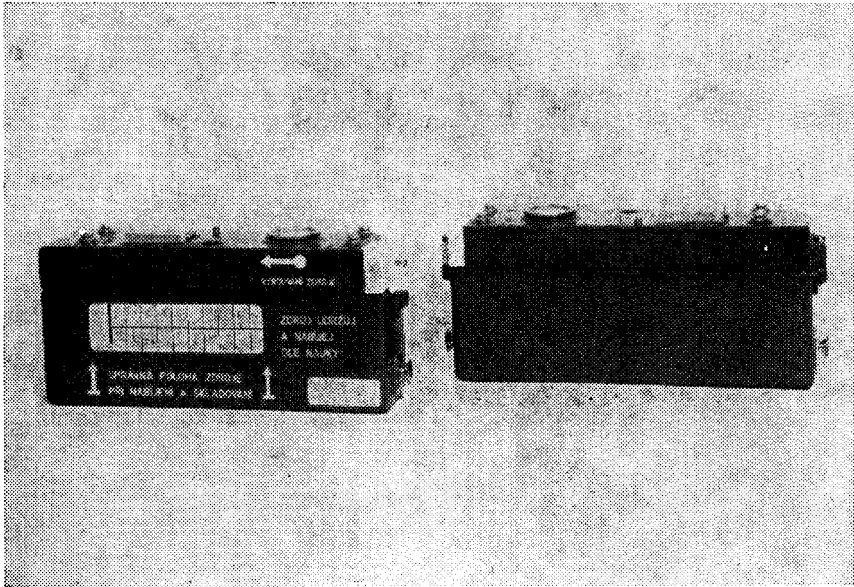


Fig. 4. Battery cabinet (front and rear).

a) Battery cabinet

41. The base of the cabinet (Figure 5b) forms the carrier portion for the battery cells. A rubber fitting is placed on the lower inner surface, which defines the tolerances of the battery cells in height. On the side walls inside the cabinet there are two mouldings made of polyethylene. The mouldings make compartments for the individual cells.
42. The battery cells are connected in series by means of wires soldered to the solder tags of the cell. The terminals of the cells are connected with the "+" and "-" conductors. These sleeves are inserted and secured against ejecting in one of the polyethylene adaptations.

The second moulded polyethylene moulding does not have holes for the hollows, but there are full pins to prevent misalignment of the lid.

43. On the narrower sides of the outside the box, two captive M4 threaded screws are used to fasten the lid. There are also steel pins are which are used to fasten the battery box to a radio station.
44. On the front surface there are instructions for maintenance and charging battery position. There is also a label attached to record charging cycles.

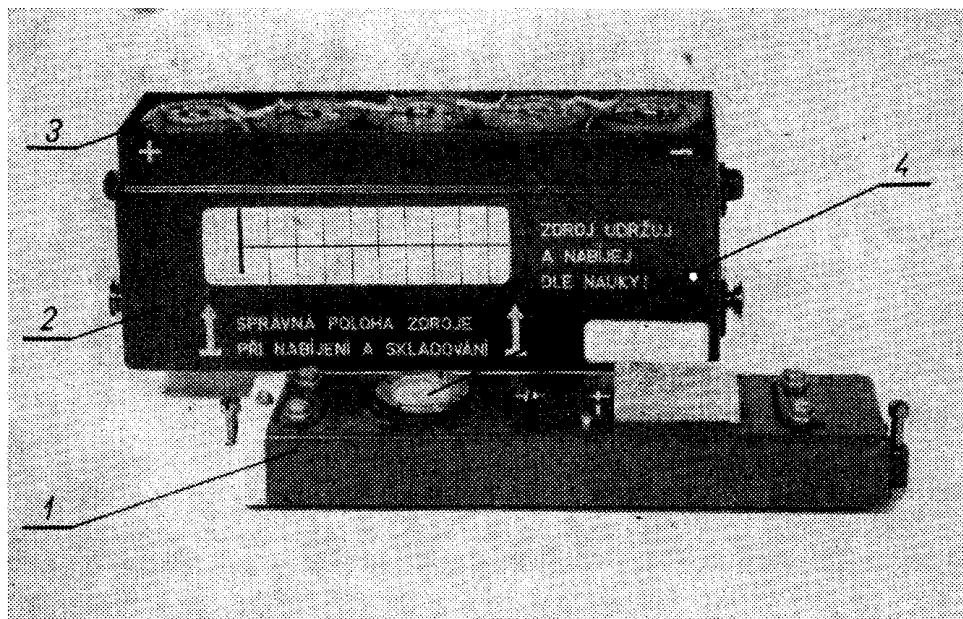


Fig. 5a. The open battery box with accumulators
1 - Lid; 2 - battery box; 3 - NiCd 4000; 4 - ceramic vents.

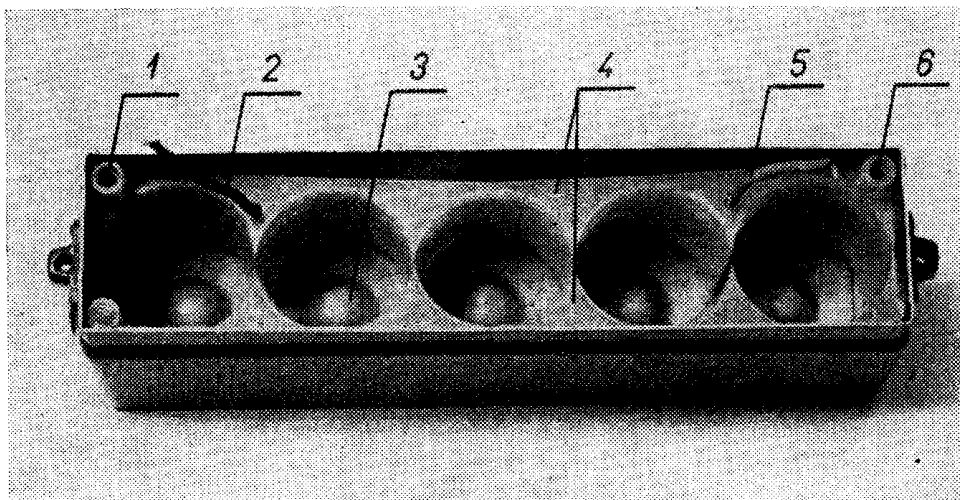


Fig. 5b. View of the battery box top.
 1 - negative battery terminal; 2 - negative lead; 3 - rubber seal for cells; 4 - shaped sealing inserts; 5 - positive outlet; 6 - positive terminal

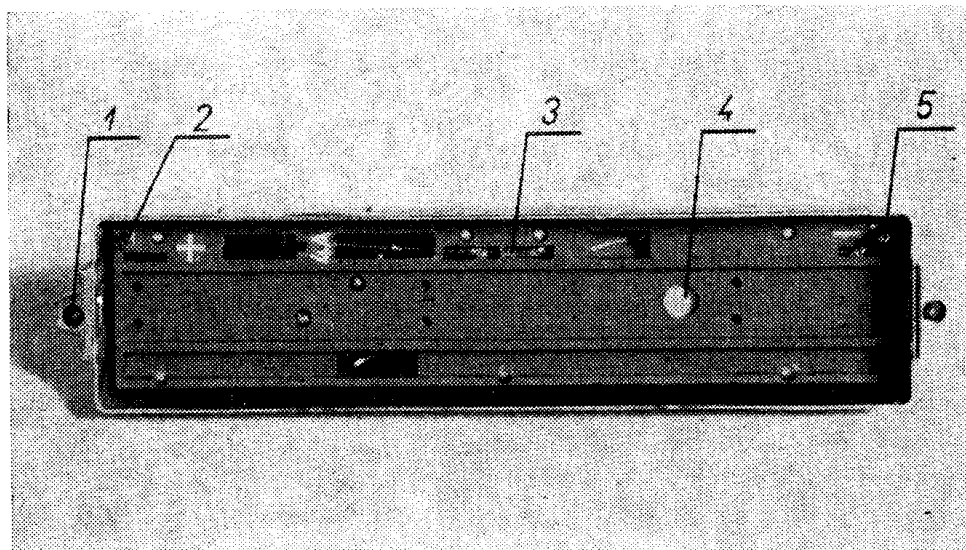


Fig. 5c. View of the bottom of the battery box lid
 1 - Screw for connecting the lid to the battery box; 2 - positive

terminal, 3 - test push button; 4 - battery gauge; 5 - negative terminal.

b) Enclosure lid

45. Inside the lid is a moulding which carries the connecting pins, the fuse and the switching contacts of the button. Between the moulding and the lid of the power supply there is a rubber seal
46. The outer surface of the lid is provided with 4 locating pins to connect the battery box to the radio station. Furthermore, a locating pin is fitted on this surface, which, along with the bottom hole on the radio station cabinet, provides a means against incorrect installation. A 2-way power connector and a rubber push button are attached to this area. This button together with a bulb provide an indication of the state of the charge. Furthermore, on this external surface there is a M22 x 0.75 threaded hole with a ceramic vent.
47. On the narrow sides, two mouldings for M4 captive screws are threaded to attach the lid to the housing. On the face is the label for the fitting of the battery.

3. Rod antenna 0.5 m long

48. The rod consists of three steel wires. An additional loading coil is mounted in the antenna base in a metal housing.

4. Rod antenna 1.5 m long

49. The rod antenna consists of five steel wires. In order to achieve stiffness, the wires are wound with steel wire into a spiral by twisted wire.

5. Suspension antenna

50. The actual antenna is supplied wound on a polystyrene spool. It consists of a cable connector for antenna connection to a radio station, a coaxial cable with a length of 4.25 m, an matching coil and its own 3.34m long radiator. The radiator is terminated by a

suspension eye.

51. To hang the antenna, use the 20-meter-long suspension cord with a carabiner and wind it on a polystyrene coil (Figures 84 and 85).

6. 30-meter directional half-rhombic antenna

52. The antenna is supplied wound on a polystyrene spool. It consists of four parts: terminator with tension cords, radials, impedance transformer and radials (Figure 86a).
53. The radiator is made of insulated wire 30 m long. At one end, two guy lines are attached together with a termination resistance terminated by three 180 cm long wire radials. At the other end of the antenna there are also 2 guy lines and 3 wire radials with a banana plug.
54. The impedance transformer is enclosed in a housing with 4mm sockets for the antenna, radial and a BNC plug for connecting the transformer to the radio station. The radials consists of three 180cm long wires with a banana plug which is inserted into the relevant impedance transformer socket.
55. For the erection of the antenna, the same 20 meter cord is used as for suspending the suspension antenna.

7. Handset

56. The handset is made of polystyrene and aluminium carrier chassis. The handset incorporates a "Temir" earpiece inserted into a moulded rubber bed and a DEMS-1A microphone insert in soft rubber mouldings and covered with a microphone cap.
57. The "Push To Talk" button controls a micro-switch via a spring. Two round buttons are located above this button to provide tone signalling.
58. A cord is terminated from the handset by a 19 way circular connector that plugs into the matching connector on the radio set panel.

8. Bags

59. There are a total of 3 bags in the kit (Figures 6 to 9): a radio station bag, a bag for a spare battery and a storage/transport bag. All of them are made of polyamide canvas, PVC is woven on both sides and waterproof.

9. Straps

60. The strap set consists of two carrying straps and a cross strap. The carrying straps are separate and allow simple variations.

They are made of polyamide silk.

10. Transport packaging

61. The shipping container (Figure 7) consists of a self-contained bag of impregnated canvas and a carrying case made of two polystyrene foam mouldings with separate compartments and a lid with a groove on the inside for the rod antennas (Figure 7). There are two grooves on the surface of the trunk, into which the straps that the suitcase fit (Figure 8).

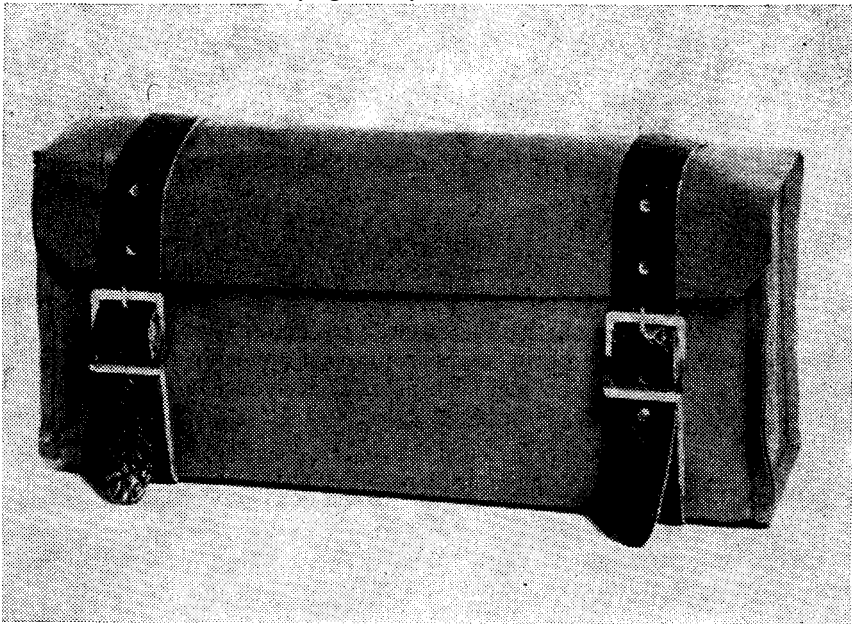


Fig. 6a. battery box bag

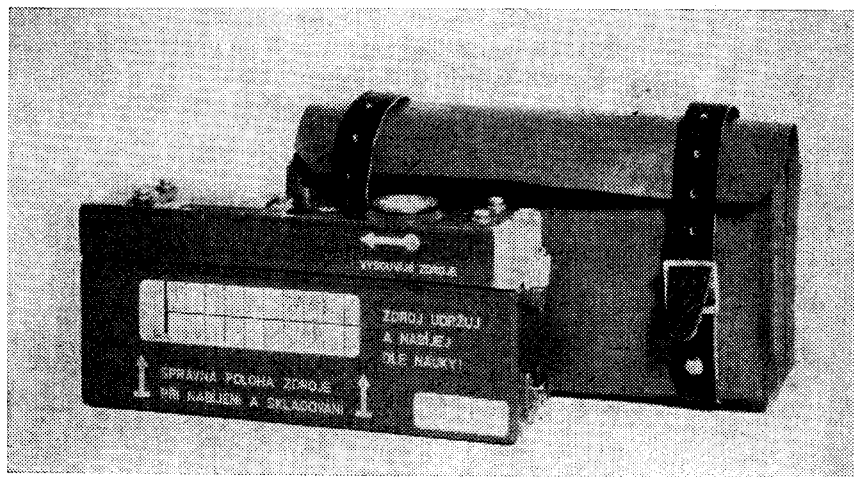


Fig. 6b. battery box removed from the bag



Fig. 7. Transport Bag

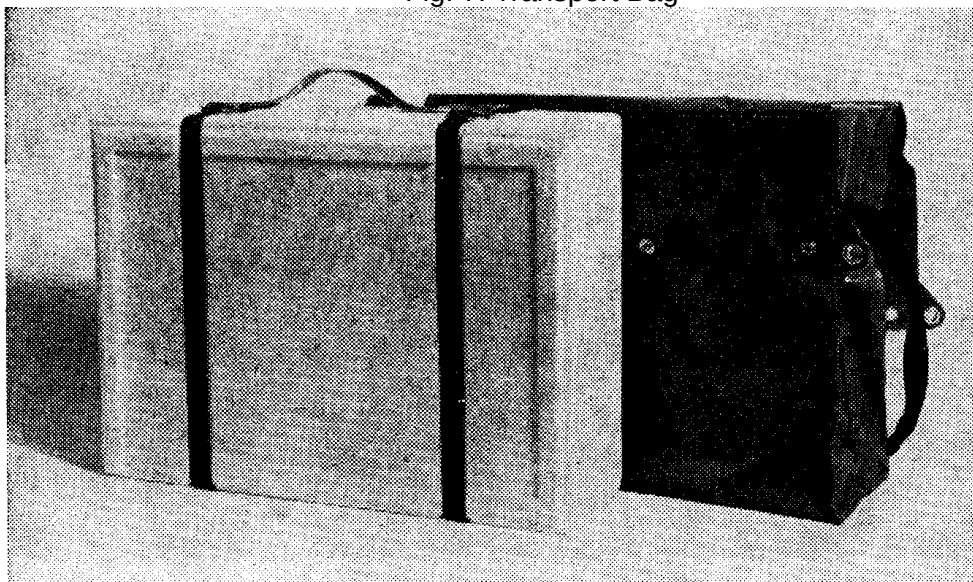


Fig. 8. Transport case of a radio station with its own packaging

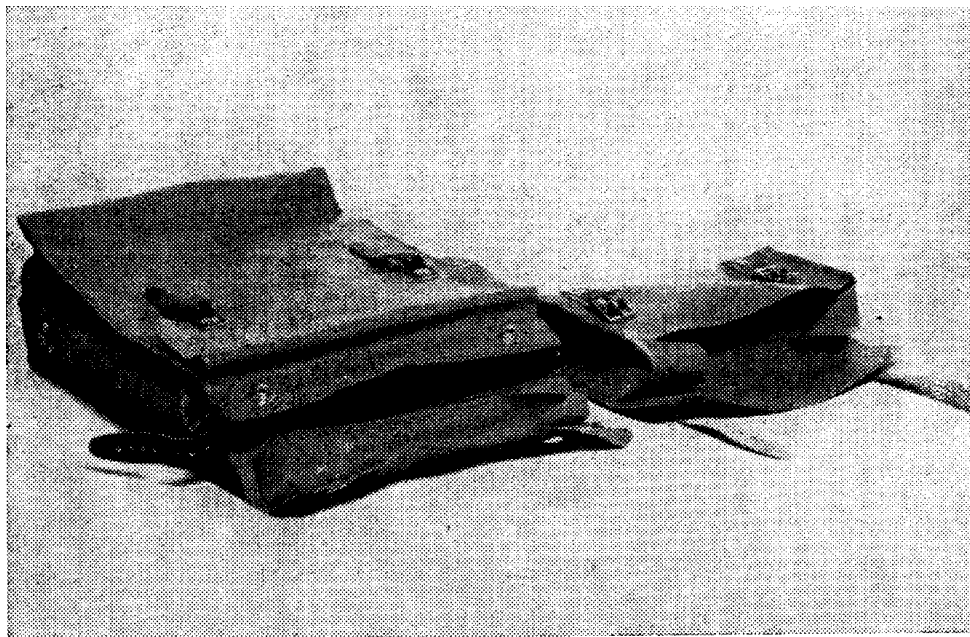


Fig. 9. Radio Station Bag and Battery Bag (Empty)

CHAPTER 3

DESCRIPTION

1. General provisions

62. The radio station RF-10 consists of four basic functional units:

- receiver,
- transmitter,
- frequency generation circuits,
- power and auxiliary circuits.

62. The receiver includes:

- radio frequency and intermediate frequency amplifier,
- audio frequency amplifier and noise limiter.

Frequency generation circuits include:

- a frequency switchboard,
- main oscillator and reference frequencies generator.

The transmitter includes:

- power high-frequency amplifier,
- preamplifier and driver,
- modulator and modulation amplifier.

Supply and auxiliary circuits include:

- voltage converter and stabilizers,
- high voltage circuit,
- indication of radio station power on and power status.

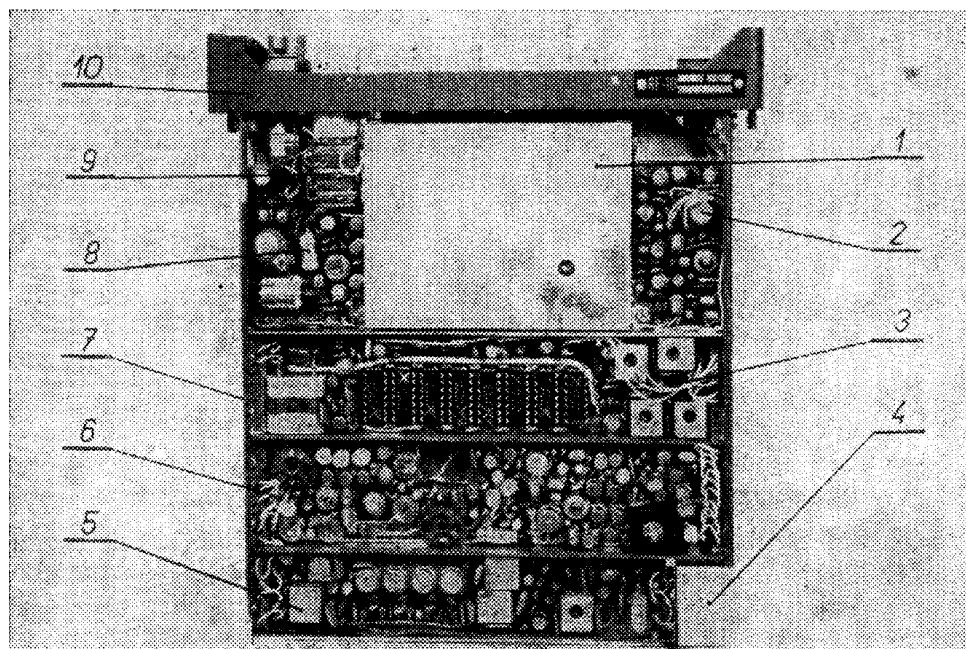


Fig. 10. Radio station without cabinet - front view
 1 - frequency switchboard; 2 - modulation amplifier; 3 - reference frequencies generator; 4 - crystal oscillator; 5 - IF amplifier; 6 - low-frequency amplifier and interrupter; 7 - chassis; 8 - stabiliser, 9 - operating switch; 10 - control panel

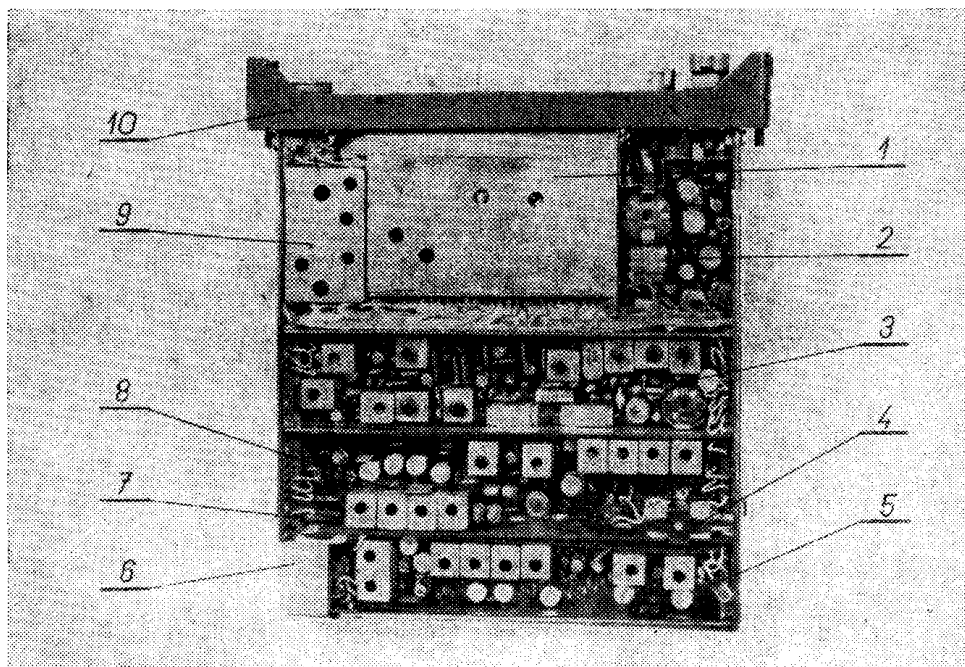


Fig. 11. Radio station without cabinet - rear view

1 - frequency switchboard; 2 - voltage converter; 3 - modulator; 4 - relay; 5 - radio frequency unit; 6 - crystal filter; 7 - chassis; 8 - transmitter; 9 - main oscillator; 10 - radio station panel

63. The radio station is divided into 11 parts, assembled on 11 printed circuit boards. In some cases, the printed circuit boards are double-sided. In some cases, for the sake of integrity of the wiring and the blocks, the continuity of the function combine the circuits that are part of the various functional units.

The location of the radio station components is shown in Figures 10 and 11.

The functional division of the radio station into the peripheral units is shown in the block diagram (Appendix 1).

2. Receiver

64. The radio station receiver is double conversion superheterodyne. The signal from the antenna is fed through the relay contacts to the RF pre-amplifier input. Here it passes through a band-pass filter into a RF amplifier, through a quadruple band-pass filter through to the 1st mixer and onto the 1st IF. The local oscillator frequency for mixing is fed via a tuned band-pass filter from the main oscillator. Frequency and filter matching is in the range of 50,000 to 59,975 MHz - along with all six pre-amplifier filters ranging from 44,000 to 53,975 MHz.

Bandwidth is electronically tuned by variable capacitance diodes.

65. The mixing product, at a frequency of 6 MHz, passes through the crystal filter to the 2nd mixer, which is already part of the IF amplifier. In the IF amplifier, a signal of the auxiliary oscillator of 5.9 MHz is generated on the 2nd mixer. This results in a 2nd IF frequency of 100 kHz. It is filtered, amplified and is demodulated in the discriminator.
66. The output signal of the demodulator is fed through the frequency adjustment circuits, the pre-amplifier and the end stage through the loudspeaker connector to the handset. The signal is also fed to the 19 pin connector directly from the demodulator.
67. If there is no signal at the output of the demodulator, the receiver noise is fed through the 8 kHz filter to the noise limiter input. The noise limiter controls the pre-amplifier and the so-called "power-saving" mode of the radio station during reception. The limiter closes the amplifier if the receiver is noisy (there is no signal at the input of the receiver), so noise does not reach the earpiece. In this case, the radio station may operate in so-called "economy" mode. In this mode, the high-frequency circuits are periodically switched on for a short period of time, during which time if a signal from another radio station is received the radio station automatically switches to "permanent" reception. If the radio station is in a "permanent" reception mode and the RF signal at the input of the receiver disappears, the radio station reverts to the "economy" mode.

3. Transmitter

68. The required frequency is generated in the transmitter mixer from the unmodulated signal input from the master oscillator and from the modulated 6 MHz signal input from the modulator. A quadruple band-pass filter identical to the pass-through of the receiver's component is assigned to the mixer. The pre-amplifier is a two-stage, broadband amplifier (band 44 to 55 MHz). The second stage of the pre-amplifier is controlled by the auto-tuning circuit of the transmitter's output power.
69. The driver stage and the final stage are broadband class C amplifiers. The final stage is supplied with a voltage of 12V. The low-pass filter matches the end stage of the transmitter to the antenna and limits the harmonic frequency emissions. There is an antenna relay between the filter and the antenna connectors, which latching and switches the radio station from reception to transmit. It only takes energy when energised.

The 6MHz modulated signal from the modulator is generated in two steps (3x and 5x) from the 400 kHz frequency.

70. The modulation is performed at a 400 kHz frequency by overloading a 4-pass passive filter using capacitance diodes, to which the signal is adjusted and amplified in the modulation amplifier. The modulation amplifier has a restricted rise and fall time. Unwanted parts of the audio spectrum are removed by a suitable filter. The modulation amplifier input is also connected to the 19 pin connector along with a special input of the modulator to transmit the information. The signal key is connected to the signal input to the modulation amplifier input.

4. Frequency Generation Circuits

71. The radio station uses a frequency synthesizer with a frequency divider in the so "Servo loop"
72. The signal for the receiver and the transmitter signal are generated in a voltage controlled oscillator. This oscillator operates in the 50 to 60 MHz band. The receiver and transmitter are connected to

the oscillator via a buffer amplifier.

Although the logic integrated circuits are very fast and the operation of the divider is synchronous, it is not possible to enjoy the reliable operation of the circuits at a frequency higher than 5MHz. Therefore, auxiliary circuits are arranged between the oscillator and the dials of the auxiliary circuit, namely: a mixer which provides frequencies in the 50 to 60 MHz range, in the 10 to 20 MHz range and a divide by four, which further provides for frequencies in the range of 2.5 to 5 MHz.

73. The oscillator frequency with the exact frequency of the frequency synthesizer compares to the frequency of 6.25kHz; Arrangement of the dividers and connection of the reset is such that it allows the selection of any pulse between the 400th and 799th pulse. After the preset count of the pulses is reached, the parts are automatically reset and the readings are resumed. The reset signal along with the reference frequency of 6.25kHz are fed to a comparator circuit whose output is a DC voltage used to tune the oscillator to the frequency selected by the control panel switches.
74. The source of the reference frequencies for radio station circuits is a crystal oscillator of 1.6MHz. From this oscillator is derived the 40MHz signal needed for auxiliary mixing in the frequency centre, compare the frequency of 6.25kHz for the frequency centre and 400kHz for the modulator.

5. Supply and auxiliary circuits

75. Voltage must be stabilized to power up some circuits in the radio station. The power supply voltage fluctuates from 5.0 V to 7.8 V.

In addition, the transmitter's output stage requires a supply of 12V and the capacitance diodes require 22.5V for tuning. The radio station therefore has a stabilizer and an inverter.

76. In order to provide a "power-saving" reception mode, the radio station has a circuit that interrupts the power supply of the receiver portion and the oscillators. The operation of this circuit is controlled by a noise limiter (automatically) a transfer mode switch

and a switch operation for receiving and transmitting.

77. Since the number of antenna relay contacts is not enough, there is a circuit with a semiconductor that extends the relay. A lamp is used to indicate the battery status. Another lamp is used to indicate that the station is switched on.

CHAPTER 4

PRINCIPLE OF OPERATION

1. Radio-frequency part

78. The radio frequency is formed by the circuits which alter the received RF signal (changing the frequency and to a voltage suitable for processing in other parts).

a) Block diagram

(Figure 12)

79. The signal from the antenna is fed to the circuit forming the voltage protection of the receiver. Receiver protection circuits (D301 and D302) cause low-level signals to pass to the input filter without attenuation (O301, O302), but high-level signals are limited.
80. The receiver input filter adapts to the impedance of the antenna to the RF amplifier and selectively contributes in part to the overall selectivity of the RF component.
81. The RF signal is amplified in a RF amplifier (T301, T302) and fed to a tuned four-stage bandwidth filter O303, O304, O305 and O306, which provides the major selectivity of the RF component. The selectivity of this filter suppresses unwanted frequencies that would otherwise penetrate to the mixer. By mixing the master oscillator frequency (50.000 MHz to 59.975 MHz) with the received signal in the frequency band from 44.000 MHz to 53.975 MHz, a first IF of 6 MHz is obtained.

b) Circuits

aa) Receiver input protection

82. The receiver input circuits are protected by an input voltage limiter, in order to prevent possible damage by a nearby powerful transmitter. The receiver will not be damaged by RF currents even when the receiver antenna approaches a 100 W transmitter antenna at a distance of 5 m. A double diode voltage-limiting

device between the antenna and ground (D301 and D302) is used to protect the input circuits of the RF component.

83. The RF signal is amplified in a RF amplifier (T301, T302) and fed to a tuned four-band band thrust filter (0303, 0304, 0305 and 0306), which forms the major selectivity of the RF component. The selectivity of this filter suppresses unwanted frequencies that would otherwise penetrate to the mixer.

bb) Input bandwidth of the receiver

84. The antenna coupling with the input band filter is inductive by means of a coil in circuit 0301. The interconnection between circuits 0301 and 0302 is inductive. Coupling with the next stage, i.e. the RF amplifier, is provided by the capacitor C 303. The resonant circuits are always tuned by two capacitance diodes (D303, D304 and D305, D306). The decoupling voltage is fed via the resistors R301 and R302 to the pair of capacitance diodes. For easier alignment of circuits, the trim capacitors C301 and C302 are connected in parallel to the capacitive diode pairs.

cc) Amplifier

85. The RF amplifier consists of two emitter coupled KF173 transistors. The first stage (T301) is connected to a grounded collector. The second stage is connected to a grounded base. The interconnection between the stages is the C318 capacitor. In the second stage collector, the 0303 circuit is included, which is part of the four-stage tuned band filter.

dd) Four-stage bandpass filter

86. The four-stage bandpass filter consists of four parallel tuned circuits. The circuits are always tuned by a pair of capacitance diodes (D307 to D315) and are tuned by a voltage change (just like the input bandwidth filter). The link between circuits 0303 and 0304 is inductive by means of coil L302. The bond between resonant circuits 0304 and 0305 is capacitive, with the capacity of C310 created on the printed circuit. The coupling between the resonant circuits 0305 and 0306 is also inductive, using the coil L303.

For resonant circuits, one each of the C307, C308, C309 and C311 fine tuning capacitors is connected to each resonant circuit. The mixer is inductively coupled to the resonant circuit coil 0306 through the separation capacity of C312.

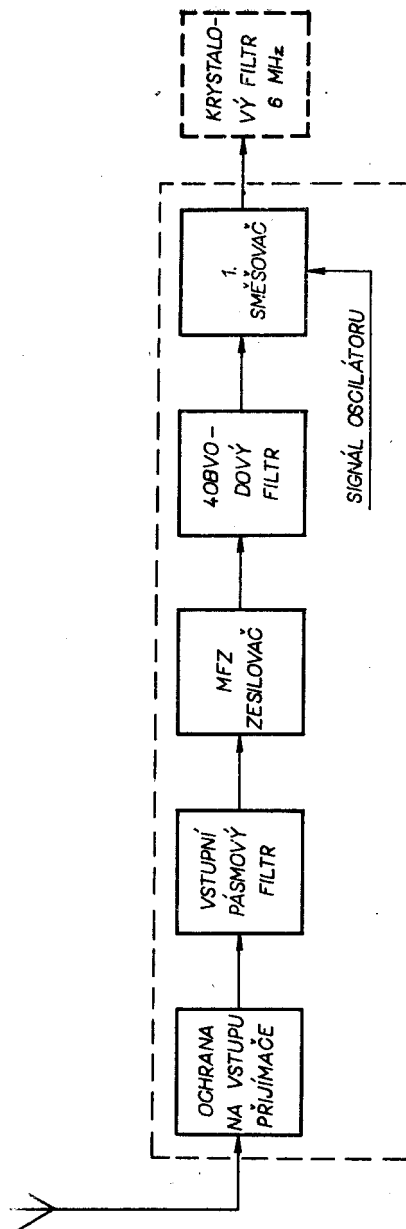


Fig. 12.
Block
diagram
of the RF
receiver
part

ee) Mixer

87. The mixer (T303) is fitted with a KF173 transistor and acts as an additive mixer. The auxiliary frequency from the main oscillator is fed via inductive coupling to the parallel-tuned circuit 0308. The resonant circuit 0308 mixes the signal and is fed via the capacitor C313 to the resistive voltage divider R316 and R317 connected between the emitter of T304 and the ground.

The amplified input signal is drawn from the fourth stage of the bandpass filter (0306) via an inductive coupling and through the C312 capacitor and fed to the mixer (transistor T303).

88. In the mixer collector, the parallel tuned circuit 0307, is tuned to a frequency of 6 MHz. With this circuit, the crystal filter (FK851) adapts impedance to the mixer. Customization ensures capacitive divider C314 and C315.
89. The tuned circuits consisting of 0301, 0302, 0303, 0304, 0305 and 0306 are simultaneously tuned to one of the frequencies between 44.000 to 53.975 MHz by changing the voltage supplied to the pair of capacitance diodes KA213. The range of tuning ranges from 44.000 to 53.975 MHz. Circuit 0308 is also tuned by a pair of capacitance diodes (D316 and D317), but in the 50.000 to 59.975 MHz band, i.e. the frequency is higher than the other circuits are tuned.
90. The gain of the RF component between the input of the receiver and the base of the mixer transistor (T303) is about 7.

c) Design of the RF part

91. The RF part is located on a 140 x 28 mm board placed in a separate area at the bottom of the radio station next to the 6 MHz crystal filter located in the lower left corner of the radio station (Figure 11). Two screws are attached to the support structure. For connection to other parts of the radio station, the inter-connects are located on the narrow sides of the board. Interconnection with side wiring harnesses provides flexible conductors with Teflon

insulation. The parts of the RF part are fastened by their outlets to the printed circuit boards on the glass fibre board.

92. The resistors used are of type TR 191 with a metal layer. The capacitors are TK754, TK724, SK790 and BT 7,5-N47-2,5/6 type.

Transistors and capacitance diodes are silicon. The filters are fine-tuned and are in aluminium shields. The layout of the components is shown in Figure 15.

2. Intermediate Frequency

93. Once the signal from the antenna has been converted to a 6 MHz signal, it is fed through a selective eight-cell crystal filter to the IF amplifier for further processing. The bulk of amplification of the whole receiver is concentrated in this part.

a) Block diagram

94. The signal (6 MHz) fed from the multi-stage crystal filter to the input of the IF component is mixed with the frequency of 5.9 MHz to give the 2nd IF frequency of 100 kHz.

It is further filtered on a 100 kHz filter and fed into a symmetric amplifier consisting of four integrated circuits. The bulk of the gain of this piece is concentrated in this amplifier. The demodulator is fed from the amplifier output. The resulting AF signal is fed through the isolation stage to the amplifier and interrupter.

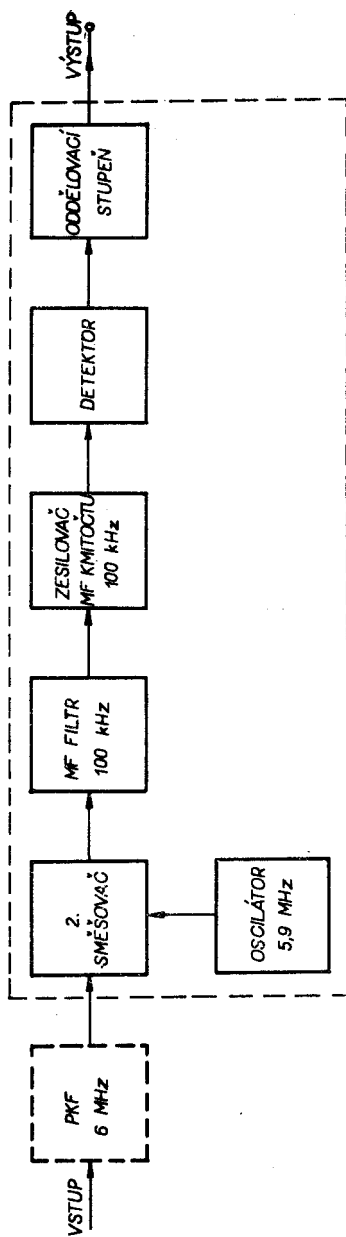


Fig. 13.
Block
diagram
of the
amplifier.

b) Circuits

aa) 2nd mixer

95. The second mixer (T351) is fitted with a KF524 transistor and acts as an additive mixer in a common emitter configuration. The 2nd local oscillator frequency from the 5.9 MHz oscillator is fed to the base circuit via the C354. Based on the T351 transistor, a tuned circuit 0351 is also connected via capacitance C352 to adapt the output impedance of the crystal filter to the mixer input impedance. The first circuit of the 100 kHz filter circuit, circuit (0352), is connected to the transistor collector circuit of T351.

bb) 2nd local oscillator 5.9 MHz

96. The fixed frequency for the second mixer is generated in a 5.9 MHz oscillator. The oscillator (T352) is fitted with a KF524 transistor. The frequency of this oscillator is controlled by the crystal K351.

cc) IF filter 100 kHz

97. The 2nd IF filter partially contributes to its selectivity to inter-channel selectivity and suppresses secondary mixing products. The IF filter consists of two parallel resonant circuits 0352 and 0353 interconnected by capacitive coupling by C363.

The output from the filter is symmetrical.

dd) 2nd IF amplifier (100 kHz)

98. The 2nd IF amplifier consists of four identical amplification stages utilising the integrated circuits 01351, 01352, 01353 and 01354 of the type MA 3000. The first stage of the symmetric amplifier 01351 is connected to the circuit of the filter 0353. The connection between individual integrated circuits (01351, 01352, 01353 and 01354) is symmetrical and capacitive.

The total amplification of this amplifier is about 100 dB. Amplifier power is from a 5 V stabilized DC power source.

ee) Demodulator

99. This stage works as a coincidence detector. It is built around the integrated circuit MA3000. The voltage from the symmetric output of the amplifier (01354 - points 8 and 10) is fed to the detector via the phase circuit 0354 and directly via the C375 capacitance. These two voltages are compared to each other in the integrated circuit 01355.

100. Frequency variation in the frequency modulation (100 kHz + -5 kHz) is reflected on the 0354 phase circuit at inputs 1 and 6 of the integrated circuit 01355 as a phase change.

This phase change is compared to the circuit voltage 01355, which is fed via C375 to input 2 and output 8 is evaluated as an AF signal corresponding to the modulation of the received signal. RC filters (C381, R378, C383, R379, and C382) filter out any remnants of the IF.

101. The output impedance of the detector (01355) is high, and therefore, the separation stage (T353) is included as an emitter follower.

c) Construction of IF unit

102. The IF board is about 140 x 28 mm and is stored in a separate space at the bottom of the radio station next to the 6 MHz crystal filter in the supplement (Figure 10).

The PCB is secured by two screws. To connect with other parts of the radio station, pins are used on the narrow sides of the board. Interconnection with side wiring harnesses provides flexible conductors with Teflon insulation. The parts are fastened with their outlets to the PCBs on the board.

103. The resistors used are type TR191 with a metal layer. Used capacitors are TK724, TK744, TK754, TK782 and SK790.

Transistors are silicon, integrated circuits are of the MA3000 type. The quartz crystal ($f = 5.9$ MHz) is stored in the glass case. The filters are stored in aluminium covers.

The layout of the components is shown in Figure 16.

3. Audio frequency amplifier and interrupter

In this part several interdependent functions are concentrated. Therefore, the section is discussed in detail in the following paragraphs.

a) Block diagram

104. The audio signal or noise is fed from the demodulator to the audio frequency amplifier and the interrupter to the transistor 407. The audio signal is amplified in this part. Another signal path is used to process the noise.

105. The presence of noise and its processing allows:

1. Turn off the first stage of the amplifier (T407) and thus reduce the noise in the headphones by means of the controlled switch of the amplifier.
2. Set up the electrical circuits that control the interruption of the power supply to some of the power station demanding power circuits.
3. Cancel the intermittent operation of the radio station and switch on the first stage of the amplifier at the moment the RF signal arrives at a sufficient level on the receiver input.

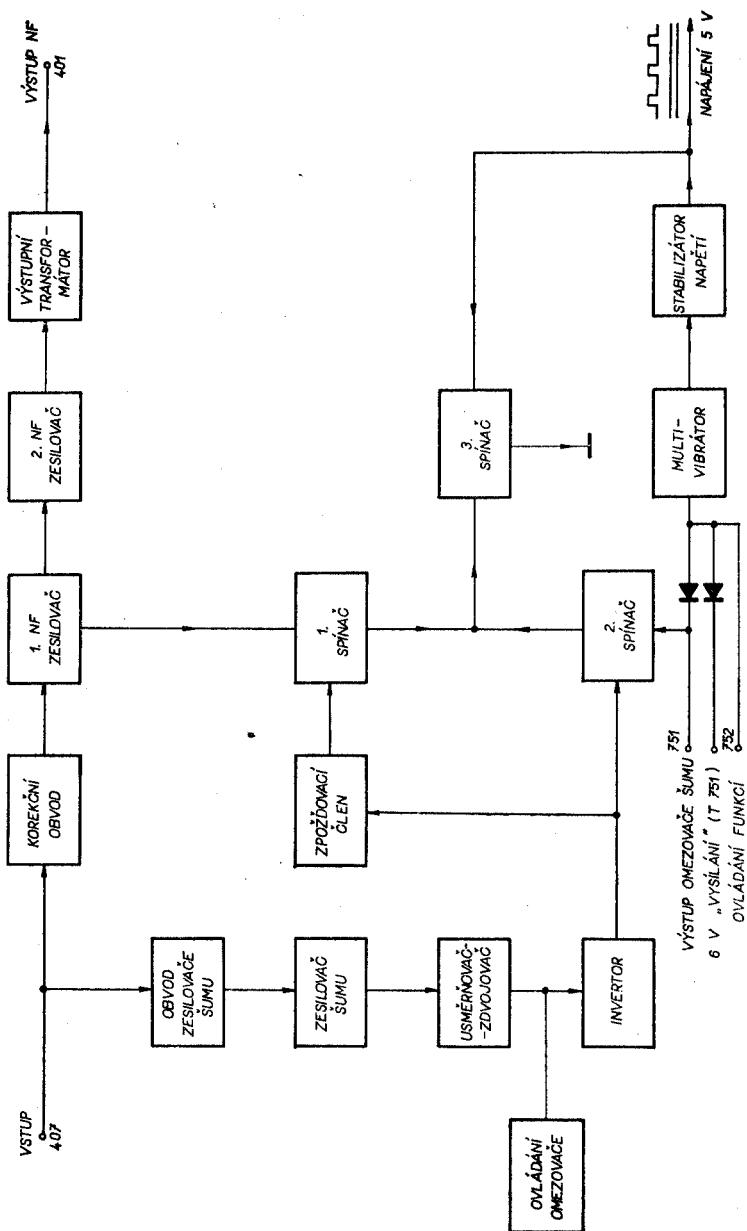


Fig. 14. Block diagram of part & breaker

b) Circuits

aa) *The noise limiter path*

106. One path goes through separator capacitor C401. The input voltage is fed from the part to the potentiometer R401. This potentiometer is used to adjust the noise input level for the noise limiter circuits.

bb) *Resonant circuit*

107. The serial resonant circuit (L401 C402) is assigned to the input of the noise amplifier (point 4 of the integrated circuit 01401) in order for the noise limiter to be not influenced by the speech spectrum (corresponding to the voltage). This circuit selects frequencies from the 9 kHz range of the noise spectrum and feeds it to the noise amplifier input pin 4 (integrated circuit 01401, type MAA325).

cc) *Noise Amplifier*

108. The Noise Amplifier is a three-stage integrated circuit 01401. (For connection of the integrated circuit MAA325 see Appendix 11).

dd) *Stabilization of the working point*

109. The DC operating point of the integrated circuit 01401 (type MAA325) is set by negative feedback from the output of the integrated circuit pin 1. The feedback is made by the resistor R412 via the resistors R409 and the resistor R403 to the input of the integrated circuit pin 4. Where, together with the divider, the resistor R402 forms the input DC voltage of the integrated circuit 01401 corresponding to the respective point.

C403 filters the alternating voltage feedback component. The resistance value R403 together with the C403 form the impedance of the integrated circuit. Resistors R405 and R408 affect the DC stability of the integrated circuit amplifier 01401.

110. Due to the significant negative coupling of resistor R408, which is common to the amplifier T3 and T1, to which it is

connected via the resistor R405, ie the connection between pins 2 and 5 of the integrated circuit 01401 (MAA325).

This feedback causes a reduction in the input impedance of the integrated circuit at pin 4. Similarly, the resistors R406 and R407 applied feedback, however this is considerably smaller.

111. Diode D401, whose temperature dependence compensates for the temperature dependence of the DC operating point of the integrated circuit, by changing the voltage at the input on pin 4, is significantly associated with the DC stability of the integrated circuit 01401.
112. The alternating negative voltage feedback from pin 1 to pin 4 through resistor R411, capacitor C404 and thermistor R404 alters the gain of the integrated circuit amplifier 01401 so as to offset the change of the noise level from the output of the IF amplifier and change the sensitivity of the voltage divider and the self-noise limiter switches T401, diodes D402 and D403, depending on ambient temperature. Capacitor C406 serves to prevent the integrated circuit 01401 from oscillation to higher frequencies.

ee) *The voltage doubler*

113. Capacitors C407 and C409 and diodes D402 and 403 form a noise amplifier from the output of the amplifier 01401. The dependence of the DC output voltage of the double-diode (D403 and D402), depending on the input peak voltage, is non-linear. This means that the output DC voltage is virtually zero up to the peak voltage of the input signal of the doubling device of about 0.7 to 1 volts. If the peak voltage rises above the specified value, the DC output voltage begins to rise sharply.

ff) *Noise limit switch*

114. The positive polarity DC output voltage is supplied on the transistor base T401, which acts as a noise limiter switch. Transistor T401, together with R413, operate to switch the mode of operation.

115. Resistance R414 is the working resistance of the noise limiter switch (T401). The resulting function of the Noise Amplifier, Duplicator, and Self-Switch is such that:

1. If there is noise at the AF input of the circuit (terminal 407), switching transistor T401 is turned on, resulting in a very low, virtually zero voltage on the collector.
2. When there is no noise at the AF input (terminal 407), then the switching transistor T401 is turned off and at the collector of this transistor the voltage is equal to the supply voltage, i.e., 6 V. From the collector of the transistor T 401, information about the presence or absence of noise R419 is passed to pin 5 of the integrated circuit 01402 (type MBA145) and via resistors R421 and R422 to pin 6 of the integrated circuit 01402.

The pinout of the integrated circuit 01402 (type MBA145) is given in Appendix 11. The switching electrodes pins 4 and 7 belong to the control pin 5 of the switch 2.

gg) Interrupter Multivibrator

116. From the pin 7 of the integrated circuit 01402 the interrupt multivibrator function is controlled. The resistors R421 (10 kΩ) and R422 together with capacitors C411 and C412 determine the time constant required to control the actual noise limiter.

hh) Switching circuits

117. The switching circuits 1, 2 and 3 are provided by integrated circuit 01402 (type MBA145). The diagram of the internal circuit board of the MBA145 integrated circuit is in Appendix 11.

The input control pin 6 of the integrated circuit 01402, the switching pins of the switch 1 (pins 1 and 4) belong to the first stage of the amplifier in cooperation with the switch 3 (pins 3 and 4 which are controlled by the pin 2) (T402).

The integrated circuit 01402 is connected to a supply voltage of 6V via the pin 8. At the control pin 2, which is controlled by switch 3, the control voltage is fed through the R423 from the interrupter

output (T761).

118. If there is no noise at the AF input, transistor T401 is turned off and integrated circuit 01402 with the pin 5 and the output 7 is closed, resulting in the transistor T402 being closed and the noise from the input dilution not entering the end stage AF amplifier.

The same applies to input 6 of the integrated circuit and output 1, which shows a positive voltage of about 6 V. If the mode switch is not set to "Δ", "■" or "□" positions, the radio station operates in the so-called intermittent mode. The time constant at input 6 of the integrated circuit prevents the self noise limiter and hence the AF amplifier from opening during short intervals when the radio station is interrupted. When the signal arrives and the intermittent operation stops, the time constant between terminals 6 and 4 of the integrated circuit allows part of the integrated circuit 01402 (type MBA145) to be switched on and thus allow the passage of current through the amplifier (transistor T402).

119. The primary circuit interrupter of the operation is a multivibrator fitted with transistors T754 and T755 (type KC508).

The multivibrator operates with unequal flip times such that the transistor T755 is conducting for about 5 times less than it is non-conducting.

The time constant of this integrated circuit consists of capacitor C751 and resistor R762, capacitor C752 and resistor R759. The unbalanced multivibrator operation is determined by the voltage applied to the transistor emitter T754 by a resistor R756 and R757. C757 improves the waveforms, mainly in the area of the rise and fall edges of the output voltage. C753 prevents the multivibrators from triggering due to disturbances from the supply circuits. Diodes D753 and D754, as well as the custom tuning control terminal 752, are used to control "intermittent" operation such that the multivibrator is blocked and can not operate by grounding one of the diodes or grounding the output 752. This stops the interrupted operation of the radio station. Output 752 controls intermittent operation from the operating switch.

Via the D754 diode, the operation of the radio station is controlled from the auxiliary circuits of the "RX" - "TX" switching circuits so that the intermittent operation can not be triggered during transmission. Through the D753 diode, intermittent operation is controlled from the output of limiter 7 of the integrated circuit 01402.

120. Switch transistor T756 (type KC508) is controlled via resistor R764, which blocks the stabilizer output voltage (+5 V) by grounding the transistor base T759 (type KC508) in the stabilizer. In case of intermittent operation, the collector of T755 has a positive voltage approximately equal to the supply voltage, i.e. 5V stabilized (supply 757) for a long time, and in this state the transistor T756 is open. As T756 is open, the base of the T759 transistor is connected to ground and there is no voltage on the emitter of transistor T761. For a short time (just over 20 ms), transistor T755 is open and transistor T756 closed and the stabilizer (T759, T760 and T761) is operating normally.

ii) Stabilizers

121. Transistor T761 is the power stage of its own stabilizer and is fitted with the KSY34 type. This type was chosen for low saturation voltage. The transistors T760 and T759 act as current amplifiers and are powered by 12 volts from the inverter via input terminal 758. Differential amplifier (transistors T757, T758) with common emitter resistor R765 are used as a voltage amplifier in the stabilizer. The stabilizer output voltage is set by potentiometer R768, which is connected to the stabilizer output and T758 differential amplifier.

Transistor T757 is powered by a 5V stabilizer. To make the output voltage of the stabilizer independent of temperature, the reference voltage is also supplied from the stabilizer via terminal 761 on the base of transistor T757. The reference voltage is about 3 V and is temperature independent.

122. Switching the supply voltage during reception and transmission. Some receiver circuits are powered from a stabilized 5V supply source and must be switched off when the radio station is switched to broadcast. The same applies to some of the

transmitter circuits. "Because the relay for switching from receive to broadcast does not have enough contacts, their function has to be extended. For this purpose, the transistor circuits T751, T752 and T753 are used. If the radio station is switched to transmission, the 754 part of the 6V breaker is fed from the antenna relay to the clamp. This voltage opens the transistor T751 (type KC508) via the resistor R751. When the transistor T751 opens, the voltage drops to almost zero to its collector. Via the D754 diode, as already mentioned earlier, interrupter multivibrator operation is blocked. At the same time, transistor T752 (KSY81) opens via resistor R754. The 5 V stabilized voltage (terminal 760) passes through the emitter of this transistor to the collector, at the 753 terminal, the 5 V transmitting voltage.

The 5 V voltage is reduced by the saturation voltage of the transistor T752. As the transistor T752 is open, the collector has a voltage of 5 V and current through the diode D751, resistance R755. The voltage drops on the transistor T752 and on the D751 diode are insufficient to open D752 and transistor T753 (KSY81). This means that the 5 V output for reception (terminal 756) is closed. When the radio station is switched to receive, voltage is not applied to terminal 754 and transistor T751 is "closed." Transistor base T751: closed via resistor R752 The closing of transistor T751 results in an interruption Current flowing through resistor R753 and closing of transistor T752.

There is no voltage at terminal 753 (5 V for transmission). The D751 diode does not flow, and the transistor T753 is open through the R755 and the D752 diode (type KA501). At terminal 756 (5 volts for reception), the voltage +5 V, less the saturation voltage of the transistor T753 (type KSY51), appears.

jj) AF amplifier

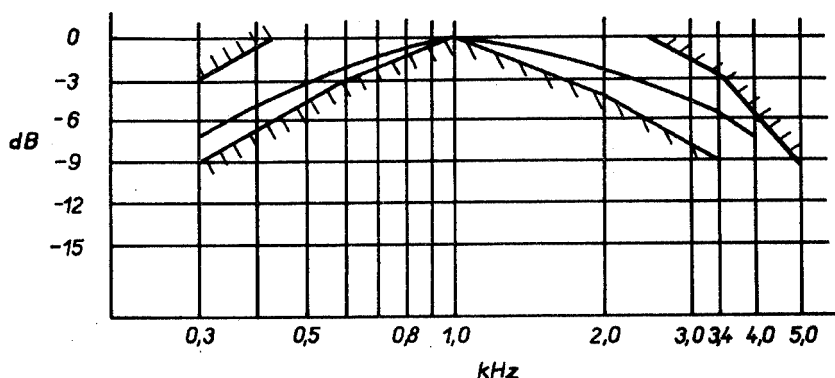
123. The input nf signal is fed via pin 407 to the R415 potentiometer. By adjusting this potentiometer, the variance of the output voltages of the part and the variance of the sensitivity of the actual amplifier is compensated.

The C413 capacitor is a separator. At the same time, however, it

reduces the lower spectrum of the speech spectrum.

The resistors R417, R418 and R442, the capacitors 7C414, C415 and C421 form the frequency adjustment circuits. The characteristics of the low-frequency component are shown in Table 1. The tolerance band of the frequency characteristic is shown in Table 1. is also indicated.

Table 1



124. Transistor T402 (KC508) is supplied from terminal 403 (6 V for reception) via filter resistor R426 and working resistor R425. The emitter resistor R427 generates feedback. Resistance R428 is only power. Together with the C418 capacitors, it applies to the noise limiter time constant. Resistance R428 is connected to the output of integrated circuit 01402 (MBA145). The operating point of transistor T402 is determined by a voltage feedback via resistors R410, potentiometer R416, resistors R417, R418 and R442, which together with capacitors C414, 415 and 421 modulate the frequency response. With the R416 potentiometer, the operating point of the transistor T402 can be adjusted so that the collector has a voltage of approximately 3 volts.

125. The C419 capacitor modulates the characteristic for higher frequencies than the transmitted band. Capacitor C417 is a decoupling capacitor. Resistor R424 increases the internal resistance of the amplifier T402 and, along with the divider resistors (on the mode switch), enables the volume adjustment via

the terminal 402. The capacitor C422 is also a decoupling capacitor and reduces the lower frequencies of the spectrum of the transmitted frequencies. At the point between the resistor R424 and the capacitor C422, a thermistor is connected to compensate for changes in the sensitivity of the low-frequency part in dependence on temperature.

126. The end-stage driver of the nf part is two-stage. The first stage of the driver is fitted with a transistor T403 (KC508). On this transistor, the operating mode of the entire output stage is set by adjusting the voltage based on the transistor T403. This voltage is taken from the runner of the potentiometer R431, which is part of the voltage divider. The voltage divider consists of resistors R432, R434, R435 3 potentiometer R431. The emitter of the transistor T403 is DC coupled to the output of the amplifier, ie to the emitters of the complementary pair of transistors T404, T405. The working resistance of transistor T403 is resistance R433. The transistor T403 is coupled to the output stage of the amplifier with DC and AC feedback (resistors R436, R435 through the C424 separator capacitor). At the same time, the resistor R429, R431, R434 connected to resistor R435 is used as feedback. The second stage of the T404 driver is fitted with a p-n-p type transistor (KSY81). The resistors of transistor T404 (KSY81) are resistors R439 and R438. This is in fact a distributed load, to which the output voltage is applied by a positive voltage feedback across the capacitor C426. This feedback allows full excitation of end-to-end transistors, as is common in similar terminals with complementary transistors.

127. Resistance R 441 and potentiometer R437 with diodes D404 and D405 (type KA501) set the working mode of the end transistors - their quiescent current. The D404 and D405 diodes are used to compensate for the T405 and T406 quiescent current in dependence on temperature.

The entire operating mode of the output stage is stabilized by the negative voltage feedback via the R436 resistor as explained earlier.

128. The output of the complementary pair of transistors T405 and T406 is connected to the output transformer circuit Tr401 'via

two parallel connected capacitors C427 and C428. The transformer adapts the load impedance of the acoustic transducers (possibly the 0 0 resistance line 300 9) to the end stage so as to achieve the required output power of about 30 mW.

c) Design of the nf part and the breaker

129. This part is assembled on a coupling plate with double-sided cladding of dimensions 154 x 36 mm and is placed in a separate space (fig. 17). This part is fastened to the supporting structure of the radio station by three screws.

For connection to other parts of the radio station, the soldering tips are mounted on the narrow sides of the coupling plate. The board and side wiring harnesses are connected by flexible conductors with teion insulation. The parts are fastened with their outlets to the printed circuit boards on the coupling plate.

130. The resistors used are of type TR191 with a metal layer. Trimming potentiometers are type TP 095 - 0.5 W.

The used capacitors are both ceramic type TK744, TK774 and TK782, and TC276 polyester type. The electrolytic capacitors used in this part are tantalum. "Drop" design.

Fig. 15. High-frequency part

Fig. 16. Intermediate part

Fig. 17. Amplifier and interrupter part nf

Transistors and diodes are silicon, integrated circuits of the type MAA 325 and MBA145.

The inductance of the resonant circuit and the output transformer are wound into 14 mm diameter miniature cup cores. The layout of the components is shown in Fig. 17.

4. Modulation amplifier

131. The modulation amplifier is a separate unit whose function as the first stage of the transmitter is to amplitude and frequency modulate the signal which the acoustic transducer - microphone delivers in a phonic connection - so that the level equilibrium of the modulation path is maintained.

a) Block diagram

(Figure 18)

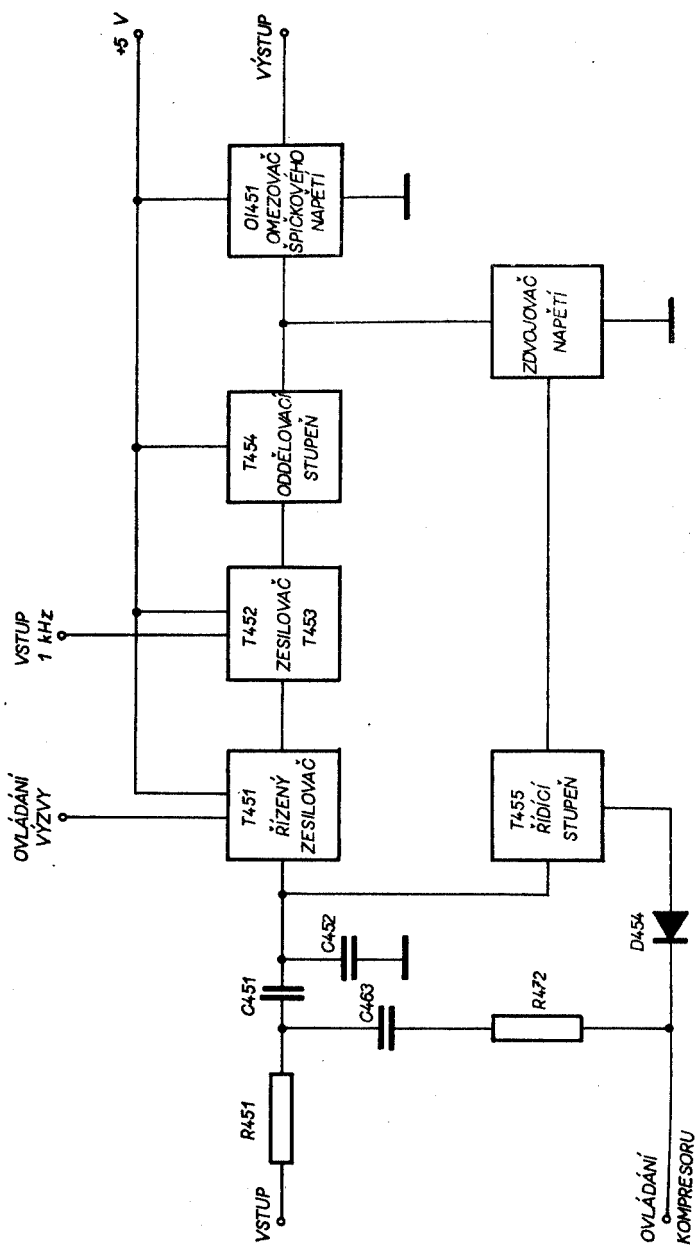


Fig. 18. Block diagram of the modulation amplifier

132. The input signal is fed from the microphone to the controlled transistor T451, from there to the two-stage amplifier (T452 and T453), via the emitter follower T454 to the peak limiter 01451 to the output and then to the modulator. The voltage amplifier is pulled down by the step amplifier, controlled by the voltage divider, and a dynamic amplitude limiter controlling the gain of the first stage (T451) is controlled so that the modulator operates at full stroke for a large input voltage range. The peak limiter ensures that the output voltage of the modulation amplifier does not exceed the level corresponding to the maximum frequency stroke ($A_f = :: 8 \text{ kHz}$). Since the silent call is sufficient to ensure full modulation of the station, the sensitivity of the modulation amplifier is about 0.5 mV. For maximum clarity, the frequency response is adjusted so that the maximum sensitivity is in the 3 to 3.4 kHz band.

b) Circuits

aa) Amplifiers

133. The microphone signal is fed through the R451 resistor and the T451 (KC509) controlled transducer C451 which works as a low-noise amplifier. The bridging connection is used to stabilize the operating point. Resistance R451 with capacitor C452 limits higher spectrum spectrum. Transistor T451 is controlled by a stronger T455 transistor signal (KC508) and is coupled with a dynamic amplitude limiter.

With a small input signal until its amplified value exceeds about 0.4 V at transistor output T454 (KC508), transistor T455 is closed and T451 (KC509) operates at full gain (about 20 dB).

The magnitude and mutual ratio of resistors R452 and R453 determine the collector current (200, μA) for DC power supply (5 V) and emitter resistance R455 which is blocked by capacitor C455.

134. Transistor T452 (KC508) is connected via coupling capacitor C454 and its working point is stabilized by voltage feedback resistors R457 and R456. Grade gain is about 12 dB. The next step, coupled by capacitor C456 with transistor T453

(KC508), is connected as a previous circuit. The operating point is in the middle of the load characteristic in order to avoid a limitation at high peak signal values. With a negative feedback of R464 emitter resistor and collector resistor R463 this gain has a gain of about 20 dB.

135. The base of the following stage (Emitter Tracker) is galvanically coupled to the T453 collector. The tracker is fitted with transistor T454 (KC508). The low Emitter Tracking Output (less than 50 Ω) guarantees the operation of a voltage dampener that controls a dynamic amplitude limiter.

136. As noted above, the amplifiers must be equipped with a dynamic amplitude limiter so that the frequency of the transmitted frequency is irrespective of the volume of the call near $f = 5$ kHz.

The DC voltage required to control the dynamic amplitude limiter is obtained by detecting the output voltage of the emitter tracer T454 obtained from resistance R465.

137. The detector performs a voltage amplifier C460, D451 and D452 (KA501) and C461. The ratio of the capacities C460, C461 and the ratio of resistors R471 and R470 determines the time constant of the dynamic limiter. Via the resistor R471, the base of the T455 control transistor itself is controlled.

If the signal increases, the voltage on the tweeter and thus the collector current of the transistor T455 (KC508) increases. The T451-based voltage variation caused by the co-current current of the transistor T455 closes the transistor T451 and reduces the gain. At high amplitudes of input voltage. The current of the transistor T455 is due to the greater output voltage of the doubter so large that the low dynamic resistance of the transistor T455 is also applied. The dynamic resistance of this transistor forms a divider with resistor R451, causing further gain after gain of the whole amplifier.

In order for the attenuation stage to be controlled by the DC output voltage from the double-pole, the output voltage on the T454

emitter should be at least 0.5 V.

When the input signal drops, the control transistor T455 closes. To limit the discharge time dependency on the T455 operating point, the capacitor C461 is connected in parallel with the discharging resistor R470. With the transistor T455 closing, the gain of the transistor T451 increases.

138. 139. If dynamic radio amplitude limiter is deactivated when radio transmission conditions are impaired, such as ambient noise, such as ambient noise. This is done by cathode diode D454 (KA501) connected to the carcass. The transistor T455 is thus closed and the transistor T451 operates at full gain. The R451 and R472 resistances regulate the sensitivity of the modulation reverser for this mode of operation of the radio station.

cc) Peak amplitude limiter

139. The time constants of the dynamic limiter allow it to respond to very fast changes in the input signal level. This would not be met for these extraordinary. Input signals allowed maximum frequency stroke $A_f = 8 \text{ kHz}$, determined by technical conditions. Therefore, an additional stage (peak amplitude limiter 01451) fitted with the integrated circuit MA3005 is included behind the emitter. The limiter is not disengaged and limits the spikes by about 12 dB.

The signal is fed from the emitter tracker T454 via the C465 separator capacitor, the value of which is determined to limit the transmission of the lower portion of the modulation signal spectrum. Resistance R475 determines the peak limit level. The integrated circuit works as a two-stage emitter coupled amplifier. The R476 potentiometer is a divider for powering and stabilizing the operating point of the integrated circuit. It sets a symmetric limitation. The thermal stability of the integrated circuit is fully secured by its own structure (Appendix 11). Resistance R478, R479 guarantees the same working conditions for both circuit systems.

The second input of the integrated circuit (7) is alternately grounded via capacitor C466. The peak limit output voltage is

about 3 volts.

dd) Tone Call

140. The diode D453 (KA501) is connected to the collector of the transistor T451, which can be connected to the ground with one of the two buttons on the handset. This eliminates the input circuit of the modulation amplifier as the current passes through the resistor R454 and the diode D453 to the ground. The D453 has a small dynamic resistor, and the transistor T451 in the collector is short-circuited. This means that the radio station can not be modulated by input 455 of the modulation amplifier from acoustic transducers. At the same time, a Tone Call signal of 2 parts of the reference frequencies is fed into the T452 collector via the C457 capacitor.

c) Mechanical arrangement of the modulation amplifier

141. The modulating amplifier (Figure 21) is placed on a 32 x 60 mm size plate in a separate room. The load-bearing structure is secured with two screws. Other soldering tips are used to connect with other radio stations. The connection itself is ensured by flexible conductors with teion insulation. The used components are soldered to the PCBs of the couplings.

142. All resistors are type TR191 with a metal layer for a load of 0.25 W.,

Capacitors C451, C453, C454, C455, C456, C461 and C463 are tantalum, the others are ceramic or polyester according to the requirement for temperature stability of capacity.

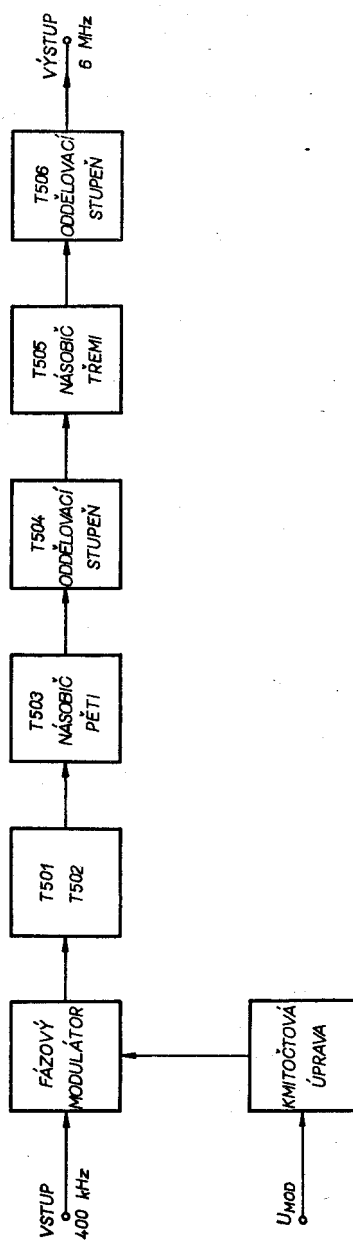
The integrated circuit, transistors and diodes are silicon. The arrangement of the components is shown in Fig. 21.

5. Modulator

143. The modulator's task (Figure 22) is to modulate a phase-stable carrier frequency of 400 kHz adjusted by the low-frequency

signal from the modulation amplifier so that after amplification and multiplication we receive a frequency modulated 6 MHz signal. "

Fig. 19.
Block
diagram of
the
modulator



a) Block diagram

(Figure 19)

144. The modulating frequency from the modulation amplifier is first frequency modulated and modulates the fixed frequency 400 kHz in the phase modulator, fed by 2 parts of the reference frequencies. The modulated signal is amplified in a two-stage amplifier (T501 and T502), multiplied by a multiplier of 5 (T5P3) to 2 MHz, and again in the isolation stage (T504).

After multiplying in the multiplier (T505) to 6 MHz, the signal through the separation stage is fed to the transmitter input.

b) Circuits

aa) Adjustment of the low frequency signal

145. The low frequency modulation signal that is input from the modulation amplifier must be modified. This signal is fed to the modulator via pin 508 via a low pass filter consisting of inductance L501, capacitor C502 and capacitors C501 and C503. The capacitor C502 and the inductance L501 together form a parallel resonant circuit with a resonant frequency of about 7 kHz. This circuit serves to achieve a decrease in the amplitude characteristic for frequencies higher than 3.4 kHz. Capacitor C504 separates DC voltage. Potentiometer R502 is a load of the 2nd cell and serves to adjust its own stroke level with a given modulation signal, that is, to adjust the sensitivity of the modulator. Combination of resistors R508, R510 3 of R504 thermistors is used for temperature compensation (guarantees stroke stability at ambient temperature changes). Terminal 509 receives a signal from the radio station radio accessory supplementary device.

bb) Phase modulator

146. The modulation is provided by capacitance diodes on a fourfold subcritical filter. Frequency 400 kHz is fed to the modulator via pin 504 and capacitor C512 to the coupling coil of the first modulation filter circuit (0502).

Capacitive diodes D501 to D504 (KA213B) feeds a fixed frequency of 400 kHz, as well as a low frequency modulation signal that causes the distortion of circuits 0502 to 0505, causing a phase shift of 400 kHz by an amplitude-proportional and modulation frequency angle. Since four filters are included, the resulting phase shift is approximately the sum of the phase shifts achieved on the individual circuits. Resistors R505, R507 are used to provide DC diode operating modes. Resistance R501, R506 and R511 are damping. Capacitor C506 is blocking.

cc) Amplifier

147. The output voltage of 400 kHz from the phase modulator is fed through the separating capacitor C516 to the first amplifier stage to the transistor base T501 (KC508). The amplifier works in normal wiring with stabilized voltage feedback via R517. The amplified voltage is fed via the C518 isolation capacitor to the next amplifier stage, ie based on the transistor T502 (KC508). This step uses bridging stabilization of the operating point.

The voltage, amplified to approximately 0.5 V, required for the correct operation of the multiplier, is fed through the separating capacitor C522 to the next stage.

dd) Frequency multiplier of five

148. A phase modulated 400 kHz signal is fed on a transistor basis T503 (KC508) operating in class C with an open angle of $0 = 240$ as a frequency multiplier. The circuit 0506, which is tuned to the 5th harmonic input frequency, ie at 2 MHz, is connected to the collector circuit where the input voltage arcs appear.

Resistance R525 and R524 determine the working point of this stage. Resistance R526 is filtering. Circuit 0506 is part of the band filter with circuit 0507. The connection between them is critical. The capacitor C526 is a coupling and determines the degree of bonding. Capacitors C525 and C527 form the resonance capacities of these circuits.

ee) Separation stage

149. The voltage is taken from the C527, C528 capacitive divider and is fed on the transistor T504 (KC508), which serves to separate both multipliers while providing sufficient voltage for the second multiplier. This degree has a gain of about 20 dB. The R531, R530 and R533 resistors are secured in the same way as the T501. In the transistor collector T504 a circuit is tuned to a frequency of 2 MHz. This circuit suppresses undesirable multiplication products. The capacity of this circuit is C529.

ff) Frequency multiplier of three

150. From the transducer collector T504, the signal is fed through a T505 transistor-based separator capacitor C531 (KC508) which again acts as a class C amplifier and has a two-band bandpass filter (0580, 0509) in the collector tuned to a third harmonic frequency, To 6 MHz.

Opening angle $\theta = 400$. Frequency stroke at filter output $\Delta f = + -5$ kHz. Corresponds to the phase stroke at the input. Level feedback is again provided by voltage feedback via resistor R535. Resistance R537 improves the stability of the amplifier.

gg) Separation stage

151. From capacitance divider C536, C537 We receive a modulated 6 MHz signal, which is input based on transistor T506 (KC508). A tuned circuit is connected to the collector of the transistor, the coupling winding of which impedances adapts the modulator output to the input of the next part. Resistance R542 with capacitor C510 in the supply branch forms filtration, resistance R543 improves the stability of the amplifier. Circuit 0510 is tuned to 6 MHz and suppresses unwanted multiplication products.

c) Power supply

152. The modulator is powered by a stabilized voltage of 5 V, which allows stability of set parameters of the whole modulation chain. For the operation of the D501 to D504 capacitive diodes, a 4.2 V DC voltage is obtained from the 22.5 V divider stabilizer (resistors R505, R507).

d) Mechanical arrangement of modulator

153. The modulator is mounted on a 35 x 155 mm board. It is attached to the support structure by three screws.

For interfacing with other parts of the radio station, soldering tips are placed on the narrow sides of the plate. The proprietary interconnection is provided by flexible tection insulation conductors.

The parts are soldered with their outlets to the couplings of the couplings.

154. Resistors are type TR19 with a metal layer for a load of 0.25 W.

Potentiometer R502 is type TPO 95.

The capacitors are ceramic type k47N, P4002 or Supermit 12, tantalum or ployester according to the requirement for temperature stability of capacity.

Transistors and capacitance diodes are silicon.

For 1: L501 is a pot ferrite core.

Zero filter circuits and 2 MHz multipliers are in ferrocert mines, 6 MHz multiplier circuits, and output circuit 0510 are on ferrite cores. All circuits are in covers and are tunable.

6. Transmitter

155. The transmitter mixes a signal of 6 MHz 2 signal modulator, 50 to 60 MHz 2 frequency exchanges, and the difference frequency after filtration is amplified to achieve a 1 W high power. At power supply, the output stage is supplied with 12 V voltage from the transistor converter.

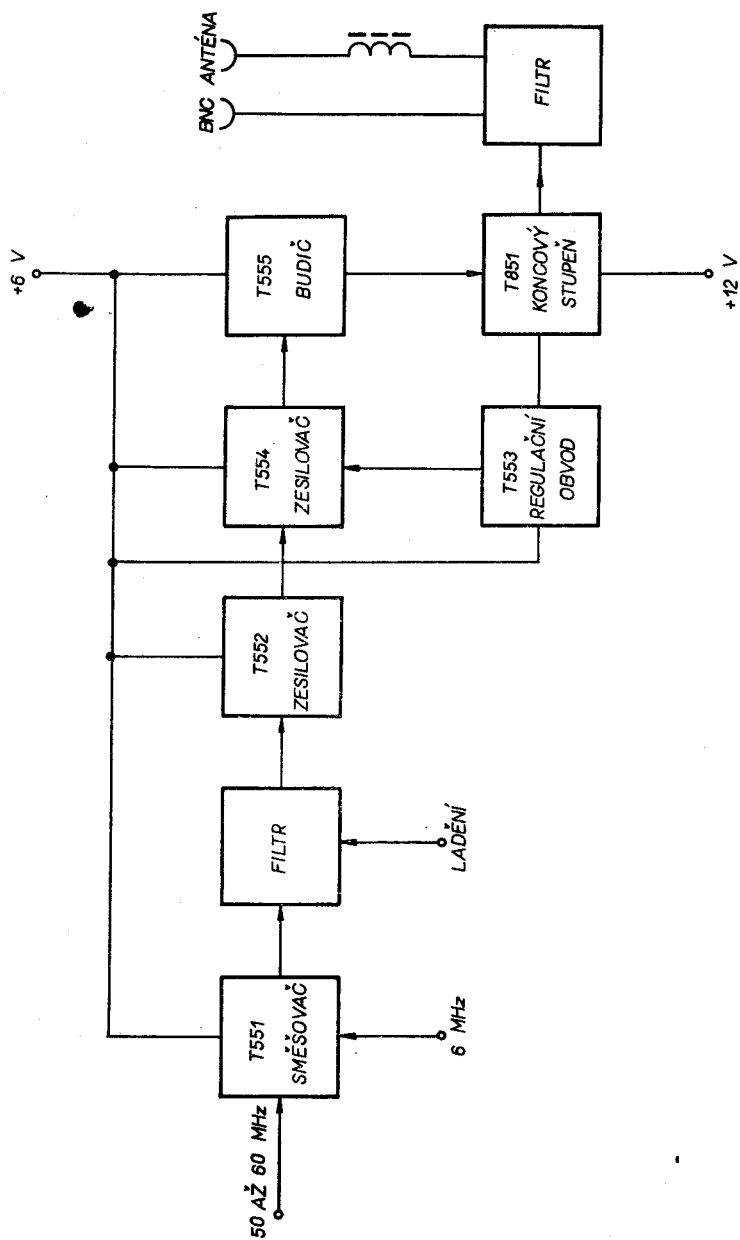


Fig. 20. Transmitter block diagram

a) Block diagram

(Figure 20)

156. The 50 to 60 MHz signal from the frequency exchange shall be mixed in the first step (T551) with a frequency modulated signal of 6 MHz from the modulator and the difference frequency shall be taken. The following filter suppresses the undesirable frequencies of mixing. The filtered signal is amplified by a two-stage amplifier (T552 and T554) to about 1 V / 50 9 excitation exciter (T555) with a power of about 120 mW. This amplified signal triggers an output stage (T851), from which the signal goes through a double 11: cell (filter) to the BNC connector and via the L851 extension coil to the radio station antenna connector.

The voltage is withdrawn from the output stage for the control transistor T553, which controls the power of the 2nd stage of the amplifier. This control keeps the constant current of the output stage.

b) Circuits

aa) Mixer

157. A modulated 6 MHz signal is fed via the terminal 557 to the transmitter input. Via the C552 coupling capacitor, this signal is based on transistor T551 (KF173), which works as a mixer. To the emitter of this transistor, a master oscillator signal of frequency 50,000 to 59,975 MHz is fed through the coupling capacitor C553 from clamp 558. The resulting mixing product is the differential frequency. That is, the resulting frequency ranges from 44,000 to 53,975 MHz, which is the band of reception frequencies and radio station broadcasting.

Resistors R551, R552 are used to adjust and stabilize the smelter's working point.

bb) Filter

158. Since undesired frequencies occur when mixing, the mixer (T551) and the first amplifier stage (T552) must be included in the filter. This filter consists of the circuits 0551 to 0554 and matches the capacitive diodes D551 to D558 (KA213 / B). The pair of diodes are used in terms of more favorable dynamic properties for larger signals. The C555, C560, C557, and C559 fine tuning capacitors are used to fine tune the circuits at the upper frequency ranges of the crossover band. At low frequencies, circuits are tuned by the ferrite cores of their own tuned circuits.

Circuits 0551 and 0552 have a mutual current inductive coupling formed by the T1555 choke. Circuits 0552 and 0553 are voltage-coupled by capacitor C558. Circuits 0553 and 0554 are again coupled by a current inductive coupling formed by the T1556 choke.

The decoupling voltage is fed from terminal 560 via resistor R571 and filtered with capacitor C582. Resistance R555, R557, R558 and R559 are power supplies for capacitance diodes. The capacitor C551 filters the supply voltage for transistor T551.

cc) Amplifier

159. From the filter output, the 44.000 to 53.975 MHz signal is fed via the C561 separator capacitor based on the first stage of the two-stage amplifier. The first stage is fitted with transistor T552 (KF173).

The base of this transistor is powered by resistors R560, R572. The C562 serves as a filter. The D560 (KA501) and D561 (KA501) in the power supply guarantee thermal compensation over the entire operating range, ie from -50 °C to + 70 °C. The diodes thermally compensate for the base-emitter transition of the transistor T552. A tuned circuit 0556 is connected to the transistor collector. This circuit serves primarily to transform the impedance from transistor collector T552 to transistor base T554 (KSY71). The transformation itself is carried out by capacitors C564 and C565, which form a capacitance divider. Circuit 0555 operates with a low operational quality factor and is tuned to a medium frequency

band (49 MHz).

160. The voltage from the capacitance divider is fed on the transistor T554 (KSY71), which again acts as an amplifier. The thermal stabilization of this transistor is ensured by a diode D559 (KA501) that stabilizes the base-emitter transition. The current for this diode is provided by resistance R562. The output of the control circuit is connected to the transistor emitter T554. Toggle circuit 0556, similar to Circuit 0555, is connected to collector T554. The impedance transformers provide capacitors C571 and C572, connected as a capacitance divider. The C570 is used to filter the supply voltage.

dd) Driver

161. From a capacitance divider, the signal is fed through a resistor R567 based on transistor T555 (KSY34), which acts as a driver.

By selecting resistor R567 it is possible to change the degree of excitation of transistor T 555. The collector of this transistor is supplied via voltage T1552 with +6 V voltage. D0 of collector T555 is connected Tr551 transformer with transformation ratio 4: 1. Due to the required transformation, another broadband transformer Tr 552 to the base of the T881 stage.

ee) Final stage

162. High-frequency voltage from adaptive transformers is fed on transistor base T851 (KT907/A). This transistor is energized via the choke T1553 and the circuits 0559 and 0558. These circuits together with the C578 capacitor form a filter that adapts the output impedance of the transistor to its own antenna and at the same time limits the frequencies above the frequency range of the stations. It's actually a low pass filter. The signal is fed into the antenna via the C580 separator capacitor.

Circuits 0.557 and 0560 are serial resonant circuits that harmonize the harmonic frequency band. Circuit 0557 is tuned to resonant frequency 102 MHz, circuit 0560 to 92 MHz.

163. The parallel combination of resistors R589, R565 is used in the transistor emitter T851 to adjust the range of the control circuit. The damping resistor R570 is connected to the T851 base. Reduces the occurrence of parasitic vibrations during load changes.

ff) Control circuit

164. The radio station must be protected against permanent short-circuit and permanent disconnection of the antenna. In order to avoid an increase in the output current and thus the destruction of the final transistor, a control circuit is connected to the transmitter part.

The DC voltage withdrawn from the resistors in the transistor emitter T851 is fed via the T1554 choke to the transistor emitter T553 (KC508). The base of this transistor is connected via the limiting resistor R573 to the potentiometer runner R566, which divides the voltage generated on diodes D560 (KA501) and D561 (KA501). This translates the base-emitter transition of the transistor T553, which ensures the stability of the control circuit regardless of the ambient temperature fluctuations.

165. If the current of the T851 transistor increases, the R565 and R569 parallel resistors are increased, thereby increasing the voltage on the T553 emitter. The transistor decreases the supply voltage for the T554 transistor in the amplifier, thereby reducing the power of the amplifier, Driver output and output stage. The control circuit thus prevents damage to the expensive terminal transistor in short-circuit or disconnection of the antenna.

c) Power supply

166. All transmitter circuits except the end stage are supplied with a +6V DC power supply.

Since the transmit power with a given type of end-to-end transistor (KT907/A) is not achievable with a +6 V supply voltage, a 12 volt DC voltage is applied to the transmitter. This voltage is also connected at reception because if the output stage of the transmitter is not excited, it does not take any current.

d) Mechanical arrangement

167. The transmitter is placed on a 34 x 154 mm plate in a separate room (Figure 23). It is attached to the support structure by three screws.

To connect with other parts of the radio station, soldering tips are used on the narrow sides of the board. The connections ensure flexible Teflon insulated conductors.

The parts are fastened with their outlets to the couplings of the coupling plate.

168. The resistors used are TR191 type with metal layer for 0.25W load. The R556 potentiometer is TP095 type.

Capacitors are ceramic, fine tuning capacitors (C555, C557 C559 and C560) are type N47.

Transistors and capacitance diodes are silicon.

The chokes T1554, T1551, T1552 and T1553 are on the H22 ferrite tube; Impedance transformers are wound on a 6 mm ferrite toroid of N01 material.

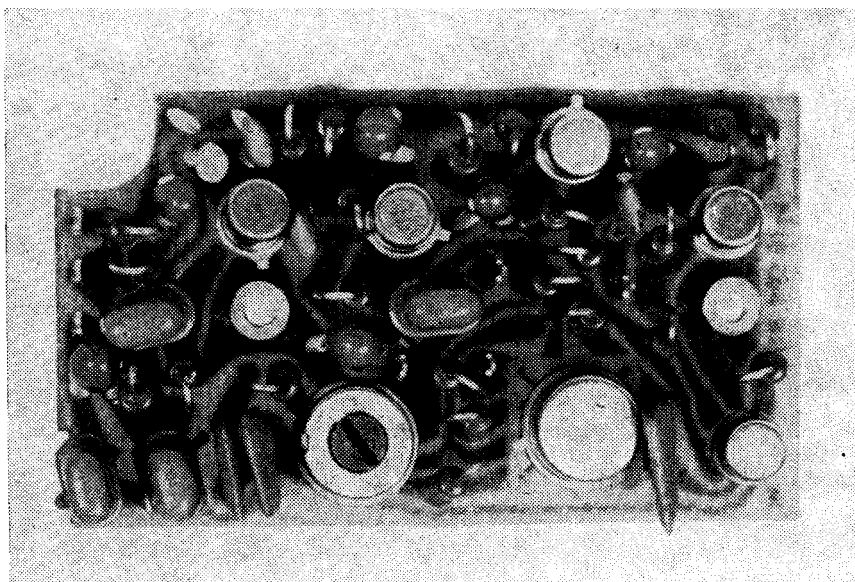


Fig. 21. Modulation amplifier

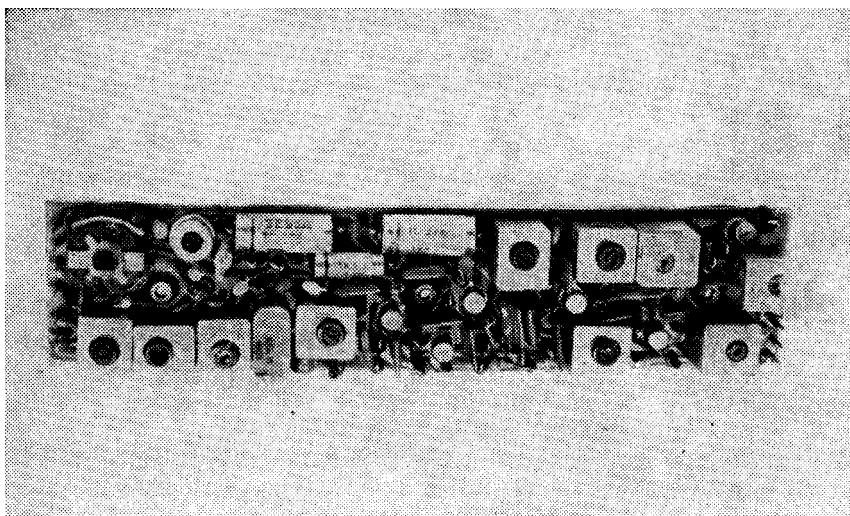


Fig. 22. Modulator

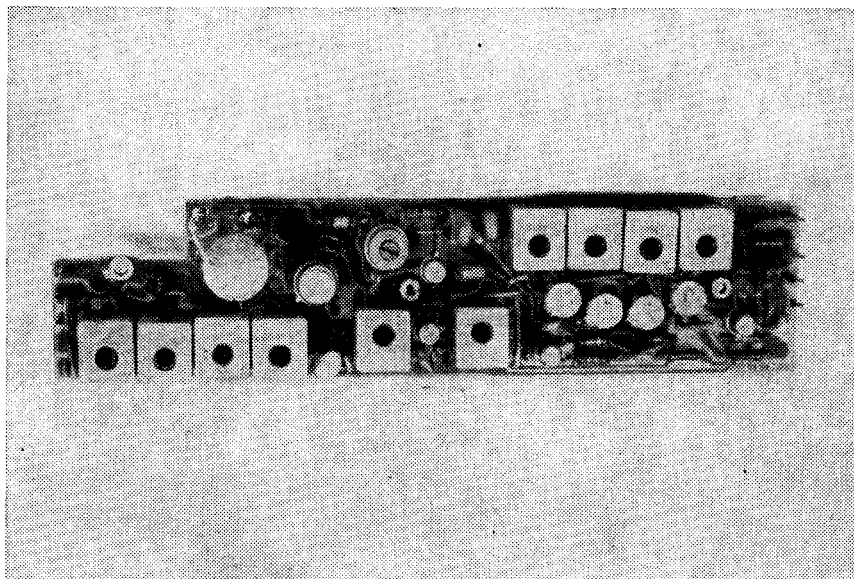


Fig. 23. Transmitter

All the RF circuits are in the enclosures and are tuned by the ferrite finishing core. The layout of the parts is shown in Fig. 23.

The final transistor is screwed directly to the body of the radio station in order to secure the necessary cooling. The transistor bolt is electrically connected to its emitter. Therefore, it must be electrically insulated with a thin thermal conductive insulating plate (mica). The KT207/A transistor itself passes through a circular hole in the transmitter board.

7. The main oscillator

169. The oscillator is connected as a LC transistor oscillator in a so-called "clamp wiring", with a grounded collector and current capacitance. The resonant part consists of serially connected capacitive diodes D701, D702 and D703, D704, inductance 0701 and tuned capacitor C702. The resonant portion is coupled to the active element of the T701 transistor via a C704 capacitor divider and an input impedance of the T701 transistor. The capacitive coupling is provided by the capacitor C705, a capacitive divider made up of capacitance diodes D703 and D704. Resistors R701,

R702 serve as capacitance diode resistors. Resistance R703 closes DC paths of capacitance D703 diode. Resistive circuit damping by R703 is negligible.

Resistance R706 is separating. The fixed preload for transistor T701 creates resistive divider R705 and R708. Capacitors C701, C703, C706, C712 are blocking. The oscillator is roughly tuned to the DC voltage displayed through resistors R701 and R702 on capacitance diodes from the resistor divider switched by the SI81a switch when selecting the channels. Accurate tuning ensures the DC output voltage from the "servo loop" of the PBX via the resistors R706 and R707 to the diodes D703 and D704. This trimming voltage is about 2.2V. The oscillator output voltage measured at operating resistor R709 is 260-300 mV (the oscillator is loaded with a separating stage). The master oscillator operates in the 50 to 60 MHz band, which is 6 MHz higher than the receiving (broadcasting) channel.

170. The second stage of the main oscillator consists of a tuned amplifier serving simultaneously as a separating step. The signal from the oscillator is fed through the T702 transistor-based coupling capacitor C708. The resistor divider R711 and R712 is provided to stabilize the operating point of the transistor. To set the operating point, the resistor R713 is blocked to prevent negative feedback by capacitor C709. Preamplification of the RF amplifier is done by capacitance diodes D705 and D706 via resistors R715 and D706 through resistor R715 and capacitor C711. Resistance R714 is used to close the DC path of the D705 capacitance diode. The output amplified main oscillator voltage is withdrawn from the encoded circuit 0702.

8. Frequency switchboard and signal circuits

a) General provisions

171. Frequency switchboard with frequency dividers in the "servos" stabilizes the frequencies of the receiver and transmitter of the radio station in the frequency band 44,000 to 53,975 MHz. The frequency exchange allows you to receive or transmit exactly

at the selected frequency and ensure its accuracy and stability even in the event of climatic influences, component aging and source voltage changes.

172. The CA operates on the principle of frequency analysis. That is, the main oscillator frequency in the RF is roughly set near the desired frequency and then compared to the reference frequency. A control DC signal is generated from the frequency deviation, by which the master oscillator is precisely tuned to the desired frequency. The frequency of the KU master oscillator is roughly set electronically. The CA is set at the selected frequency by three switches, which determine the order of the tens of MHz (the so-called "decimal tuning"), the MHz units (so called "unit tuning") and the decimal (MHz) . The tuning members are essentially accurate DC voltage dividers, providing the necessary voltages for electronically tuned RF circuits. Frequency selection is performed by three multipoint rotary switches that form a single mechanical unit with DC voltage dividers.

The RF also allows the selection of 400 different frequencies corresponding to 400 channels of radio stations with a frequency of 25 kHz.

b) Block diagram (Appendix 2)

aa) General provisions

173. The radio station's radio station consists of the following functional units: KU main oscillator, own counters, auxiliary logic circuits and evaluation circuits.
174. The signal for the mixers of the receiving and transmitting portions of the station is generated in the main DC oscillator which is controlled by the DC voltage. This oscillator operates in the frequency range 50 to 60 MHz. The mixers of the receiving and transmitting parts of the station are connected to the oscillator via a separating stage, which is intended to prevent the mixer from penetrating the mixer back to the oscillator.
175. However, the signal from the 50 to 60 MHz oscillator can not be processed by logic integrated circuits (they have guaranteed reliable operation at a repetitive frequency of up to 5 MHz). Therefore, additional auxiliary circuits are coupled between the oscillator and the controlled dividers via a further separating step and an auxiliary mixer which converts the original frequency of the 50 to 60 MHz oscillator to a frequency of 10 to 20 MHz, a broadband frequency amplifier of 10 to 20 MHz, a shaping circuit , Where the impulse is pulled down appropriately, and a 1: 4 divider that converts pulses into the 2.5 to 5 MHz band. This frequency can already be processed by the logic integrated circuits of the frequency exchange. The frequency of 2.5 to 5 MHz (according to the set operating channel) is then fed to a system of controlled frequency dividers, which are automatically reset after the countdown of the pre-selected number of pulses.

bb) Separation stage for the frequency exchange

176. A two-stage separator (Figure 24) is included between the reversible master oscillator and the auxiliary mixer in the frequency converter, the main requirement of which is to prevent the miscible mixer products from penetrating into the oscillator. At the same time, there is a partial amplification of the signal from the oscillator at these stages. A selective filter 0101, tuned by the capacitive

The C101 capacitor is used to adjust the input.



Via the coupling capacitor C102, the oscillator signal is further fed on the transistor base T101 as an amplifier with an earthed collector; From its low output impedance (from the emitter), the signal is fed via the C104 capacitor to the emitter of transistor T102 operating as a ground-based amplifier. From its high output impedance, the signal is fed through the C107 coupling capacitor to another selective filter (described in the auxiliary mixer). T1101 chokes make up the load impedance of transistor T102. Resistors R102, R103 and R104 stabilize the operating point of transistor T101. Resistors R105, R106 and R107 stabilize the operating point of transistor T102. Resistance R108 prevents circuit oscillation.

cc) Auxiliary mixer

177. The auxiliary mixer (Figure 25) converts the original frequency of the main oscillator operating in the 50 to 60 MHz band to the bandwidth 10 to 20 MHz suitable for further processing by the integrated circuits of the KU.

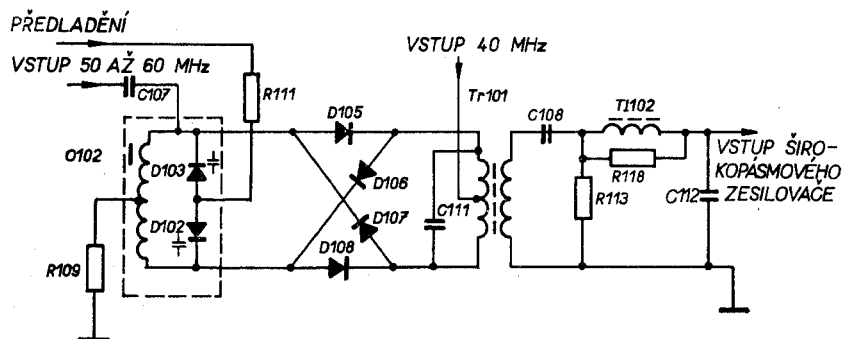


Fig. 25. Connection of the auxiliary mixer in the frequency switch

178. The mixer is connected as a circular modulator and forms a symmetrically connected selective filter O102, modulation transformer Tr101 and four diodes (D105 to D108).
179. The main oscillator frequency is fed via the C107 coupling capacitor to the selective filter O102 which is tuned by the capacitive diodes D103 and D104 and roughly pre-fed via the supply resistor R111. The auxiliary frequency 40 MHz is connected to the centre of the modulation transformer. The resulting voltage is taken from the secondary winding Tr101. The primary winding is tuned by capacitor C111 with respect to higher frequency transmission.
180. The non-linear characteristics of the diodes are used in the actual mixing. At positive half-waves of a 50 to 60 MHz oscillator, this signal passes through the D105 and D108 rectifiers, which release the oscillator voltage while polarizing the D106 and D107 rectifiers negatively and blocking them. The positive half-wave oscillator thus links the bandpass filter O1102 and the modulation transformer Tr101 directly. In the case of negative half-wavelengths, rectifiers D105 and D108 are blocked, and D106 and D107 rectifiers open. The filter and the modulation transformer are cross-linked.
181. Frequency of the frequency of the 50 to 60 MHz oscillator is changed to 40 MHz. (Out of the base frequency, the sum and difference band are generated.) They are filtered out by the basic

frequencies because they are connected in the opposite phase. The sideband is transmitted via the transformer TrIOI to the load resistor R113. The filter circuit of the T1102 choke, capacitor C112 suppresses the sum band and the remaining 10 to 20 MHz band is fed through the C108 coupling capacitor to the input of the broadband amplifier.

dd) Broadband amplifier and keying step

182. For the control of the logic circuits of the RF, a voltage of 0 amplitude of at least 3 V is required. However, from the mixer we get a signal of the voltage of 100 mVŠŠ. Thus, a broadband amplifier and a keying step (Figure 26) have been incorporated between the mixer and the logic circuitry, which works simultaneously as another amplifier.

The stage fitted with transistor T103 operates with negative feedback on emitter resistor R116 and R117. The emitter is partially blocked by a capacitor C113, which is sized to compensate for a decrease of the gain in a certain frequency range.

183. Resistors R112, R113 and R116 are designated for setting and stabilizing the operating point of transistor T103. An amplified signal (about 1 to 2 VS) is taken from the load resistor R114. The chokes T1103 and capacitor C164 are connected as a supply voltage filter for the supply of the logic circuits. Resistance R115 and capacitor C109 are connected as an auxiliary circuit power filter.

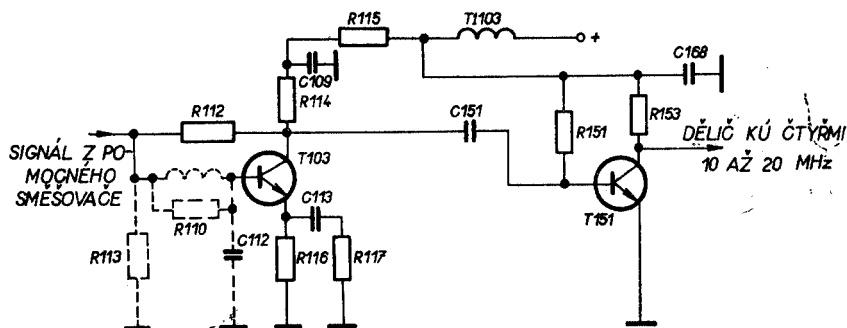


Fig. 26. Connection of broadband amplifier and keying step

184. The keying step is fitted with a T151 non-transistor which works as follows: If the amplified amplifier voltage C151 is not amplified, the transistor T151 is fully open and DC voltage does not appear on the load resistor R153. When the signal (10-20 MHz) is received on the transistor T151, the transistor is blocked and the full voltage of the power supply appears on the load resistor. This voltage is simultaneously shaped and amplified to a value of about 3 to 4 amps, versus the input signal based on this signal. Resistor R151 is used to set the operating point of transistor T151.

c) Logic circuits of the frequency exchange

aa) Description

185. Frequency switch logic circuits are based on synchronous frequency dividers that allow the maximum speed of integrated flip-flops to be used. That is, the time elapsing between the control input impulse and the creation of the desired combination at the outputs of the individual bistable flip-flops is equal to the time required to overturn one flip-flop. The tiller circuits are type D, labeled MIB1, their inputs allow pre-setting of the function.

In addition to these dividers, the gateway is used to evaluate the course. The gates provide either the negated logic product of the individual inputs (gate 01 158) of the feedback gates (in the decimal counters 01159, 01160), or in gate 0151, they only act as an inverter.

186. Besides the logic circuits, the own reference circuit of the CA is also included, the function of which is described separately.

The logic circuits are connected as a variable ratio counter (pre-selection counter).

Circuits consist of two 1: 4 counter counters, two 1: 10 counters, one 1: 2 counter, auxiliary flip-flop, and evaluation gate.

The pre-selection of the required split ratio is made by three pulse selection switches. The counters used are connected to allow pulse selection in the range of 400 to 799 pulses.

The input signal for the logic circuits is taken from the output of the amplifier T103 via the keying step T151, where it is partially shaped and fed to the input of the double bi-stable flip-flop circuit which operates as a first divider in a 1:4 ratio. The pulse frequency at the input of the divider is 10 to 20 MHz according to the selected frequency channel. Individual parts of these circuits are described separately.

bb) Basic functions of the D-type divider

Entrance divider by four

187. The input divider 4 acts as a synchronous forward counter and is connected as a double bi-stable flip-flop D (Figure 27). They are actually two splitters involved in the series.

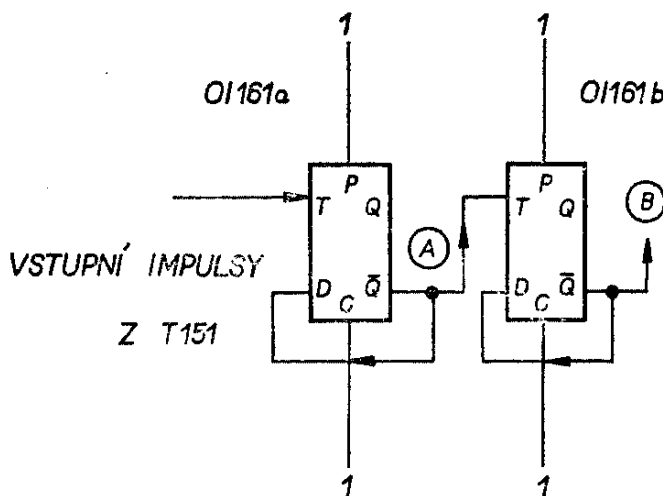


Fig. 27. Connection of the input divider by four

The basic operation of the bi-stable flip-flop is briefly described as follows:

If the input level D is before the clock pulse and during the logic level 1, the output Q of the flip-flop circuit with the leading edge of the clock pulse passes to the logic state 1.

Note. In the diagrams, the term "logical 1" ("logical 0") is abbreviated as "log. 1" ("log 0").

If there is a logic level 0 at the input D before the clock pulse and the logic level 0 during it, the output of the flip-flop circuit with the leading edge of the clock pulse will go to logical state 0. The output value Q is always inverse to the output Q. This function is valid assuming that on asynchronous Zero inputs (P) and setting (C) is logical 1.

188. In this connection, the basic wiring is supplemented by feedback from the output to the Input of each counter. The logic function of the input divider by four shows the pulse waveforms on the individual outputs of two dividers by two connected in series and simultaneously a table of truth (Appendix 3).

For the truth table, the relationships 1, 2:

$N = 2; n; N$: number of states 1

N = number of variables

$Y = N \cdot 2^n + C \cdot 2^1 + A \cdot 2^0$

Where $2^0 = 1$: the weight for variable A;

$2^1 = 2$: the weight for variable B;

$2^2 = 4$: the weight for the variable C;

2^n = weight for variable N;

Y = state;

A, B, C N - coefficients (variables) of the value 0 or 1

Also included in the appendix are the numbered terminals of the respective integrated circuit with its designation. E.g. 2-01161 means terminal No. 2 of Integrated Circuit No. 161.

Since these waveforms can not be drawn on all integrated circuits on a single scale (large partition ratio), the same waveforms are drawn multiple times in different scales: one as a result of the previous division and once as the basis of the next division.

189. The input divider 4 (at position 01161) has auxiliary inputs P and C connected permanently to the logic value 1 so that the divider is not controlled and counts permanently, and on its output (Q 01161b) are repeating (clockwise) pulses in the range of 2.5 MHz to 5 MHz depending on the tuning of its own radio station.

These output pulses are simultaneously pulse pulses for the next already divisor of four (position 01152) this time already controlled and simultaneously pulse pulses for auxiliary evaluation circuit (01157b).

cc) Controlled divisor by four

190. The controlled divider of the four is not different from the previous divider by four in the basic connection (Figure 28). It also works as a synchronous forward counter and is connected as a double bistable flip-flop D. Input (pulse) pulses are output pulses Q

01161b of the previous divider by four. The frequency of these pulses is therefore 2.5 to 5 MHz according to the tuning of the whole radio strand.

If logic 1 is input to the inputs P and C, the counter function will be similar to the previous counter.

However, if the logic level 0 of the P or zero input is set, the Q and Q outputs are set to the appropriate state irrespective of the clock pulse. By pushing the logic 0 to the input setting, output Q is set to logic level 1. This state remains preserved after the next change of the input of the setting to the logic value 1 until the edge of the clock pulse appears when the flip-flop Q and / Tables of truths. Thus, basically, after logic 0 is input to the input or reset input, it will cause the counter to lock (write the preselected frequency).

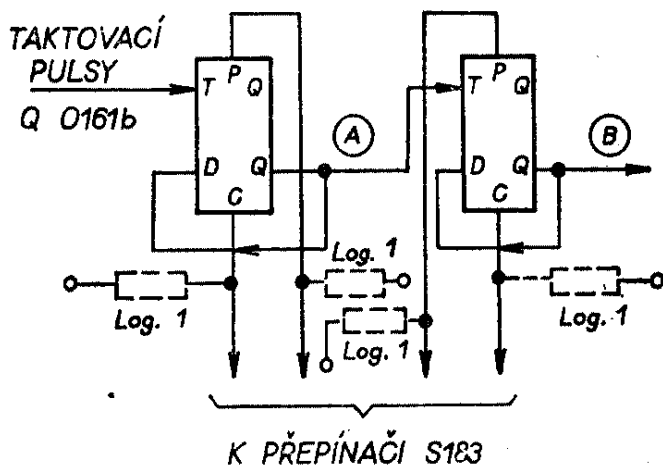


Fig. 28. Connection of controlled divider by four

191. The logic function of the controlled divider (without pre-setting) shows the pulse waveforms on the individual outputs and at the same time the truth table (Appendix 4).

The output pulses (Q 01152h) are fed to the evaluation gate 01158 and simultaneously produce clock pulses for the first controlled divider ten.

The output impulses (Q 01152a) are also fed to the evaluation gate 01158.

The input and reset inputs are output directly to the 8183 switch and are connected to the R155 to R158 power supply via logic 1 (power supply).

When switching via switch S183, logic 1 or logic 0 is connected to the inputs P of the circuit 01152, according to the instantaneous state Q to 01157b. Switch 8183 provides pre-selection at 25 kHz.

dd) Controlled divider ten

192. There are two dividers in the logical circuits of the KÚ. The first consists of circuits 01152 to 01154.

A synchronous forward counter circuit A, B, C, D - 1, 2, 4, 8 is used which changes from binary to decimal. On the flip-flop 01153b the output pulses from the previous divider are fed by four, which generate clock pulses for the proper decimal divider.

The connection of the first decimal divider is shown in Fig. 29.

The connection of auxiliary inputs P and C is only shown for the first divider for clarity.

clock input of the next divider ten.

194. The input and reset inputs, which are similar to those of the four dividers, are output directly to switches 3182b, c, d, e, and are connected via the power resistors R159 to R162 to the logic value 1 (power supply). When switching the switch 8182b, c, d, e, logic 1 or logic 0 is connected to the inputs P or C, according to the instant state Q of the circuit 01157b. (Gate 01151 works only as an inverter) Switch 8182b, c, d, e performs a pre-selection of 0.1MHz. The logic function of divider ten, without presetting, shows pulse patterns on individual outputs, depending on the pulse pulses and at the same time, a table of truth (Appendix 5).

195. The use of divider ten with a pre-selection does not arise, unlike normal dividers from state 0, but from the split ratio supplement to

Full capacity P:

$$P = K - N,$$

Where: P: the full capacity of the n-decade divider

$$K = 10^n - 1$$

N = required split ratio.

The choice of $K = 10^n - 1$ eliminates the complications at the end of the counting period caused by changes in the status at several decades at the same time. Divider 10 works in asynchronous mode. From the individual outputs - A, B, C, D you can derive the decade state information in the classical B, C and D codes - see the truth table (Appendix 5). The decade is set to decimal, ie zero.

196. The second divider of ten is located with the D circuits at 01155, 01156 (Figure 30). Its involvement is similar to the previous divisor of ten. The input pulses are output from the output Q of the circuit 01153a. The output Q is connected to the evaluation table 01158 and simultaneously to the feedback gate 01160c. A Q output 01155b is simultaneously connected to the input of this gate. .

The output Q of the array 01155a is fed to the clock input 01155b.

An output of the product gate 01160c is connected to the clock input of the circuit 01156b. The output Q of the circuit 01156b is connected to the input of the next gate 01159. The output Q of the same circuit is connected to the clock input of the circuit 01156a.

The output Q of the circuit 01156a is connected to the gate input 01159. The gate output 01159 is connected to the input D of the circuit 01155b.

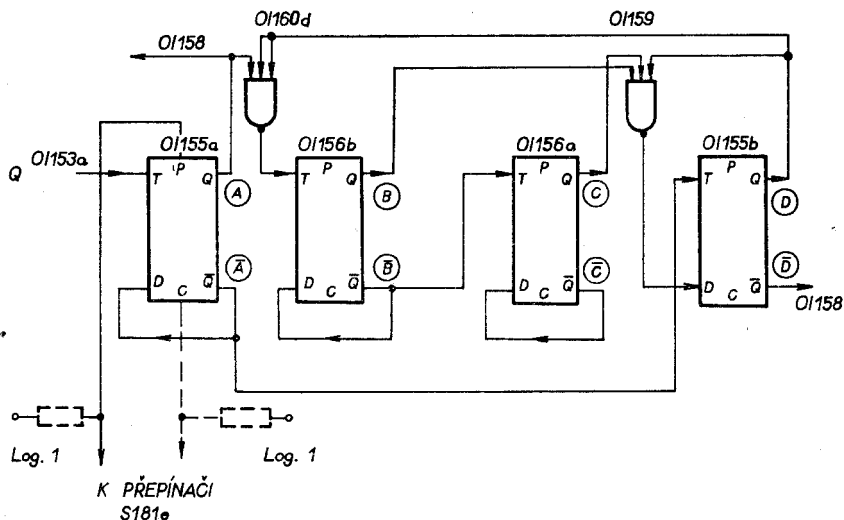


Fig. 30. Joining the second divider ten

The output Q of the circuit 01155b is output to the output product gate 01158. The output Q of the circuit Q1155b is fed to the input gate 01159 and simultaneously to the clock input of the divider by two. The input and reset inputs are output directly to switches 8181b, c, d, e and are simultaneously connected via the supply resistors R167 to R174 to logic value 1 (power supply). The function of the switch is similar to the previous divider of ten. With the 8181 switch, pre-selection is made at 1 MHz. The logic function of this divider (without pre-setting) shows the pulse waveforms at the individual outputs, depending on the KU Input pulse pulses and at the same time the truth table (Appendix 6).

ee) Divide by two

197. The next divider used in the logical circuits of the CU is a two-dimensional divider (01157a) formed by one circuit of the D-MH5474 type. At the clock input of the divider, the output pulses of the divider are ten (Q 01155 b). The output Q of the circuit 01157a is connected to a product evaluation input gate 01158.

The auxiliary input is permanently connected to logic level 1.

Auxiliary input C is permanently connected to inverter 01151,

whose input is connected to the evaluation circuit (01157b, 01158). The impulse runs on the divider are given in Appendix 7.

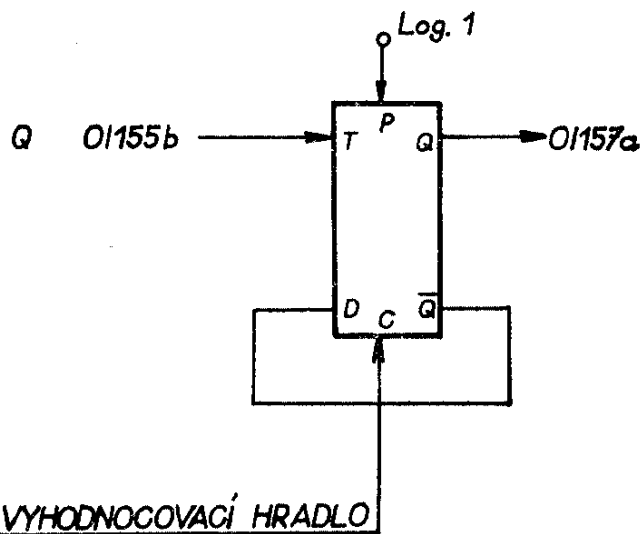


Fig. 31. Connection of divider to two

ff) Pulse selection

198. The auxiliary inputs P and C of the individual controlled dividers are output to the individual switches, where their own impulses are selected for the evaluation gate (01152), the input P and C of the divider by four (01152) are output to switch 8183. Inputs P and C of divider ten The inputs P, C of the second divider ten (01155, 01156) are fed to the switch 8181b, c, d, e. The splitter two (01157a) has the P input permanently connected To logic 1 and input C is connected to evaluation gate 01158 before inverter 01151.

199. The presetting of the function (coarse tuning of the radio station) is ensured by the switch 8181a and 8182a, by switching the appropriately chosen resistors, which form the DC voltage divider. These voltages are fed to the capacitor diodes of the master oscillator and the capacitance diodes of the auxiliary mixer, which, by changing their capacity, pre-tune the main oscillator and the auxiliary filter.

On the radio station's own panel, the 8181 switch has a 1 MHz band between 44 and 53 MHz. Switch 8182 has a scale divided by 0.1 to 0.9 MHz over 0.1 MHz. Switch 8183 has its positions marked on scale 00; 25; 50; 75.

200. The channel switch (8181, 8182 and 8183) also chooses the appropriate dividing ratio of all logic circuits, or a pulse is selected, which at the output of the evaluation gate 01158 will have a logic 0. That is, it clears all the counters and the counter counting begins again at the beginning.

d) Evaluation ICs

201. The basis of the evaluation circuit is a product eight-input gate (01158), whose output is that

$$Y = A.B.C.D.E.F.G.H.$$

This gate implements the operation of the negated logical product. It is a logical operation in which the output value of the function X is logical 1 if at least one function variable has a logical 0 value.

Thus, the output voltage of the gate is at a logic level 1 ie (higher voltage) if at least one gate input is logic 0 (ie, low voltage). If all inputs are logical 1, gate output will be logical 0.

202. The following outputs of the dividers are connected to the inputs of this gate:

- Q 01152a, 01152b, (4th divisor),
- Q 01153b, 01153a, (divider ten),
- Q 01155a, Q 01155b, (divider ten),
- Q 01157a, (divider two).

At the same time, the output Q of the circuit 01157b is also supplied to the input.

203. The output of the product gate is fed to the input D of the auxiliary flip-flop (01157b) acting as an unmanaged divider with two whose clock pulses are in the tuning range of 2.5 to 5 MHz.

The output / Q 01157b is fed to a four-way NAND gate which works essentially as an inverter. The outputs from this gate are fed to individual switches for pre-selection of the frequency. On these outputs, we get a logical 0 that sets the individual counters and the logic 1 which is fed to the comparator population. The circuit connection is shown in Figure 32.

204. The auxiliary evaluation circuit (01157b) operates as an uncontrolled flip-flop, on whose clock input the clock pulses Q 01161b are fed from the first divider with four or pulses of the frequency of 2.5 to 5 MHz. At the D input of the auxiliary flip-flop, the output of the product gate 01158 is fed.

Input Q is fed to individual inverter inputs (01151).

Output Q is fed back to product gate 01158.

For this product gate, it is true that: if logic 1 is at all inputs of this product gate, logic will be 0 at the output of this gate.

Otherwise, if at least one logic input is at 0, the output voltage of the gate will be logic 1.

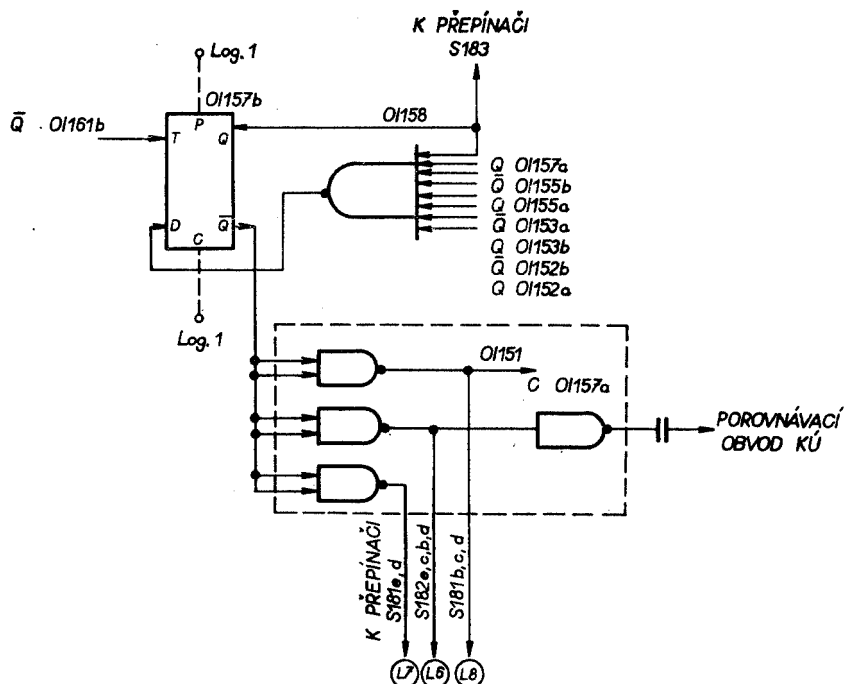


Fig. 32. Wiring of the logic evaluation logic circuit (RF)

205. The operation of the same gate in negative logic can be described as a logical operation as a negated logical sum, also referred to as the NOR abbreviation. This is an operation where the value of the logic function is 1 if each function variable has a logical value of 0.

The impulse runs on the individual outputs of the evaluation circuits are given in Appendix 9.

e) e) Functions of logic circuits

206. A general description of the logic circuit function can be traced from the pulse selection table (Appendix 10) and from the time pulses on the individual outputs of the individual counters (Appendix 8). If the set is tuned to the frequency of 44 MHz, then the pulse frequency that is fed to the input of the logic circuits of the CO (collector T151) is 10 MHz + -400 kHz.

At the output of the first divider by four (01161b) are in this case pulses with a frequency of 2.5 MHz. This alignment corresponds to the basic positions of the switches 8181, 8182 and 8183 as they are drawn in the overall switching scheme of the frequency switch (QN 283 41 sheet 03).

At the input of the product evaluation gate 01158, pulses are output from these outputs: Q01157b, Q01152a, Q01152b, Q01153b, Q01155a, Q01155b, and Q01157a.

207. For this case, the total counter counts to the state 799 (actually 798, from the starting state from the 399th pulse).

At the input of the product gate 01158 a logical 1 appears, at the output of this gate a logical 0 appears. In the next step (pulse pulse), this logic 0 from the output 01158 is overwritten to Q 01157b. With this logic 0, the switch 8183 is set to the default state given by the table (Appendix 10) controlled by the four-digit divider (01152). Simultaneously, at Q 01157b, a logic 1 is fed to the inputs of the gate 01151 at the moment. On the outputs 11, 6 and 8 of the gate 01151 a logic 0 appears in the given case which is set to the starting state given by the table via the switches 8182, 8181 (Appendix 10) two controlled dividers ten (01153, 01154, 01155, 01156). Divider two (01157a) is reset directly from output 11 of circuit 01151.

Simultaneously, in this state, logic 1 is output at the output 3 of gate 01151, which is fed via the coupling capacitor C153 to the comparator circuit KU.

208. In the initial state, the counter is held in the next step by the inputs P and C, since the logic 0 at the output Q 01157b remains about 10 to 30 ns after the leading edge of the next clock pulse. At a later time, the normal counter steps take up to 799 pulses. The number of pulses after which the condition is repeated again is given in the table (Appendix 10).

Similarly, from the pulse selection table and from the time sequence of the pulses, all the frequency channels in the range of

44.000 to 53.975 MHz can be traced.

209. If the switch is tuned to the desired frequency, the reference pulse frequency is 6.25 kHz. However, if the requested frequency is up to + 400 kHz, the frequency of the comparison pulses is different by a maximum of 250 Hz. The comparator circuit generates a differential voltage that tunes the radio station to the desired frequency.

f) Circuit voltage indication

(Figure 33)

aa) Flip-flop

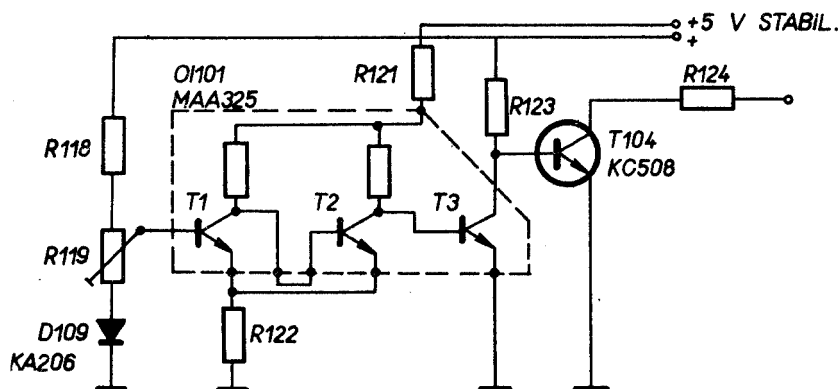


Fig. 33. Connection of the voltage drop indication circuit

210. The hinged circuit consists of the integrated circuit MAA 325.

Resistances in transistor collectors T1, T2 are part of the integrated circuit, the other elements are connected outside the circuit. Transistor collectors T1, T2 are supplied with a stabilized voltage of 5 V and the base T1 is connected via a voltage divider to the battery voltage U_B . Using the divider, the voltage is selected based on the transistor T1 in the conducting state in the idle state (U_B is within the allowed limits), whereby T2 is closed and T3 open.

There is a low positive voltage on the T3 collector, which is not enough to open the transistor T104. If the UB drops, TI-based voltage drops. The transistor T1 closes to turn the circuit to a second state. That is, the transistor T3 is closed and a positive voltage near the battery voltage appears on its collector. The magnitude of the voltage at which the circuit is to be overturned is set by the potentiometer R119. D109 is a temperature compensating element. Resistance R122 helps to accelerate the tilting of the circuit by creating a positive bias on transistors T1 and T2 emitters.

Note. The circuit of the voltage drop indication is placed on the RC only for structural reasons.

bb) Amplifier

211. The transistor T104 has a bulb in its collector circuit. In a quiescent state where T3 is conductive, the base of transistor T104 is at a low positive potential that is not enough to open and the bulb is off.

If the UB drops, and thus the tilting of the circuit according to the previous paragraph, the sufficiently high voltage T 104 opens and the bulb illuminates.

cc) Mechanical design and construction

212. The signaling unit is located together on the circuit board auxiliary board, which is covered by the cover. The connection to the radio station wiring provides soldering tips and teflon-insulated conductors. The components of this unit are soldered to the printed circuit board by their terminals.

The resistors used are with a TR191 type metallic layer with a tolerance of + -10%.

Capacitors are tantalum.

Semiconductors used are silicon.

The overall mechanical arrangement is apparent from Figures 39 and 40.

g) Evaluation ICs

aa) Shape of a reference signal of 6.25 kHz

213. The 6.25 kHz reference signal shaping circuit (Figure 34) consists of two gates (01160a, 01160b), an integrated circuit R178, C162 and C163, an integrated circuit R175, C154 and C155, a discharge circuit (D151 diode) And the internal resistance of the gate 01160b.

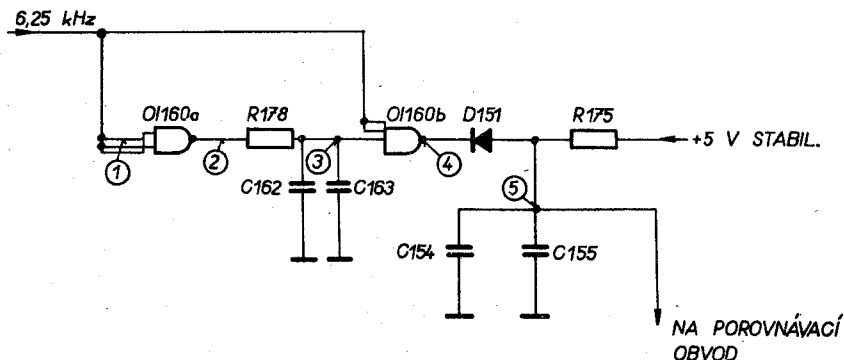


Fig. 34. Connecting circuit for forming a reference signal

214. The wiring and waveforms are shown in Figures 34 and 35. Rectangular pulses with constant frequency of 6.25 kHz (waveform 1) are fed to gate 01160a. At the output of the gate 01160a acting as an inverter is the pulse course 2. On the integrated circuit (R178, C162 and C163) a pulse course 3 is produced. To the input of the product gate 01160b, therefore, impulses with waveform 1 and impulses with course 3 are delivered. By negating their product, 4 at gate exit 01160b. It is true that the logical 1 product will be when the 1 and 3 waveforms will simultaneously have a logical 1.

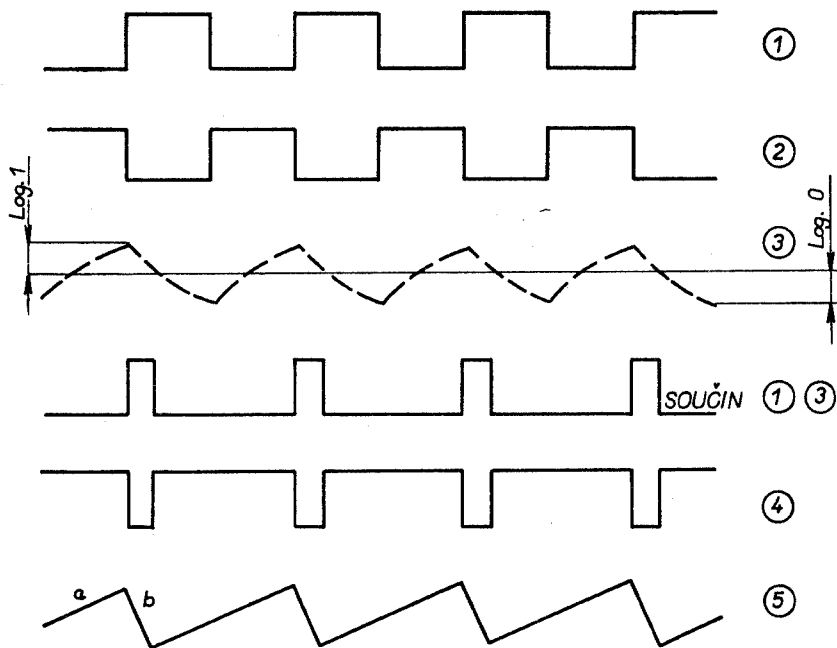


Fig. 35. Shaping the reference signal

If the output of gate 01160 is logic 1, capacitors C155 and C156 are charged via resistor R175 (diode D151 is closed).

Thus, if the logic 0 appears at the output of the gate 01160b, the diode D151 opens and the capacitors C154, C155 discharge through the internal resistance of the gate 01160b. This gives rise to the b-waveform 5. Thus we get the pulsed course of the pulses, suitable for comparison in the comparison circuit of the CO, on capacitors C154 and 0155.

bb) Comparative (evaluation) circuit of the RA

h) Shaping the output impulses of the CO

215. The entire reference circuit (Figure 36) operates as a so-called "sampling" phase detector. From the output of the evaluation gate 01151b, the impulses of the shape 1 (Figure 37) are fed to the capacitor C153 which adjusts them to the course 2.

After amplification of this pulse, the two symmetrical secondary windings produce a voltage of the same magnitude but opposite polarity, so that no other pulses will be supplied to the transformer, there will be no DC voltages on the C160 and C161 capacitors. If we bring the sinewave voltage to the center of the secondary winding of the fixed frequency divider 6.25 kHz, the diodes D152 (D153) on the capacitors C160 and C161 ss will be controlled, whose magnitude will depend on the phase shift between the reference voltage and the Impulses from output gate 01151.

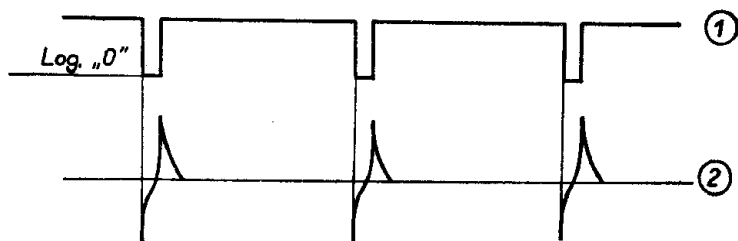


Fig. 37. Output pulse shaping of the frequency exchange (RF)

216. We can also consider the connection as a serial diode switch that processes both positive and negative input signals. The pre-tension produced by the C156, C157, R176 and R177, C158, C159, C159, previous sampling pulses from the gate 01151 is of sufficient magnitude to keep the diodes D152 and D153 closed in the desired reference voltage regions. Therefore, there is no voltage on the C154 capacitor. The sampling pulse supplied by the LS1 transformer gives a positive voltage to the diode anode D153 and the negative voltage to the cathode of the diode D152. The reference voltage is then passed through the scatter inductance of the secondary winding of the transformer and through the diode D153, if positive and on the diode D152, is negative. The capacitors C156 to C159 are recharged to the peak value of the sampling pulse, thereby maintaining diodes D152 and D153 in the absence of the sampling pulse closed. The explanation is illustrative of Fig. 38.

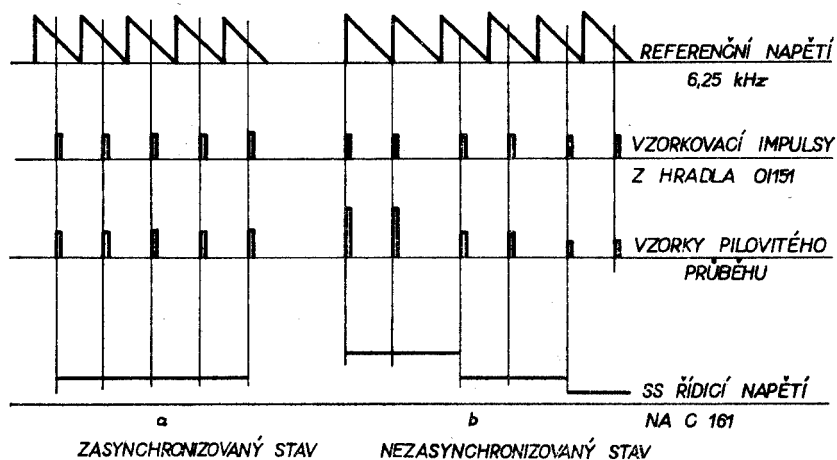


Fig. 38. Pulse paths on the comparison circuit

217. In this figure, pulse patterns in the comparison circuit are plotted in the so-called "synchronized" state, i.e., that the sampling pulse frequency from the output gate is the same as the frequency of the reference sawing voltage. Therefore, if the radio station is tuned properly, the samples still have the same amplitude and the DC voltage on the capacitors C160 and C161 is constant (zero).

218. However, if the oscillator frequency is above the frequency of the ratio of all logic circuits, the sampling pulse frequency deviates from the reference sawing frequency (6.25 kHz) and the amplitude of the saw-tooth sample will have a decreasing level as well as the voltage on the capacitors C160 and C167, which tunes the oscillator over the capacitive diode to the desired frequency. If the oscillator frequency is below the frequency given by the log splitting ratio, the amplitude of the saw-tooth sample will have an increasing level. Similarly, the voltages on the capacitors 0160 and 0161. The impulse flows in the comparison circuit in the so-called "unsynchronized" state are shown in Figure 38.

i) Construction

(Figures 39, 40, 41)

219. Frequency switchboard (CA) is a separate mechanical unit. Its main mechanical parts are: metal chassis, three frequency switches and two circuit boards. The switch axes are grounded through a bronze pen and terminated by a clutch. The circuits of the logic board and the auxiliary circuit board are made on the printed circuit boards and are led through the through-capacitor capacitors. An independent electrical component consists of a radio station power indicator and a battery voltage drop indicator. Two shielding plates equipped with insulating panels are used to close the block of the exchange

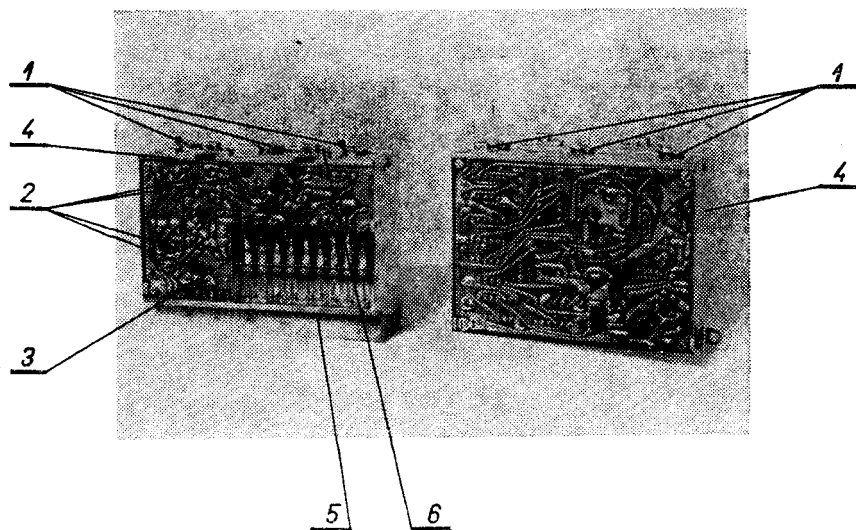


Fig. 39. Frequency switchboard (rearward facing)

- 1 - channel switch gear couplings; 2 - circuit tuning openings; 3 - Potentiometer for setting the status of the source state; 4 - covers; 5 - connection points of the frequency exchange; 6 - Signal glow

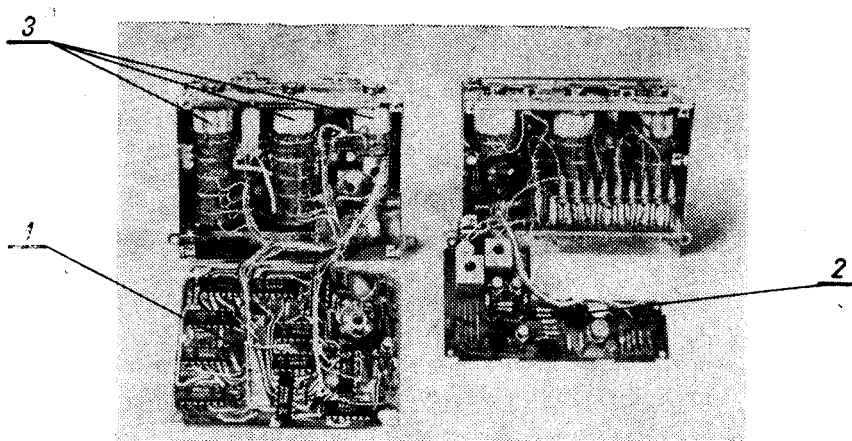


Fig. 40- Frequency-switches

1 - logic circuit board; 2 - auxiliary circuits; 3 - frequency switches

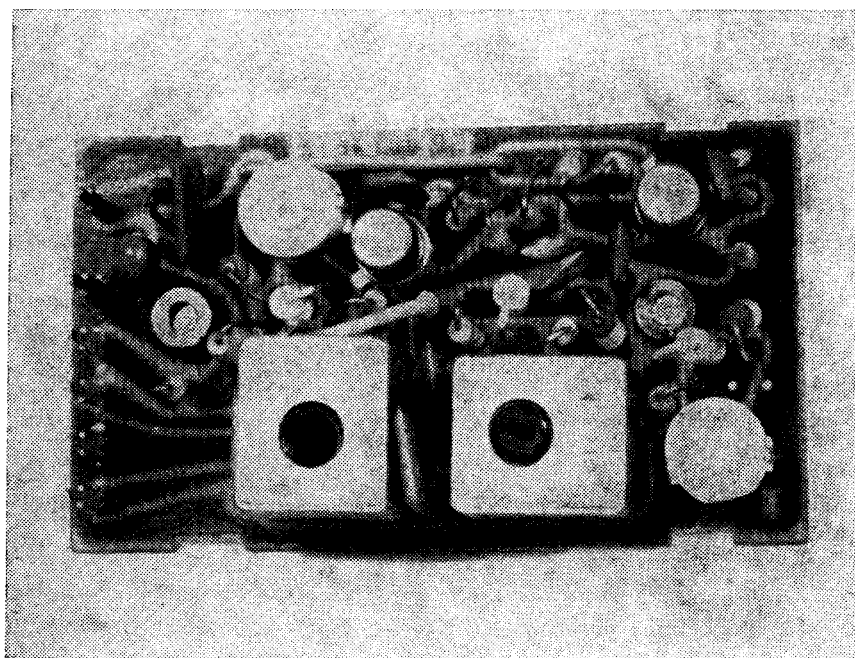


Fig. 41. Main oscillator without cover

The frequency switchboard is secured by two screws to the control panel and the other two screws to the radio station chassis. A light

bulb holder is inserted between the frequency control panel and the control panel to illuminate the frequency switching scales.

220. The main oscillator part forms a separate unit. It consists of a printed circuit board measuring 30 x 60 mm, placed in a shielded metal housing. It is fastened to the support structure by two screws. For connection with other parts of the radio station, the soldering tips are used on the narrow side of the board.

221. The connection to both parts is ensured by conductors with tear insulation. The resistors used are TR191 for a load of 0.25 W.

222. Electrolytic capacitors are tantalum.

The VF circuits in the main oscillator (0701 and 0702) and the amplifier circuit (0101) are tunable to the frame in the shield housing. The comparator transformer coils L151 are wound on the ferrite core.

223. The symmetrical round modulator (mixers), labeled L101 and L102, are wound triangularly on the toroidal core. The L103 Broadband Amplifier is normally wound on the toroidal core. The choke L104 is wound on the ferrite core.

The layout of the components on the individual boards is on the drawings of the relevant assemblies.

9. 9. Part the reference frequencies

a) General provisions

224. The part of the reference frequencies (Figure 47) is a separate block that is created with the frequencies 40 MHz, 400 kHz and 6.25 kHz for further processing in the modulator and the frequency switch. In addition to these frequencies and mounting, this part supplies a 1000 Hz or 2280 Hz (2100 Hz) tone signal. Frequencies 400 kHz & 6.25 kHz are obtained by dividing and frequency 40 MHz by multiplying the base oscillator frequency. The oscillator works as a two-stage amplifier with a positive link, created by the so-called "Wien" member. The frequency of this

oscillator is 1000 kHz. The 2280 Hz (2100 Hz) tone tone oscillator works in connection with a ceramic filter.

225. The whole piece is made by PCB. The electrical wiring uses the most integrated circuits.

b) Block diagram

226. The base of the reference frequency block is a reference oscillator with a frequency of 1.6 MHz. The shape of the output signal is different in the positive half-wave from the sine wave and can be used to multiply the frequency twenty-five times without further shaping. A 40 MHz signal is output at the output of the multiplier. The output voltage of the oscillator is also fed to the input circuit of the frequency divider, which for its function requires the input voltage of the rectangular shape. The frequency of rectangular pulses is still 1.6 MHz.

227. With the modified signal, the first stage of the frequency divider with a split ratio of 1: 4 is set.

A 400 kHz output signal is fed to a divisor of sixty-four, at the output of which we get a frequency of 6.25 kHz.

A separating step is assigned to the divider output. A 6.25 kHz signal is output from the output of the divider stage for further processing.

228. The tone alert generator is a stand alone total consisting of 1000 Hz and 2280 Hz or 2100 Hz oscillators (as required). The part is fed through a filter assembled from the choke L205 and capacitor C220.

c) Functional diagram

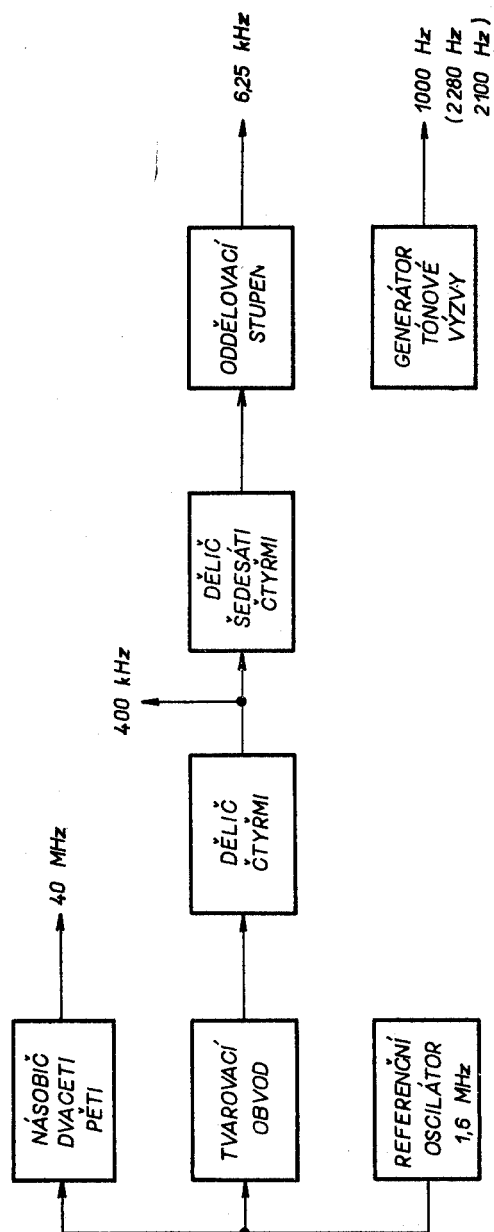


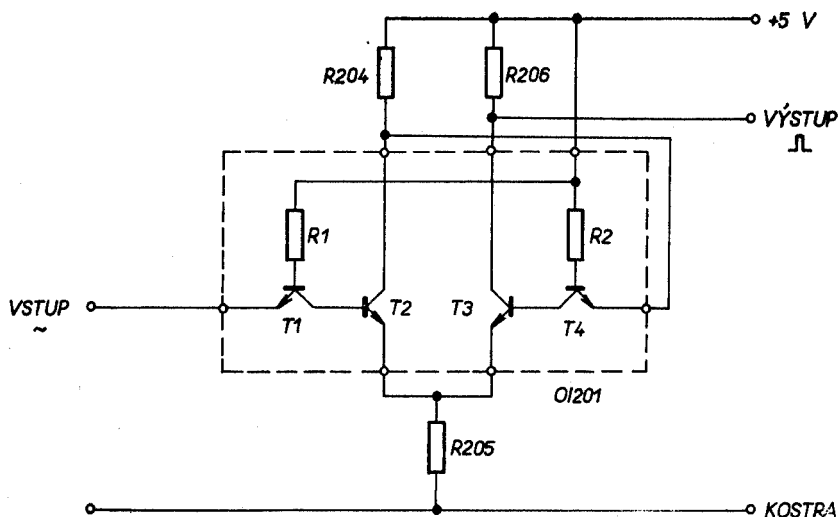
Fig. 42. The block diagram of the reference frequency part

229. The KF524 (T201) transistor is used for the oscillator, which works in a common collector connection. The operating point of the transistor is set using resistors R201, R202 and R203. These resistors are also provided with thermal stabilization and the resistor R203 in the emitter simultaneously serves as a working resistor. A crystalline cutter is connected to the base circuit, the replacement circuit being a high-quality Q-series serial circuit.

Feedback from the emitter to the base is provided by the current capacitive coupling through the C202 and C203 capacitive dividers. Fine tuning of the oscillator is possible by changing the capacity of the C201 capacitor. The VF path of the oscillator is closed by the C204 capacitor. The oscillator frequency variation for the supply voltage in the range 4.5 to 7.8 V is 0.8 Hz. The relative change of the oscillator frequency in the temperature range from -50 C to +80 C with respect to the frequency at + 25 C is max. 2.56×10^{-6} .

d) Frequency divider forming circuit

230. An MH5460 integrated circuit connected as a "Schmitt" flip-flop is used for signal shaping. The connection of the OI201a-b is shown in Fig. 43.



In the quiescent state, the emitter of the transistor T1 through the oscillator output resistor is connected to the ground and thus the current flows through the base-collector transition to the base of the transistor T2. Transistor T2 is closed. The voltage on its collector is fed to the transistor T4 emitter, which becomes conductive in the base-collector direction and thus opens the transistor T3, at the output of the element there is a zero voltage. After the positive voltage is applied to the T1 emitter, its transition of the base-emitter becomes conductive. Transistor T2 opens. The voltage on its collector drops to zero, base transition - collector T4 becomes non-conductive and transistor T3 closes. The output of the element is full voltage. By feeding the sine wave from the oscillator, the element cyclically flips and outputs pulses with a repetition frequency of 1.6 MHz.

e) Frequency divider

231. The frequency divider serves to obtain frequencies of 400 kHz and 6.25 kHz. Frequency divisions are provided by bistable flip-flops (splitter two) fitted with integrated circuits MH5460. The circuit is connected to Fig. 44.

232. Integrated circuit circuits operate as negated logic products (Figure 45) according to $Y = AB$. The logic product's function is governed by the status table (Figure 45a).

Assume that the output of circuit 01 is state "1". Due to the feedback from the output of the circuit 01 to the input of the circuit 02, the state "0" at the output of the circuit 02 is also at the input of the circuit 01. The state "1" is also at the inputs of the two circuits via the resistors R1 and R4. The entire circuit remains in this state until it is changed by the external signal. At the output of the entire circuit, the state is "0" in the given case.

At the input, a periodic rectangular waveform corresponding to the state of the logical state "0" and the state of the logical "1" (the leading edge of the rectangular waveform is assumed to be "1" and descending after the state "0"), "1", the leading edge of the above-mentioned barrel is not changed. "

The circuit responds only to the "0" state (descending edge) as

follows: the inputs of circuits O1 and O2 will be in state 0 (via capacitors C1 and C2). This will change the state only at the output of circuit O2 (where state 1 occurs and this state is at the input of circuit O1). The output of circuit O1 is now in state 0. The whole circuit has changed the output state from state 0 to state 1. The transition of the entire circuit to output state 0 is analogous. The bi-stable circuit uses only downward edges to change the state of output, and thus occurs in a 1: 2 frequency division (see Figure 46).

233. Frequency 400 kHz is obtained by using two dividers, each divided in a ratio of 1:2. The 400 kHz signal is output directly without further adjustment.

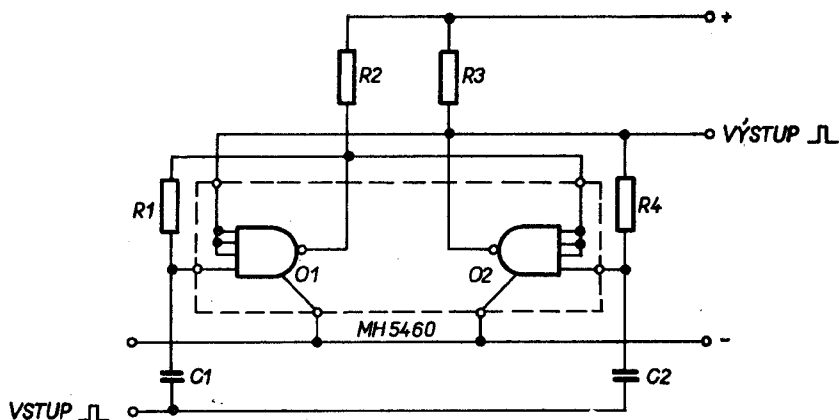


Fig. 44. Bi-stable flip-flop

A	B	Y
0	0	1
0	1	1
1	0	1
1	1	0

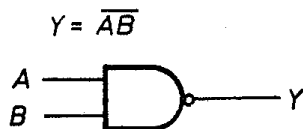


Fig. 45. Logical product

234. For 6.25 kHz frequencies, six additional stages are needed. The 6.25 kHz signal is further fed to the isolation stage, which modulates the signal formally and energetically.

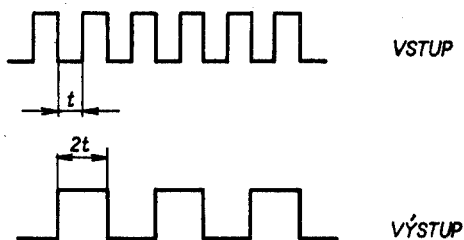


Fig. 46. Frequency divider input and output signal

f) Separation stage

235. The separating stage is fitted with a KC508 transistor. The rectangular waveform signal is fed through transistor-based resistor R220. Base transition - the emitter closes and opens in the rhythm of the rectangular waveform simultaneously controls the collector current. We receive a rectangular waveform on the R216 resistor, which is offset by 180° from the input. The signal from the transistor collector T204 is taken for further processing.

g) Frequency multiplier

236. The frequency multiplier multiplies the frequency of 1.6 MHz to a frequency of 40 MHz with a tuned two-stage low-angle amplifier (about 300). Preferred conditions for the first multiplier generate a non-sinusoidal shape of the input signal. The multiplication is progressively performed at 8 MHz in the first stage and from 8 MHz to 40 MHz in the second multiplier stage.

The multiplier is fitted with KF173 transistors. The reference oscillator signal is fed via capacitor C205 to the input of the first transistor multiplier T202. The degree is temperature stabilized by the resistors in its base and the emitter, (R207, R208 and R209), which simultaneously set the working point.

The T202 transistor collector has a bandpass filter capacitively coupled to 8 MHz. It consists of inductors L201, L202 and capacities C207, C209. The capacitive coupling is carried out by

the capacitor C210. The bandwidth selects from the frequency spectrum the fifth harmonic azimuth of the penetration of unwanted frequencies. The 8 MHz frequency is fed through the capacitor to the next multiplier stage, operating under the same conditions as the previous one.

The T203 transistor collector has an inductive coupling bandwidth tuned to a frequency of 40 MHz, which is composed of inductors L203, L204 and capacitors C212, C221 and C222. The 40 MHz output signal is taken from the C221 and C222 capacitive divider. The R215 and R216 filters are included between the stages in the feed branch, which prevents the formation of a tie between the first and second stages. At the same time, it also contributes to suppressing the penetration of the processed signals into the power supply and thus to other station blocks.

h) 1000 Hz tone generator

237. The generator consists of a two-stage amplifier with a positive feedback using the Wien member.

The transistors T205 and T206 type KC508 are mounted. The Wien member connected between the T206 collector and the T205 base consists of R225, R217, input impedance T205 and capacitors C218, C219. Element values meet the condition for oscillating the reference frequency, ie the phase shift equals zero for resonant frequency and changes for other frequencies.

The oscillator therefore oscillates at the resonant frequency. Another condition for oscillation is the amplifier amplification size, which must be greater than the attenuation of the feedback cells. The resonance frequency is 1: 3 attenuation. This condition is ensured by selecting the values of the working resistances of both transistors. Transistor T206 has bridging stabilization of the operating point using resistors R219, R218, R222. D201 is used to increase temperature stability. The output voltage of the oscillator has a rectangular shape. Frequency change in the temperature range from -50 to + 70 ° C is 20%.

The generator is controlled by connecting the negative pole of the

power supply.

238. Frequency is set by changing the resistance R225 in the range of 180 to 330 k Ω .

i) Tone Call Generator 2280 (2100) Hz

239. The generator is fitted with a KC508 transistor. The ceramic filter FN201 is used as a selective element which determines the frequency of the oscillator.

The ceramic filter forms a selective member with the constant R, L, C, and has parasitic elements R_p, L_p, C_p that can create parasitic resonance. The transmission at this resonance is about 0.1 to 0.2. For this reason, the gain is chosen so that temperatures between -50 and +70 °C can not oscillate the parasitic resonance. For the proper functioning of the oscillator, it is necessary to connect real impedances at the input and output of the peer-ceramic filter much smaller than the capacitance generated by the capacity of the patches. This requirement is fulfilled by introducing a negative feedback via the R226 base voltage resistor, which reduces the input resistance ten times against the input resistance of the transistor with the unblocked emitter resistor R228. The generator is controlled by the connection via the outlet 204 to the frame.

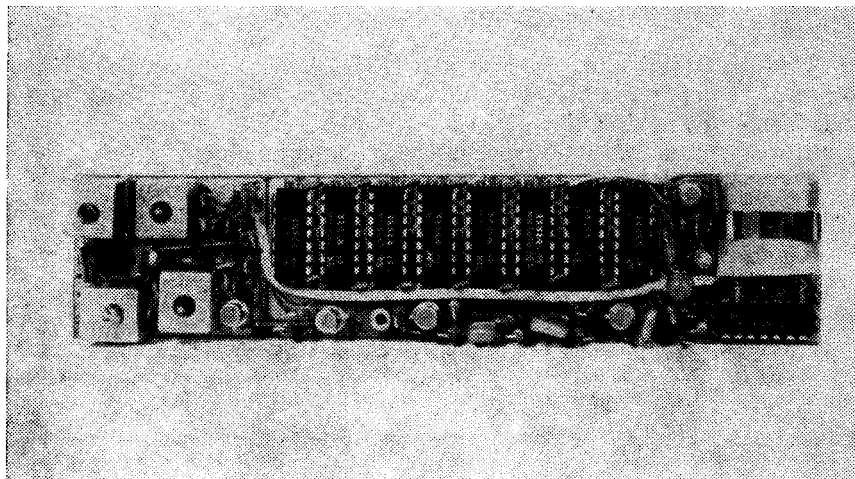


Fig. 47. Part of the reference frequencies

j) Construction

240. The part of the reference frequencies is connected to a separate PCB, which is stored in a separate space of the radio station and is secured by three screws. The board is connected to other circuits of the radio station by means of soldering tips and tecton insulation conductors. The parts are soldered to printed circuit boards.

241. Resistors with TR191 metallic layer with a permitted load of 0.25 W are used in the reference frequencies. Capacitors are ceramic and tantalum. Integrated circuits, transistors, and diodes are silicon. Coils are wound on skeletons by 5 mm and are housed in aluminum housings that are mechanically attached to the skeleton. The 1.6 MHz and 2280 Hz (2100 Hz) crystals are attached to the board by means of brackets. The layout of the components is shown in Figure 47.

10. Voltage converter

242. The voltage converter (Figure 51) is designed to generate DC +12 V, +50 V and - 50 V from the source voltage of 5.0 to 7.8 V. The voltages obtained are fed to the stabilizers and perimeter of the glow tube.

a) Block diagram of the voltage converter

(Figure 48)

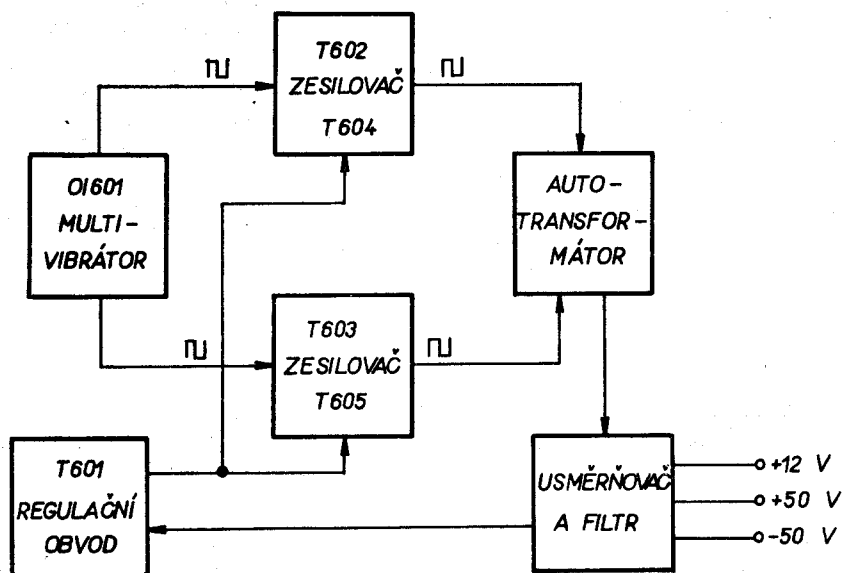


Fig. 48. Block diagram of the voltage converter

243. The astable Multivibrator (O1601) opens a two-stage double-action amplifier that has a 12V and + 50V transformer in the end-circuit transistor collector. The transformer output voltage is adjusted and filtered. The control circuit (T602 and T603) for controlling the amplifier transistor (T602 and T603) serves as a control circuit (T601) which compares the output voltage of the 12 V converter with the supply voltage of the source and controls the excitation of the end transistors so that the drive current is only the same at each inverter load. It is absolutely necessary for the full excitation of the end transistors.
244. This excitation is always such that, even with reduced supply voltage, transistors T1, T2 are open even when the R602 and C603 and R604, and C603 and R604, C603 and R604 and C604 are disconnected.

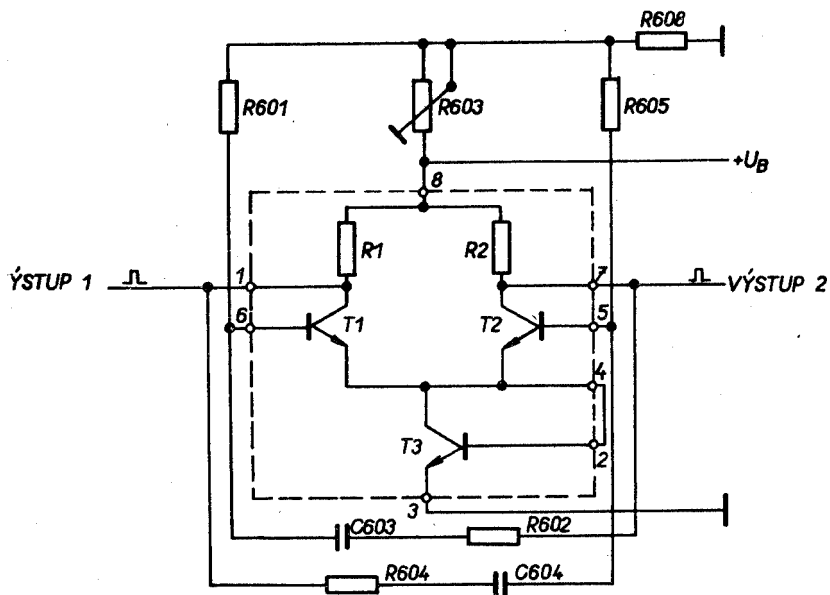


Fig. 49. Schematic diagram of astable multivibrator connection

245. As soon as the supply voltage is switched on, due to the very small unbalance of the wiring, one of the transistors T1 or T2 opens faster. Suppose the transistor T1. The voltage on its collector (outlet I) is very low. The charging current of the C604 capacitor limits the current to the base of the transistor T2 and speeds up its closure. The C603 capacitor is charged over the working resistance of the transistor T2 to the voltage difference at point 7, i.e. the supply voltage, and the voltage at point 6, which is the base of the transistor T1. After charging the C604 capacitor, the transistor T2 opens and the voltage of its collector at point 7 starts to drop rapidly. The capacitor voltage C603 closes the transistor T1 by negative base preload (point 6). The voltage in the transistor collector T1 (point 1) will increase. The C604 capacitor will start charging as a voltage difference in collector T1 (point 1) and base T2 (point 5). The negative voltage at point 6 decreases with the current flowing through the resistor R601. If the voltage at which the transistor T1 opens opens, the voltage in the collector (point 1) drops rapidly and the capacitor voltage C604 closes the transistor T2 by a negative bias in the base (point 5), the voltage in the collector T2 (point 7) rises and the capacitor C602 is charged to

the voltage difference of points 7 and 6. These processes are repeated at a frequency of 12 kHz. The tilting speed and hence the frequency of the multivibrator indicate the C603, R601, C604 and R605 members. The R602 and R604 resistors improve the shape of the output voltage, and the frequency has little effect. The voltage on the multivibrator is affected by the voltages to which the resistors R601 and R605 are connected. These resistors are connected to a voltage divider (R603 and R608).

By varying the R603 resistance value, the multivibrator frequency can be set to 12 kHz even at 20% C603 and C604 tolerance capacities. At the outputs of the multivibrator (points 1 and 7) there are pulses with an amplitude of about 4 V at a rated supply voltage of 6 V with the waveforms shifted by half the period.

bb) Inverter

246. The inverter consists of two two-stage transistor dc amplifiers. In the T604 (KSY34), T605 (KSY34) terminal transistors, an auto-transformer with a symmetrical center point is connected to the positive pole of the battery. The end transistors are energized by a T602 (KC508), T603 (KC508) preamplifier via resistors R614, R615 limiting the base current of the transistor terminals. In the quiescent state, the transistors are almost closed by the preload on base, applied via resistors R612 and R613 from the stabilizers D602 (KY130 / 80), D603 (KY130 / 80). At this time, the battery voltage (UB) is at the output of the inverter (on the C611 capacitor)

247. When the impulse is delivered from a multivibrator based on, for example, the transistor T602 via the C605 capacitor, this transistor opens together with the T604. The battery current now flows through the transformer winding via the T604 transistor. At this time the transistor T605 is closed and the voltage on the diode anode D605 (KY130 / 80) is equal to the sum of the voltage UB and the voltage induced in the respective half of the transformer winding. At a time when the T602 and T604 are closed, the process is described on transistors T603 and T605 and diodes D604 (KY130 / 80), D605 (KY130 / 80). Voltage on the windings between terminals 1, 8 and 2, 7 will cover the losses caused by voltage drops on the end transistors and rectifying diodes. The

voltage + 50V and -50V is obtained by single winding and one-way rectifying diodes D606 (KY130/80), D607 (KY130/80).

cc) Control circuit

248. The inverter works with a variable load (4 to 180 mA) of a 12 V output voltage. With regard to efficiency, it is advantageous to open the T602 and T603 transistors only as much as necessary to achieve the desired voltage. This function fills the control circuit 3 with the transistor T601 (KSY81). This transistor is fully open using a divider between the 12 V DC output voltage and ground. The D602 and D603 diodes are connected via the limiter (resistor R611) to its collector circuit. The loss on these diodes creates pre-load for the pre-amplifier of the inverter and at the same time stabilizes their operating point in dependence on the source temperature and voltage. Similarly, the D601 diode (KY130/80) stabilizes the operating point of the T601 control transistor.

The characteristics of the inverter is that its output voltage is within a wide range of load currents approximately constant in relation to the UB source voltage. If the +12 V voltage is low, this translates slightly, thus closing the transistor T601, the diode voltage D602, D603 decreases, the excitation voltage of the transistors T602 and T603 supplied via capacitors C605 and C606 produces negative diodes on the diodes and thus on the base T602 and T603 A preload of about 0.5 V. This decreases the excitation current of the end transistors T604 and T605. The control circuit improves the efficiency of the inverter with a small load of 25% to about 55%.

b) c) Construction

249. The inverter is connected to a separate plate, which is stored in a separate area of the radio station and is secured by two screws. The inverter is connected to other radio station circuits using soldering tips and Teflon insulated conductors. The parts are soldered to printed circuit boards.
250. Resistors with metallic layer TR191 3 are permitted in the inverter with a permitted load of 0.25 W.

The capacitors are ceramic and tantalum.

The integrated circuit, transistors and diodes are silicon.

The transformer is wound on the ferrite core of the H22 mass.

The arrangement of the components is in Figure 51.

11. Stabilizer

a) General provisions

251. The stabilizer (Figure 52) is designed to stabilize the stabilized voltage of 22.5 V and 5 V. The stabilized voltage of 22.5 V serves to supply the capacitance diodes, a stabilized voltage of 5 V to supply some circuits of the frequency exchange and the main radio station oscillator. In addition, the so-called "reference" voltage is generated in the stabilizer, which is used by the stabilizer, which is part of the amplifier and interrupter part.

b) Block diagram

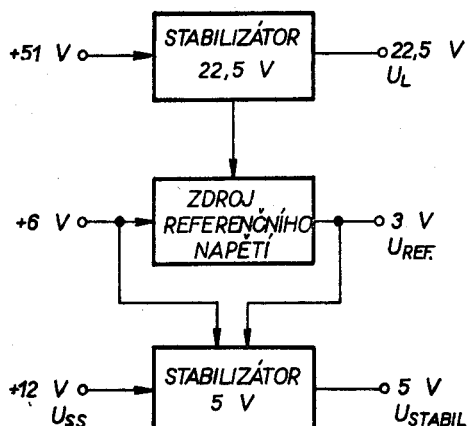


Fig. 50. Block diagram of the stabilizer

252. The stabilizer consists of a 22.5 V stabilizer, a 5 V stabilizer and a 3 V reference voltage source. The 22.5 V stabilizer together

with the reference voltage source is supplied from the +51 V converter. The input voltage of the stabilizer is the +12 V voltage is used in the stabilizer as an auxiliary and allows the output voltage to be 4.7 to 4.8 V. even if the voltage of the source is at least (+5.0 volts). In order for the stabilizer to have an output voltage independent of temperature, The reference voltage is 3 volts as the reference voltage of the stabilizer.

c) c) Circuits

aa) 3 V power supply

253. It consists of zener diode D651 (KZZ33) and stabilizing resistor R651. Rated voltage of zener diodes KZZ33 is 30 V.

bb) 3 V reference voltage source

254. The actual reference voltage of 3 V is obtained from a divider composed of resistors R653 and R654. The D652 (KY130/80) diode is connected to the circuit which has the opposite temperature dependence than the K2233 zener diode. The D652 is powered from UB (+6 V) via R661. The R653 and R654 resistance values are chosen so that the temperature coefficients of the diodes D651 (zener diode) and diodes D652 are compensated at the point between the resistors.

This produces a temperature-independent reference voltage of 3 V. Resistance size R653 & R654 is chosen so that the current passing resistors are about ten times smaller than the two voltage stabilizers from the 3 V reference voltage.

cc) Stabilizer 22.5 v

255. Voltage 22.5 V is stabilized by a series stabilizer with transistor T655 (KC507), whose collector is supplied with voltage from the inverter (51 V) via resistor R652.

This resistance results in a voltage drop due to the flow of the collector current. Transistor T655 (KC507) is protected against excessive voltage increase of the collector at maximum supply voltage. The transistor base T655 pre-load is obtained from the D651 zener diode by a resistor R653 and a parallel combination of

resistors R659 and R662 (the value of this resistance is determined by the setting of the part, ranging from 47 to 120 k Ω). At equilibrium, the voltage on the T655 emitter along with the voltage between the emitter and the base is equal to the base voltage. If the emitter voltage changes for any reason (eg increased power consumption), the voltage difference between the emitter and the base is also changed, and the transistor is clamped or opened until the equilibrium state returns.

dd) 5V Stabiliser

256. It is designed as serial with transistor T654 (KSY21) DC-coupled with transistor T653 (KC508), which works as a current amplifier. The base of this transistor is connected to a differential amplifier consisting of transistors T651 (LC508) and T652 (KC508). This amplifier is thermally compensated. The output voltage of the stabilizer therefore also does not depend on the temperature. The 3 V reference voltage is supplied from the R653 and R654 dividers based on the transistor T651. The collector of this transistor is energized from the 5V stabilizer output. The base of the transistor T652 is supplied from the stabilizer output via a potentiometer R658 which serves to adjust the output stabilized voltage of 5 V at the voltage $U_B = 6 \text{ V}$ and at rated load.

If there is a change in the supply voltage U or a change in the drawn current to increase the output voltage, the voltage of the base T652 will increase and thus the current will flow through this transistor. Increasing the collector current will also increase the voltage drop on resistor R656, to which the base of the transistor T653 is connected, that is, the transistor is welcomed. At the same time, transistor T654 is fastened to it, which reduces the output voltage of the stabilizer. The output voltage decreases until an equilibrium state is reached between the output and base of the T652 transistor. In order to provide sufficient excitation current for the base of the T654 transistor with the difference between the output and input voltage of the stabilizer, the transducer collector T653 is powered by a voltage of 12 V through the resistor R657.

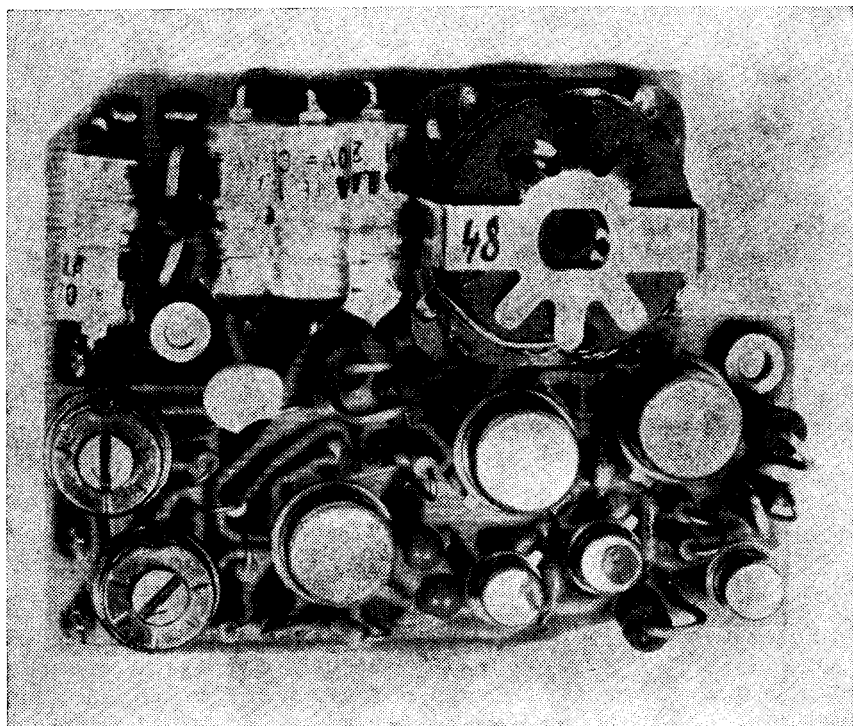


Fig. 51. Voltage converter

257. In order to achieve a small voltage difference between the output and input voltages of the stabilizer for a sufficient excitation current for the T653 transistor base, the transducer collector T651 must also be supplied via a resistor R656 from a voltage of 12 volts.
258. The high cut-off frequency of the transistors used together with other wiring features may in some cases cause the stabilizer to oscillate at frequencies exceeding well frequent frequencies of 100 kHz. Therefore, the C656 capacitor is used, which reduces the voltage gain of the transistor T652 at higher frequencies and thus prevents the conditions for the entire stabilizer to wobble.

ee) Filter members

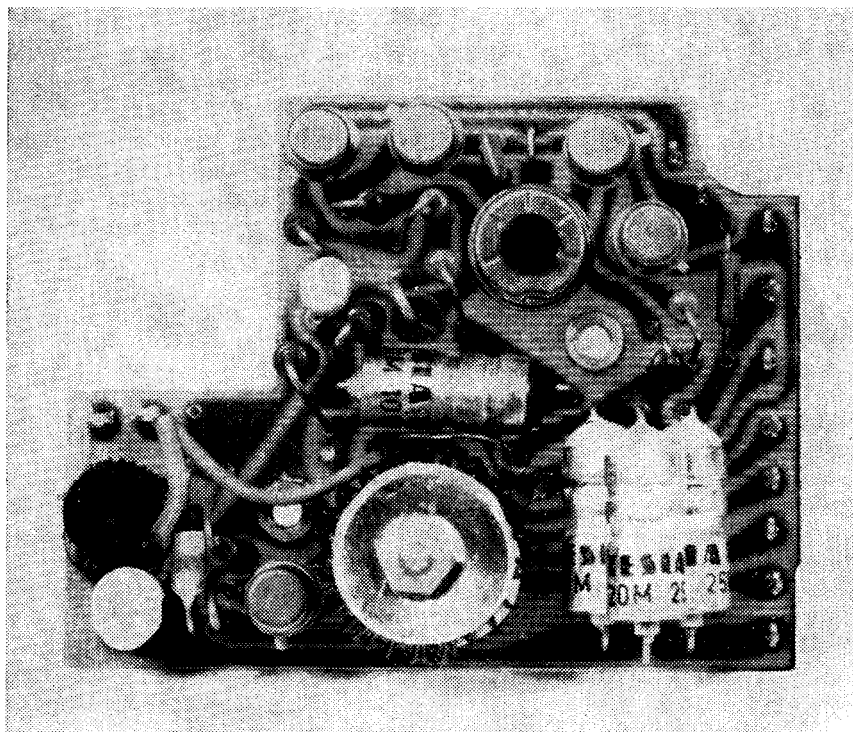


Fig. 52. Stabilizer

259. The stabilizer part contains three filter members. The 12 V voltage is filtered by an LC filter composed of a T1654 choke and capacitors C652 and C656. The filter prevents penetration of the residual AC component from the rectifier rectifier to the end stage of the transmitter, stabilizer and stabilizer in the amplifier and breaker parts.

The 6V supply voltage is filtered by a LC filter consisting of a T1651 choke and a C654 capacitor. The filter limits the penetration of interfering voltages into both stabilizers.

The C655 filters the noise voltage generated by the Zenner D651.

The T-shape filter (T1652 and T1653 chokes and C657 capacitor)

limits the intrusion into the transmitter's drive circuits.

d) Construction

260. The stabilizer is connected to a separate plate, which is stored in a separate area of the radio station and is fastened by screws. The connection of the stabilizer to the other parts of the station is carried out using soldering tips and teflon-insulated conductors. The parts are soldered to the printed circuit board by their terminals.

261. The capacitors used in the stabilizer part are tantalum except the ceramic capacitor C656. The T1652 and T1653 chokes are the same, the winding is wound on ferrite toroidal cores with a diameter of 6 mm. They are attached to the plate by a plastic rivet.

The T1651 and T1654 chokes are identical and are wound on ferrite toroidal cores 12 mm in diameter. Attached with bolts with washers.

Metal-layer TR191 resistors were used; They are for 0.25 W.

Semiconductor components are silicon.

The arrangement of the components is shown in Figure 52.

12. Switching "Rx" – "Tx"

a) General provisions

262. Switching the radio station from reception to transmission and vice-versa, performs a pulse relay. The relay switches the antenna to the output of the forward transmitter and the receiver input when received. At the same time it connects the supply voltage + 6V for the parts of the transmitter and the interrupter during transmission, for the parts of the frequency and low frequency amplifiers on reception. The relay is controlled by the "RECEIVER," "TRANSMITTING" button on the handset or acoustic

switch box.

The Re851 relay is connected and its function is shown in the schematic diagram of the input (Appendix 12).

b) Relay connection and its function

263. The relay on the diagram is in the position corresponding to "TRANSMITTING". The output of the transmitter is connected to the 4R relay terminal Re851, which is connected to the antenna connector via the switching contact. The 6V supply is connected to the relay terminal 6R Re851, hence the prep on the contact 8R. From this terminal, the transmitter (point 551) and the input (point 754) of the low-frequency amplifier and breaker part are energized.

The 7MR relay line Re851 is connected via the 19N I9N connector 19N on the radio station panel to the "RECEIVER" - "TRANSMIT" control button. The current does not flow through the relay. The button is pressed and the 3N relay connector Re851 is grounded via the 14N 19-pin connector on the set panel. set is switched to broadcast.

264. Release the control button via the 19N 19-pole connector to ground the relay terminal 7R Re851. The appropriate current protector protects the current and the switching contact connects the 2R and SR relays. 2R and 4R are being spun.

This translates the antenna connectors 2 of the transmitter output to the receiver input. At the same time, the terminals 6R and 8R are disconnected via the relay switching contact, the connection 6R with the IR relay connection is connected. This causes the current to be interrupted by the relay, the relay stops taking the current. Voltage 6 V is disconnected from the transmitter (point 551) and the amplifier and breaker part nf (point 754). Voltage 6V is fed through the IR relay inter-frequency (point 354), low frequency (point 403) amplifier and second relay winding (between terminals IR and 3R) via 6V supply. The radio station is switched to receive.

Pressing the "FRONT" - "TRANSMITTING" button sends the

current through the 19 N 19-pole connector to the Terminal 3R and the second to the Relay. The relay switches to the state shown in Appendix 12. This is a description of the relay function.

265. Since some transmitter circuitry (modulation amplifier, modulator) and some receiving circuitry (VF and MF amplifier) are powered from a stabilized 5V voltage, this voltage has to be switched. A part of the low-frequency amplifier and interrupter is a + 5V switch circuit, with a 6V supply voltage for transmitting to the low-frequency amplifier terminal 754 and a breaker from the SR relay outlet. The function of the switch circuit is explained in the description of the low-frequency amplifier and the breaker part (see Chapter 4, State 3).

13. Function of the mode switch

266. The mode switch is used to turn the radio station on and off, and select the mode of operation. In five positions where the radio station is switched on, different receiver and transmitter modes can be selected. The positions of the switch are marked on the panel by the marks chosen with respect to the symbolic expression of the respective mode of operation (Article 14).

The circuit diagram of the switch with marked marks is given in Appendix 12.

a) Position "O"

267. The radio station is switched off, the source is disconnected from all the stations of the radio station. The positive pole of the power supply is disconnected, the negative pole remains connected to the radio station's frame.

b) Position "A"

268. The radio station is switched on, working in so-called "power-saving" mode. The receiver set operates intermittently, alternating periodically: 50 ms reception, 500 ms the receiver (except for some circuits) and the frequency switch is switched off. When receiving a signal from the receiver, the receiver and the frequency exchange will automatically go on for continuous

operation. The listening volume in the handset is low, the output power of the low-frequency amplifier is 0.05 to 0.1 mW. A modulation amplifier with a dynamic stroke limiter (compressor) operates during transmission. Frequency modulation stroke is best suited for large differences in modulating voltage at the input of the modulation amplifier, that is, the difference in the volume of the call to the handset.

This mode of operation is suitable for front line and intelligence.

269. The operating mode switch connects contact 2 and 8 of the contact fields a1, and "b1, b" c1, c. The source plug of the contact 2b is connected through the switch IF terminal, the contact array b & "quot; contacts 8, 9, 10, 11, 12 via the switch contact of the switch on the contact 8, the field b1 over 2F to the point 118 of the frequency exchange which is the nodal point of the power station of the radio station.

270. At the same time, the contact of the source connector 2B to the IOF contact terminal of the contact field switch cz, the contacts 8, 9, 10, 11 and 12 is connected, the switching contact on the contact pole 8 across the switches of the switch 3F to the drive part 603, Of the radio station's power circuit.

The division of the supply circuits into two parts is made with respect to the interference caused by the transient resistor of the switch when the impulse voltage converter is withdrawn significantly.

271. The output of the 402 part of the low frequency amplifier and the interrupter is connected to the contact 8 of the field c1 of the switch and then to the resistor R801 (680R) via the field switch terminal 7F and the contact 8 (9). The amount of this resistance determines the volume in the handset.

272. The output of the 456 part of the modulation amplifier is connected via the 6F to the contact array c contacts 5, 4, 3, this path is not interconnected, the dynamic stroke limiter (modulation amplifier) works. The 752 breaker outlet on the low-frequency amplifier and interrupter part is connected to the contact field via

the switch terminal 4 F and the contacts 5, 6, this path is not further interconnected, the radio station operates in so-called "economy" mode when received. (Detailed explanation is given in Chapter 4, Section 3).

273. The output of the 405 part of the amplifier and interrupter is connected via the 5 F switch to the contact array via contacts 5, 6 which are not connected in this position. The noise limiter is in operation.

c) Position "D"

274. The radio station is turned on, working in the so-called "economy" mode. The listening volume is higher by more than 16dB. The output power of the low frequency amplifier is greater than 2 mW. The modulation amplifier works without a dynamic stroke limiter when broadcasting. Frequency modulation stroke is directly proportional to the input signal of the modulation call volume amplifier in the microphone up to the maximum frequency modulation length of the radio station.

This switch position can be used under normal connection conditions.

In this position of the switch, the contacts 3 and 9 of the respective contact fields are connected.

275. To the low-frequency amplifier terminal 402 over the 7 F switch, the contacts 9 and 10 are connected, and the resistor R802 (5.6 k Ω) is connected. This value determines the voice frequency (low power) in the handset.

276. The modulation amplifier terminal 456 is connected to the contact field c2 via the 6 F switch, the contacts 3, 4, 5 and the terminal 3 are connected in this position to the contact 3 of the field c "from there through the contacts 5, 6 of the b & . This eliminates the dynamic limiter (detailed explanation is given in Chapter 4, Section 4). Source connection, intermittent receiver operation (socket 752 nf amplifier and interrupter) The limiter control (terminal 405 of the same part) is the same as in "A" but the 3 or 9 switch contacts are connected.

d) Position "eD"

277. The radio station is switched on, it works in so-called "economy" mode as well as in "A" position. The listening volume in the handset is maximum, the output power of the amplifier is more than 30 mW. When transmitting, the modulator is working without a dynamic limiter as well as in the "cl?" position.

This mode of operation is suitable for noisy environments (combat vehicles, etc.)

In this position of the switches, contact contacts 4 and 10 are connected.

278. The output 402 of the amplifier is via the terminals 7F of the switch contacts 10 poll a1, a2 not connected to the earth loop. The volume is full by setting the maximum output power of the Low Frequency Amplifier. Connecting the other inputs ZB (source connector) 405 (low frequency amplifier and transmitter), 456 (modulation amplifier) 7 52 (low frequency amplifier) is the same as in "cl?". However, the 4 and 10-pole switches are connected.

e) Position "Q"

279. The radio station is turned on, it is operating in "Noise" mode. The noise limiter is off if there is no signal at the input of the receiver and strong noise is heard in the handset. Intermittent receiver operation is disabled. The radio station does not work in a so-called "economical" mode. The listening volume is lighter than the "a" position, the output power of the low frequency amplifier is greater than 5 mW. The modulation amplifier works without a dynamic stroke limiter when transmitting.
280. A capacitor C801 (100k) is connected to the amplifier outlet 402 via the switch terminal 7F, the field contacts 31 and 1 and a2, which reduces the overall volume, especially at higher frequencies. It adjusts to an acceptable level of listening noise from the receiver.
281. The circuit breaker 752 (part of the low frequency amplifier and interrupter) is connected to the contacts 5 and 6 of the field a2 via the contact 5 of the field a1 to the frame of the radio station via switch 4F. This causes the breaker to be decommissioned.
282. The low frequency amplifier terminal 405 (part of the low-frequency amplifier and the interrupter) is connected via the switch SF to the contacts 5, 6 of the field b, with the contact 5 of the field b1 through the field contacts 5,6 and the radio station frame. The limiter is disabled. (Detailed explanation is given in Chapter 4,

Section 3).

283. The connection of the other terminals 2B (source connector) 456 (modulation amplifier) is identical with the "co" and "417" positions but the contacts 5 and 11 of the respective switch fields are connected.

f) Position "©"

284. The radio station is turned on and operates in "Noise" mode as well as in the "-" position. The listening volume is maximum, the power of the amplifier is more than 30 mW. The dynamic stroke limiter is on. This operating mode switch position is the position of the control, the frequency switching scales on the radio station panel are illuminated. In this position, the power of the transmitter can also be checked.

This location can not be used for the connection.

In this position of the switches, contact contacts 6 and 12 are connected.

285. The connection of the power outlets 2B of the outlet 402, 752 (the part of the low-frequency amplifier and the interrupter) is the same as in position "o". The connection of the 405 (Low Frequency Amplifier and Interrupter) terminal is the same as in "D". The connection of the 456 (modulation amplifier) is the same as in "A". However, the contacts 6 or 12 of the relevant operating switch contact fields are connected.

286. The output of the transmitter 553 at the radio station switched to "TRANSMITTING" is through the 4R and 2R relay outputs the point L1 of the cabling, the resistor R86I (390 Q); The switch outlet 9F is connected to the contact 12 of the field a. This is coupled to the 12-pole contact a2 through the switch 8F to the light bulb 2802 connected to the ground of the radio station. The bulb is located on the radio station panel. It is green in color and signals the output power of the transmitter.

287. The LEDs 8080, 804, and 2805 which illuminate the frequency switching scales are connected via the resistors R803,

R804 and R805 by the values 150R via the contacts 6 of the field c1c2 and the output switch 10F to the source connector contact 2B.

288. The modulating amplifier 456 is connected via the terminal 6F of the field c to the switches 3, 4 and 5, and is not connected. Dynamic stroke limiter works.

The radio station is switched on via the same group of switches and switch contacts as in the previous positions.

14. Handset

The handset (Figure 81) is one of the presumed electro-acoustic transducers of the RF-10 radio set.

289. The handset incorporates a DEMS microphone, the TEMIR handset, the "BROADCAST" key - "BROADCASTING" and two buttons for the signal. With a seven-way shielded cable, the handset is connected to a 19-pin connector that connects to the corresponding connector on the radio station's panel. One of the cable leads to the radio station is the signal from the microphone is shielded. The connectors are provided with a so-called "key" for proper insertion and are secured with a pull-on pull nut.

290. The handset body consists of a plastic molding with very good mechanical properties so that the handset meets the demanding operating conditions.

291. The handset connection is listed in Appendix 12.

The 19-pin connector socket 19 is connected to the frame of the radio station via a pin 15N of the panel connector. In the handset connector, the socket 15 is connected to the shield of the microphone coil, furthermore it is connected to the movable contact 1 of the S3 microswitch, the S1 keys and 82, the TL1 headphones. The microswitch 83 is operated by a key.

The microphone is connected by the vein to the socket 18 and its shield. Via a 18N panel connector, a signal is input to the

modulation amplifier input (pin 455).

292. The contact 3 of the microswitches 83 is connected via a plug 14 to the relay contact 3R. By pressing the key, the contact 3 of the microswitch S3 is connected via the contact 1 to the socket 15 connected via the pin 15N to the frame of the radio station. The radio station switches to broadcast. (Detailed explanation is given in Chapter 4, Section 13).

293. By pushing one of the two signal keys S1, S2, the pin 17N (13N) 19pole connectors OUTPUT 453 of the modulation amplifier and the reference frequency terminal 204 are connected to the frame of the radio station with the frame 17 of the radio station. The radio station sends a beep tone if it is switched to broadcast.

294. The handset is connected to the output of the low frequency amplifier (terminal 401 of the amplifier and interrupter part 40) via the vein via the cavity 16 and the 16M 19-pole connectors.

The 3-pin 3 over the 3N pin connects the handset's shield to the body of the radio station.

15. Low Frequency Connector

295. The 19-pin connector on the radio station panel (Figure 80) is used to connect acoustic transducers, measuring devices for technical treatment No. 1 and No. 2, or so-called "extended" radio station accessories.

Therefore, not only the inputs, outputs and control voltages, but also the electrical quantities relevant to the assessment of the technical status of the radio station, are brought to the radio station connector pins.

296. At 1N pin, the main oscillator voltage is output from 50.00 to 59.975 MHz according to the radio station's set frequency, i.e., each 6,000 MHz more than is set on the radio frequency switch on the radio station panel.

Pin 2N is not connected.

Pin 3N is connected to the body of the radio station.

Pin 4N is connected via cabling point 856, resistor R857 to the output of 203 reference frequencies, and a matching frequency of 6.25 kHz can be measured on pin 4N.

At the 5N pin, a stabilized voltage of 5V is output through a 857 cabling point, resistor R851, point 209 of the reference frequencies from the 757 part of the low frequency amplifier and the interrupter.

A voltage of + 6V is connected to the 6N pin through the 3B point and the P2 connector of the power supply connector. This voltage is not switched off by the operation switch.

A 7N pin is output from the amplifier and breaker part 751 (noise limiter output).

Via the 8N pin, via the cable outlet 864 and the resistor R680 is fed to the data input 509.

Pin 9N is not connected.

A pin 10N is connected to an output of the intermediate frequency amplifier pin 352 (input nf of the amplifier and interrupter 457). This output is used when receiving "data".

On the pin 11N, the tuning voltage from point 115 of the PBX through cable point 863, resistor R859, cabling point 862, resistor R854, and 861 cabling point is output. This voltage gains 3.6 to 22 volts according to the set frequency of the radio station.

The power supply voltage of the 12 V transmitter is over the wiring point 851 and the R852 2 point 852 of the wiring is applied to a 12N 19-pin connector.

Pin 13N with 17N pin serves to control the signal circuit (see Chapter 4, State 15).

By connecting the 14N pin to the ground, the 3R relay output connects to the ground, the radio station switches to transmit.

Pin 15N is connected to the body of a radio station, is used to switch the set to receive or broadcast.

The pin 16N outputs the low-frequency amplifier output 401 of the amplifier and interrupter part. A headset is attached to this pin.

Pin 18N is connected to the modulation amplifier input (pin 455). By connecting the pin, a signal is fed to the signal.

By connecting the pin 19 to the frame of the radio station, the relay outlet 7R is connected to the ground. The radio station switches to receive.

297. The connector is in a miniature, waterproof design, designed for high reliability requirements. The connector on the panel is provided with a key that prevents the wrong 19-pin acoustic transducer connectors, measuring devices and extended accessories.

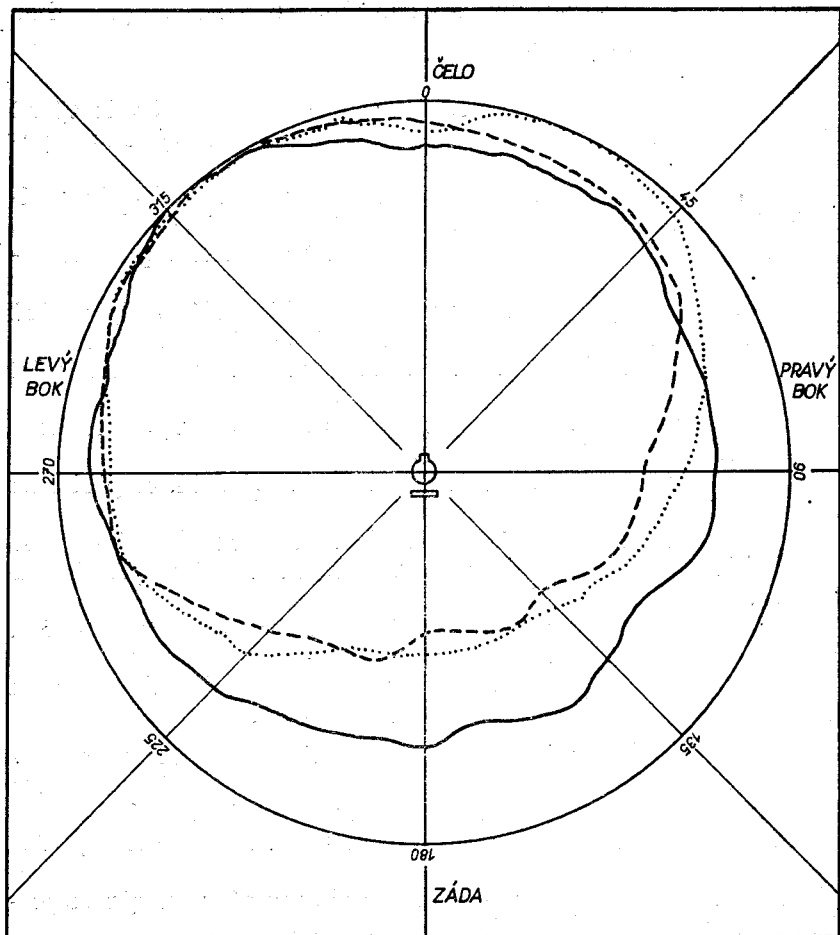
The connector at the set panel has a thread on the outer circumference to secure the coupling with the nut nuts of the cable connectors.

16. Antennas

a) Rod antennas

The kit uses:

- rod antenna 1.5 m long;
- rod antenna (shortened) 0.5 m long.



Polarization: Vertical

Plane: Horizontal

the inclination of the antenna from the vertical axis 0°

----- antenna slope from vertical axis 15°

..... slope of the antenna from the vertical axis 30°

298. These 2 types of rod antennas are used for connection of RF-10 radio stations, the basic type is 1.5 m long and it is formed from a number of black steel wires. The entire bundle is wrapped with a thin steel wire and at the lower end it is slightly bent out of

the vertical axis of 15° . There is a locking latch in the antenna connector.

This antenna is used to connect within 5 km.

The second type is a truncated 50 cm long rod antenna consisting of a pin with a housing in which the ferrite coil is a coil and a bundle of black wires. This antenna is not bent and has no locking latches. It is used to connect to a shorter distance (about 1 km) where a 1.5 m long antenna would interfere with radio control or when calling for a short distance connection.

299. The basic working positions of the radio station with rod antennas are positions "on the chest" and "on the back" (Figures 71 and 75). The radiation pattern at these positions is slightly directional. The ratio of the front and rear of the radiating characteristic is 3 to 6 dB, so that a larger gain is always on the opposite side of the radio station.

300. Both rod antennas are so-called "unipoles" and the counterweight forms their own radio station and operator's body. An antenna of 0.5 m long is an unipole much shorter than the length of $\lambda/4$. The 1.5 m long antenna is an unipolar which is also shorter than $\lambda/4$ with resonance on the frequency $f = 52$ MHz on the larger part of the frequency band.

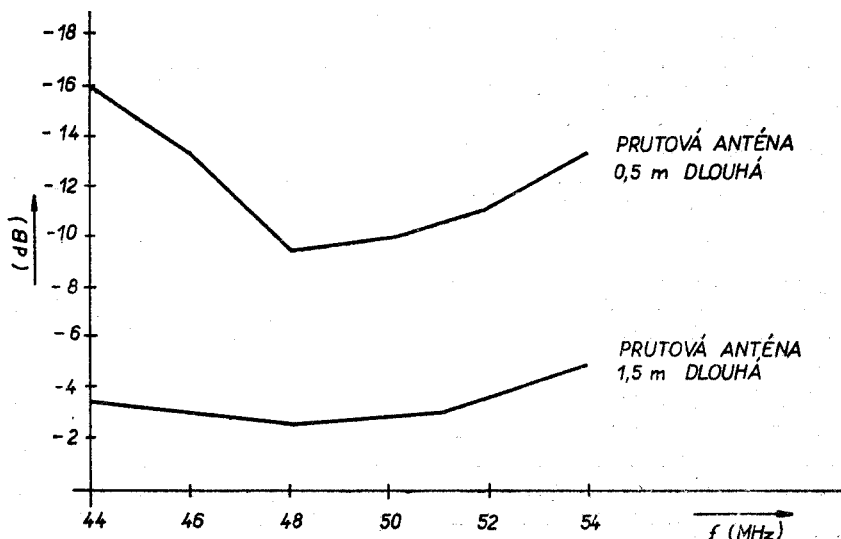


Fig. 54. The gain of rod antennas versus frequency. The radio station is "on the back"

301. The high impedances of the two rod antennas are adapted to the 50Ω impedance, which is located inside the radio station directly under the antenna connector. The inductance of this coil is $0.31 \mu\text{H} \pm 5\%$. In series with this coil, a 680 pF safety capacitor is included in the antenna feed to protect against contact with overhead power lines or other antennas.

Since the inductance of $0.31 \mu\text{H}$ is low for matching to the 0.5 m antenna, this has a built-in inductance of $1.9 \mu\text{H}$ of $\pm 20\%$. The tuning of both antennas is set for the position of the radio station "on the back" and "on the chest".

302. The beam pattern of a beam antenna is slightly directional. It is a consequence of the presence of the human body and the divergence of the antenna from the vertical position. Typical radiation characteristics are shown in Figure 53.

If the radio station is located on the back, then the maximum radiation is in the direction of the front of the operator and vice versa. For the radio station located on the operator's front, there is

a maximum radiation in the rear direction.

303. The gain of the beam antenna relative to the quarter-wave dipole in relation to the frequency is shown in Figure 54.

Note. For the radio station in the "on chest" position, the characteristic is similar.

b) Suspension antenna

304. The suspension antenna is designed to operate under harsh conditions and to extend the reach of the RF-10 radio station.

The antenna is suitable to operate on site (in the woods, gorges, uneven and rugged terrain, between buildings, trenches and bunkers). The preferred use is when operating from bunkers where some antennas (beam) can not be used with respect to radiators, others can not be used due to mechanical (long-range half-polar directional antenna). An extension coaxial cable can be used for the suspension antenna, which can increase the distance from the antenna (when operating from a bunker or trench) or use natural obstacles as a shelter for the radio operator.

305. Setting up the antenna is very simple and fast, so it does not significantly increase the time of preparation for operation.

The hanging antenna is wound on a spool and packaged in a polyethylene bag.] Is stored in the kit trunk. The exact storage location in the trunk is indicated on the drawing that comes with the kit.

306. The antenna hangs upright on various (non-metallic) objects in the field on tree branches, etc. (Figure 84). At the end of the antenna, there is a loop in which a 7 m long snake is attached, which is loaded with a heavier object (eg a knife, etc.) at the other end, and is pulled over the tree branch and the antenna pulled out as needed. The most advantageous working position of the suspension antenna is where the antenna hangs its entire length in the air. Hang up the antenna to the radio station.

307. Care must be taken to disengage the antenna to intercept or disengage the cable. Before we start downloading, we release the load from the cord. When we download the antenna, we do not use violence to damage it.

After the antenna is withdrawn, we will wind up the coil and place it in a socket made of polyethylene. We will start the antenna on the coil by one end of the antenna. Put the antenna in the holes in the coil and gradually wind the coaxial cable and then the cord emitter. The antenna is secured against unwinding from the spool by a cord (Figure 83). The coaxial cable does not bend tight bends and protect it from dirt.

308. The suspension antenna is a half-wavelength unipol whose impedance is adjusted to the LC circuit to the required impedance (in our case, 50Ω at the input of this antenna). The length of the $\lambda/2$ radiator has been chosen because the radiator is not as sensitive to the counter as the $\lambda/4$ radiator. The antenna is fed by a coaxial cable, which also acts as an impedance transformer.

The wiring diagram is shown in Fig. 55.

The coils L1 and L2 are wound on a common frame, which is made of hardened paper and has a diameter of 6.4 mm. Coil L1 is made up of 15 wire turns of 0.4 Cu U. Coil L2 has 11 turns of the same wire. The values of capacitors C1 and C2 were determined from the impedance measurement.

309. The antenna is assembled as a compact unit. An adaptive circuit is closed in the antenna body, which is made up of two vices. The lids are pressed together by two springs. On one side, an emitter is emitted from the antenna body, which is made up of the SYP 0.75z conductor. This conductor has been chosen because it tolerates up to $95\text{ }^{\circ}\text{C}$ single-phase thermal load without any deterioration in performance and has a working temperature of $-60\text{ }^{\circ}\text{C}$ to $+85\text{ }^{\circ}\text{C}$.

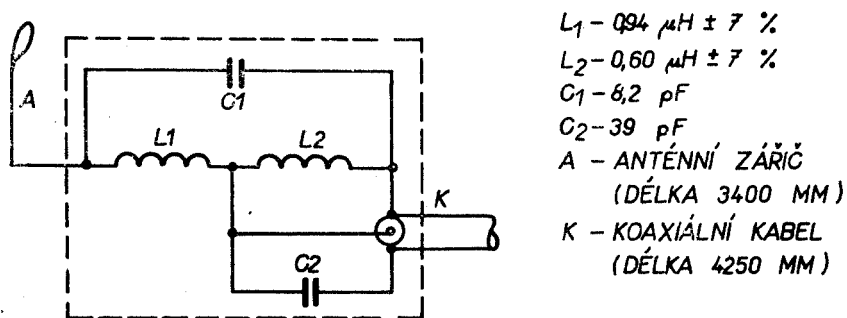


Fig. 55. Impedance matching transformer circuit diagram

The antenna is terminated by a loop in which an antenna hook is attached. The radiator, as well as the coaxial cable body, is sealed in the antenna body by means of a rubber hose. Jako coaxial cable is used Teflon cable VFKT 50-1 IB. This cable is used because the manufacturer guarantees its properties when used in an environment with a temperature of -60 C to + 105 C and a relative humidity of up to 98%. The coaxial cable is terminated by the QK 411 08 connector. This antenna connects to the RF-10 radio station or connects to the extension coaxial cable. The entire body must be watertight.

The resulting impedance waveform is shown in Figure 56.

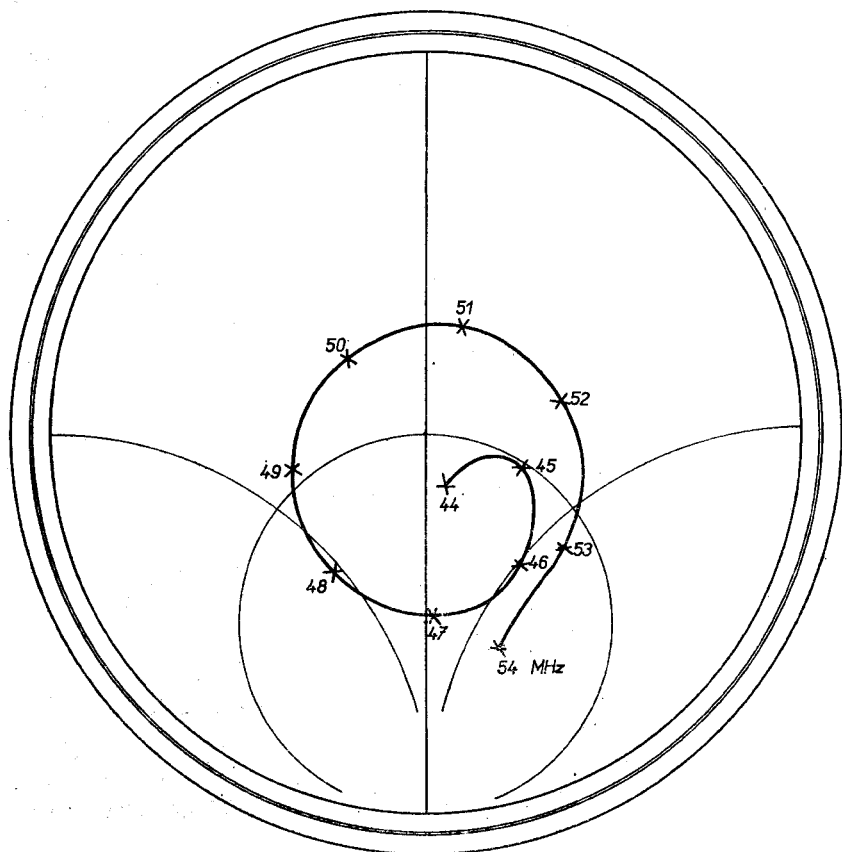


Fig. 56. The resulting course of the input impedance of the suspension antenna

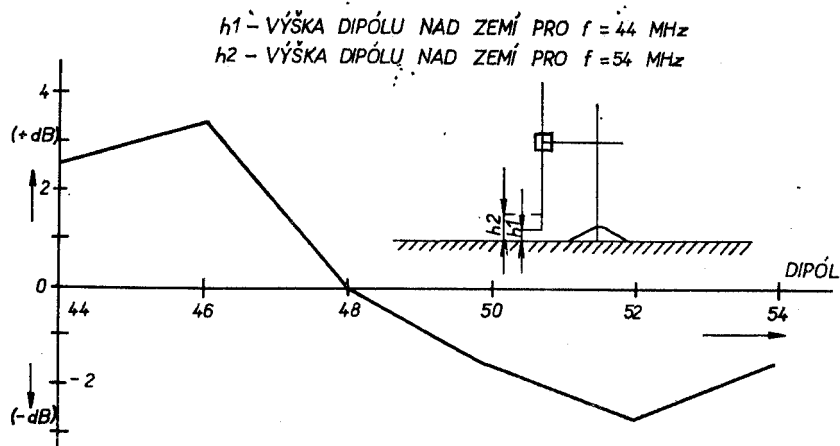


Fig. 57. The gain of the suspension antenna versus a half-wavelength dipole

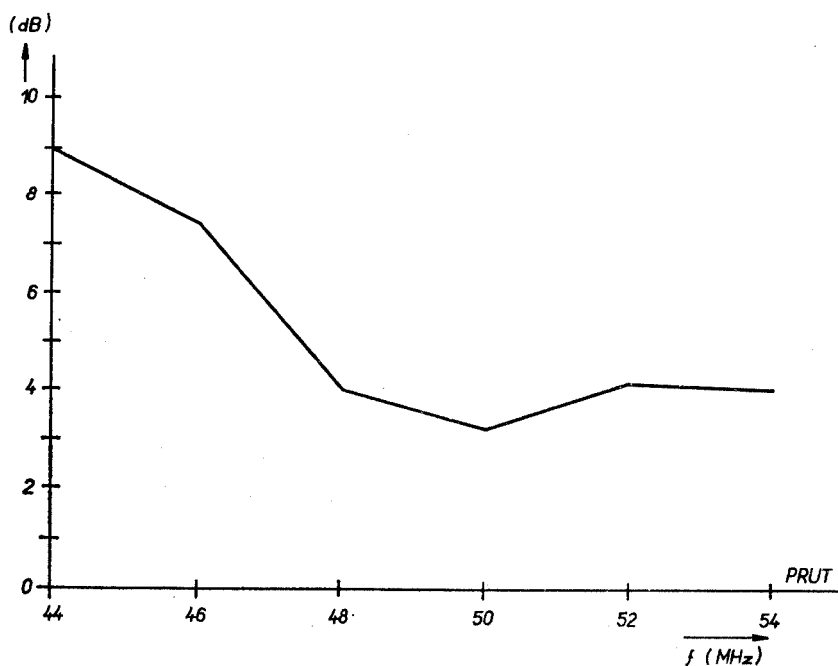


Fig. 58. The gain of the suspension antenna over the rod antenna

310. Figures 57 and 58 show the gain of the suspension antenna against the radio station with a 1.5 m long antenna array in different terrains and at various positions of the radio station.

c) A 30 meter directional antenna

This antenna is used as a.

- semi-cassette
- Horizontal.

311. For a longer distance connection, it was necessary to make an antenna that would have a higher gain of 10 dB than the quarter-wave antenna. A progressive wave antenna was designed. The actual antenna length is 30 m, ie 4.4λ to 5.4λ and the antenna height is 8 m, ie 1.16 to 1.44λ .

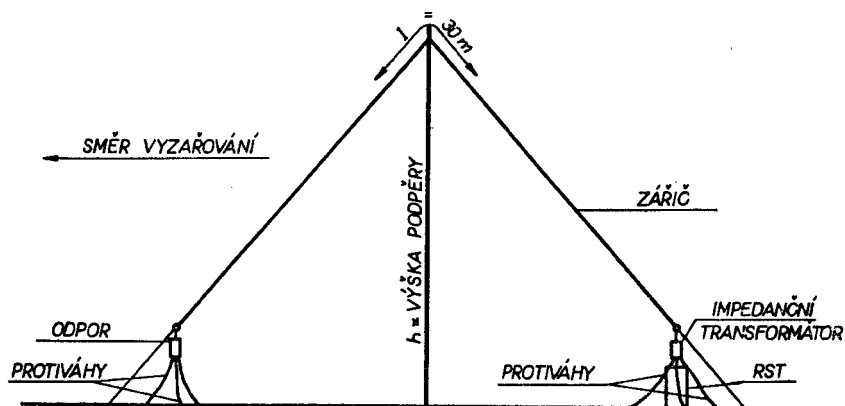


Fig. 59. Wiring, 30-meter wired polar-square antenna

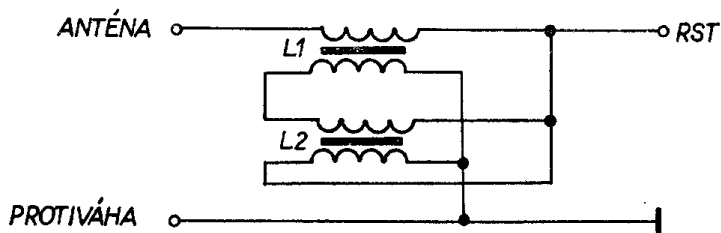


Fig. 60. Wiring of a broadband impedance transformer

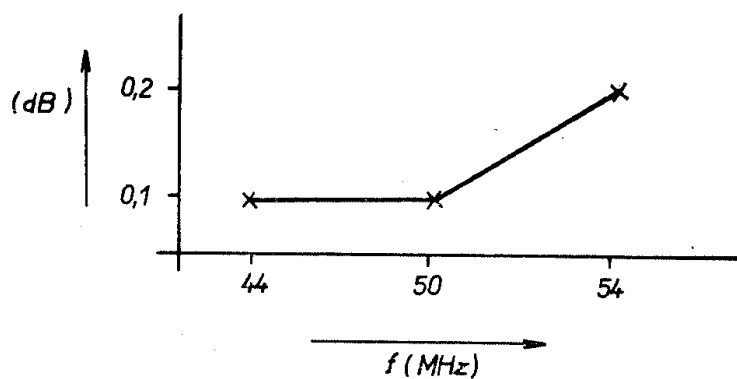


Fig. 61. Attenuation characteristic of impedance transformer

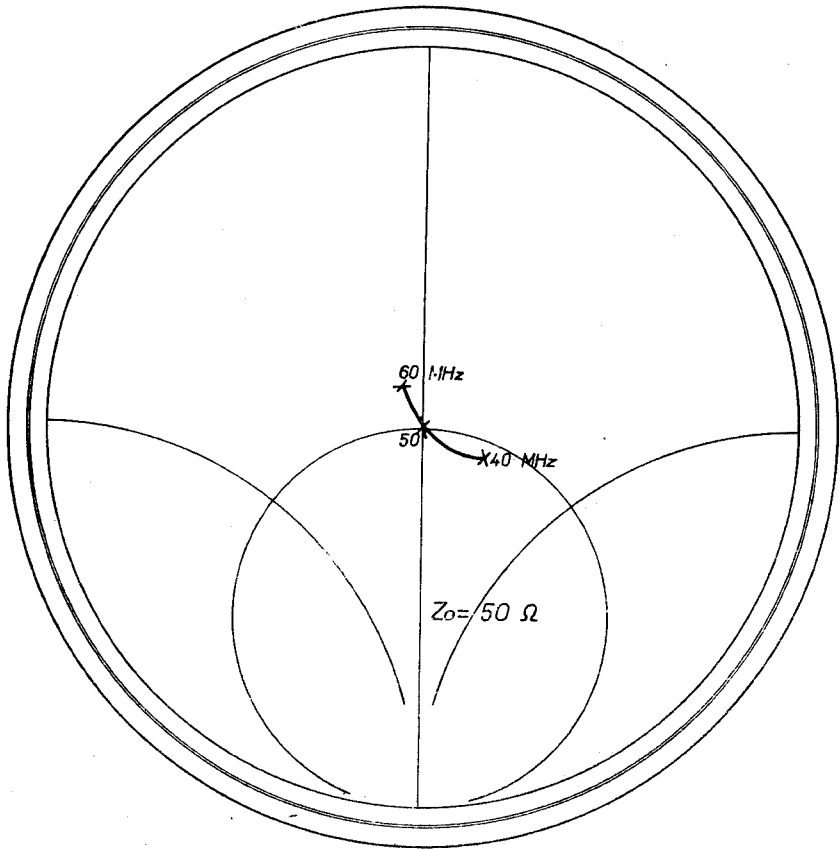


Fig. 62. Impedance Transformer Input Impedance Flow

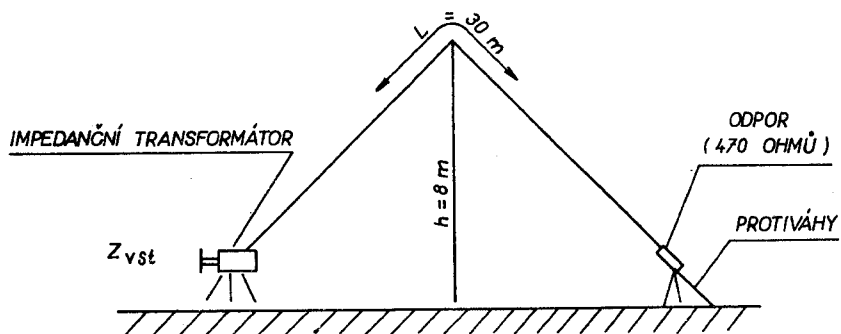
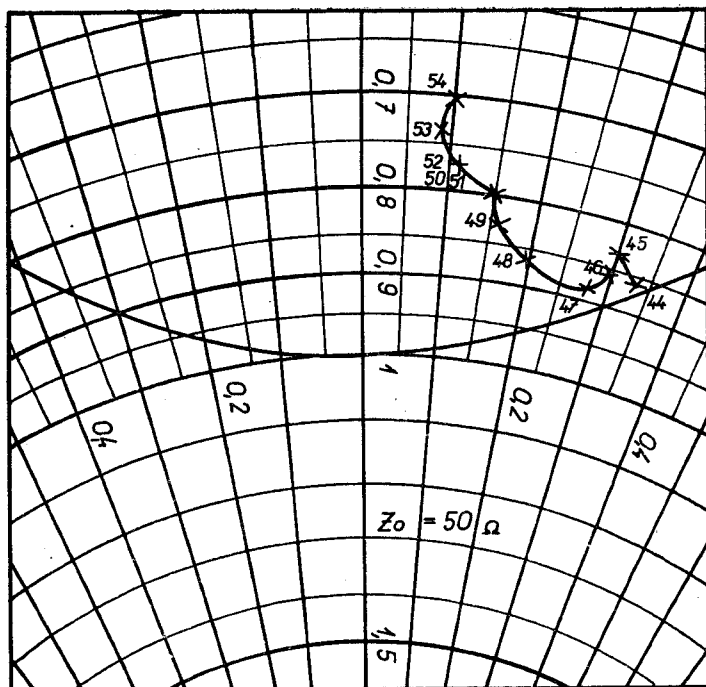


Fig. 63. Continuous input impedance 30-meter wired half-array antenna

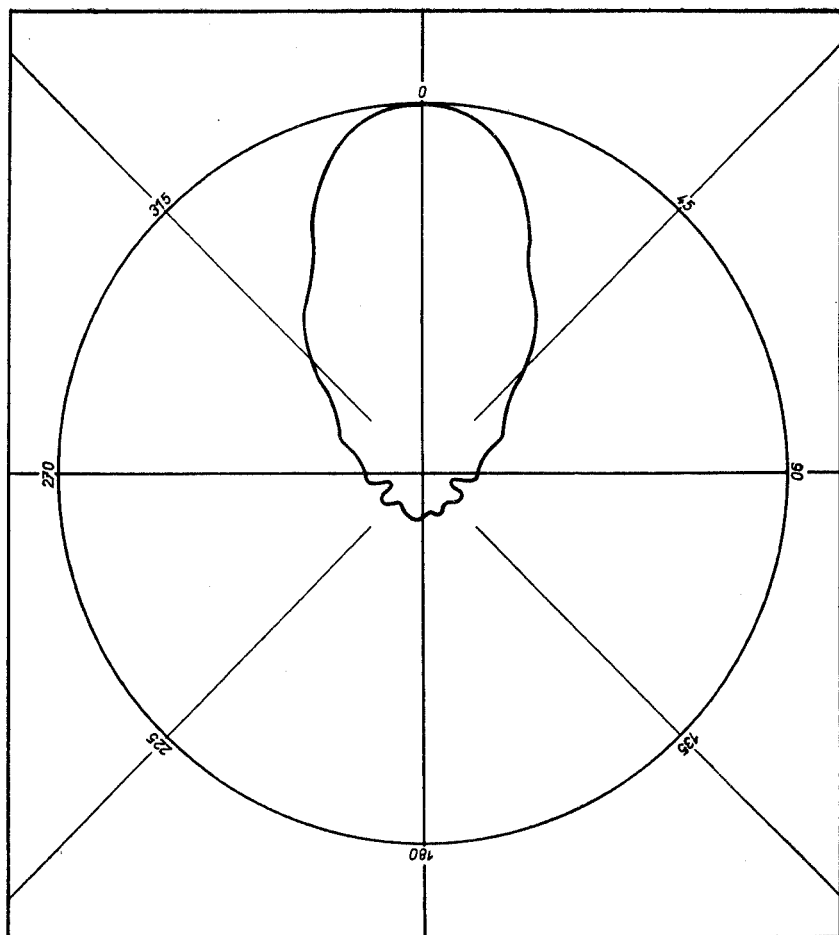


Fig. 64. Radiation diagram 30 meter wired half-array antennas at
50 MHz

Polarization: vertical

Height 8 m

Cable length 30 m

When measuring its own antenna it was found that its impedance is about 9 times higher than the radio station's impedance. For this reason, it was necessary to include a broadband impedance transformer. In the direction towards the second station it is terminated by the resistance 470. The resistances are loosely laid on the ground 3 of the counterweight. Their distribution is

approximately 1200.

The antenna is connected to an impedance transformer using bananas. The impedance transformer is connected to its own radio station by a coaxial connector. The impedance transformer is connected with three bananas, which are distributed on the ground in the same way as the resistance. Bananas are threaded against pulling.

The 30 meter wired half-array antenna is shown in Figure 59.

Load resistance TR154 470R is placed in a plastic box. On one side, it is connected to the antenna and on the other side the counterweights are connected.

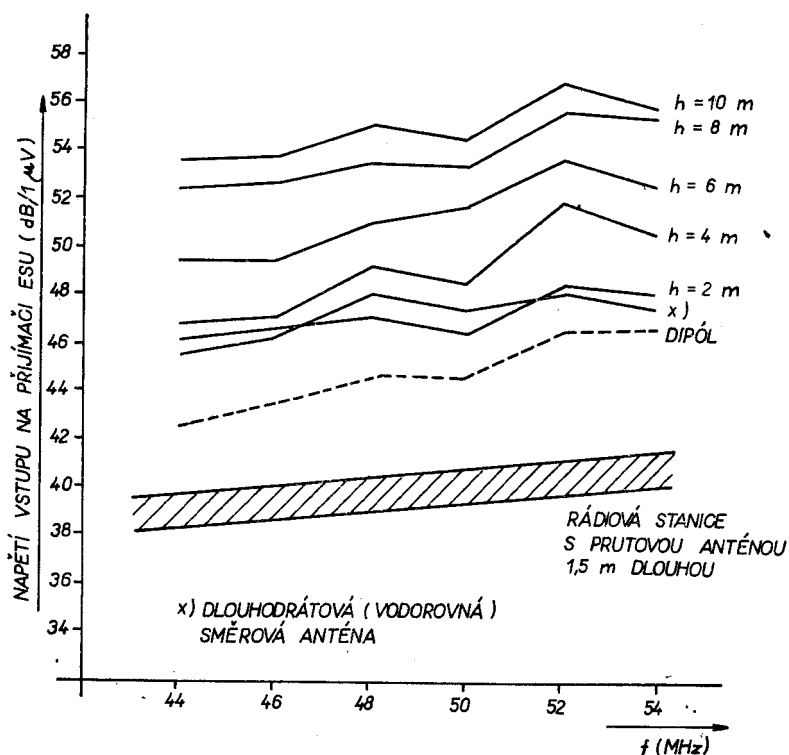


Fig. 65. Relative measurement of antenna gains in relation to height

312. The impedance transformer is wound on a ferrite ring of mass N02. Both coils L1 and L2 have 2 x 10 threads bifilar wound from MGTf 0,07. Both strands are rolled up to 20 cm twigs for 10 cm. The wound transformer is plugged into a metal box.

The impedance of the transformer is shown in Fig. 62

The impedance transformer attenuation in the 44 to 54 MHz band is not greater than 0.2 dB (Figure 61).

313. The input impedance of the antenna is shown in Fig. 63. In the desired frequency range, SWR is better than 1.7. A typical beam pattern for mast height of 8m at $f = 50\text{MHz}$ is shown in Figure 64.

The gain of the directional antenna over the dipole is in Table 2. The measured values are in dB.

314. For a shorter distance connection (up to 15 km), the antenna can be used as horizontal tension on wooden or other non-metallic high-lying supports (Figure 66).

The connection of the radio station and the counter is the same as the half-circle antennas.

The gain of this antenna was again measured against the dipole and the 1.5 m long rod antenna. Measured values are given in Table 2.

Table 2

h (m) \ f (MHz)	44	46	48	50	52	54
Vodorovná anténa	3,1	2,7	3,5	2,8	1,8	1,0
2	3,6	3,1	2,6	1,8	1,9	1,5
4	4,3	3,6	4,7	3,9	5,4	3,9
6	6,9	5,8	6,5	7,0	7,1	5,9
8	9,7	9,1	9,0	8,6	9,0	8,6
10	11,0	10,2	10,6	9,7	10,3	9,2

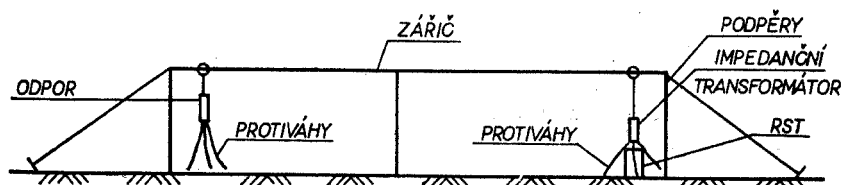


Fig. 66. 30 meter wire horizontal directional antenna

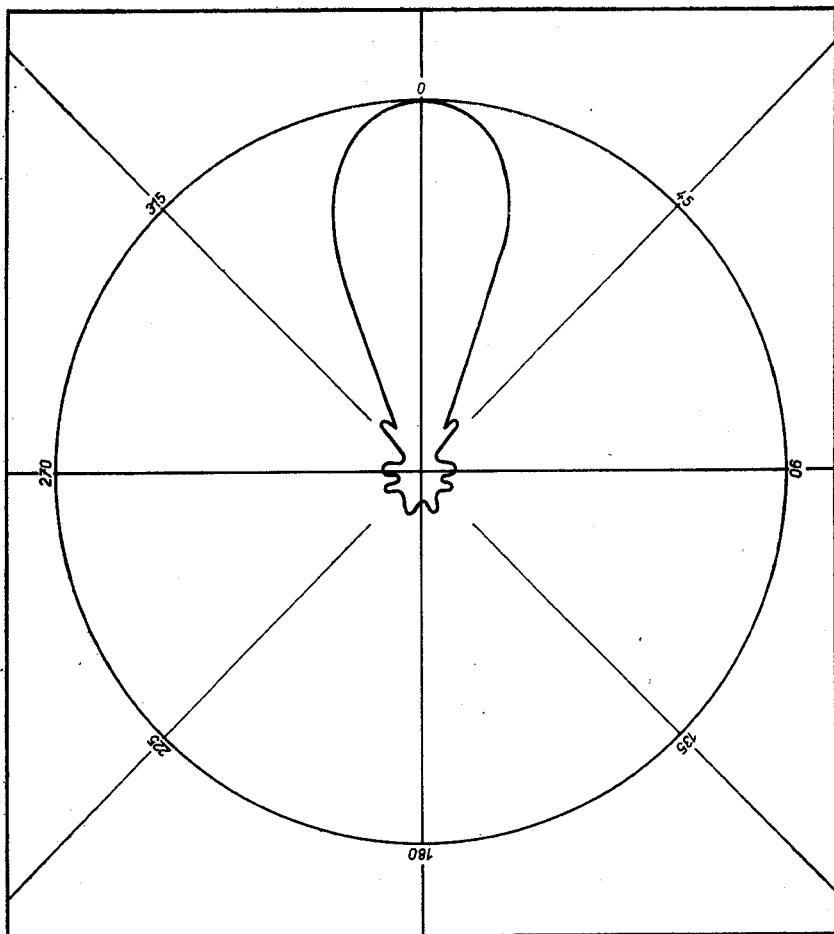


Fig. 67. Radiation diagram of a 30 meter wired half-array antenna
at a frequency of 44MHz

Polarization: Vertical

Plane: Horizontal

Height 8 m

Cable length 30 m

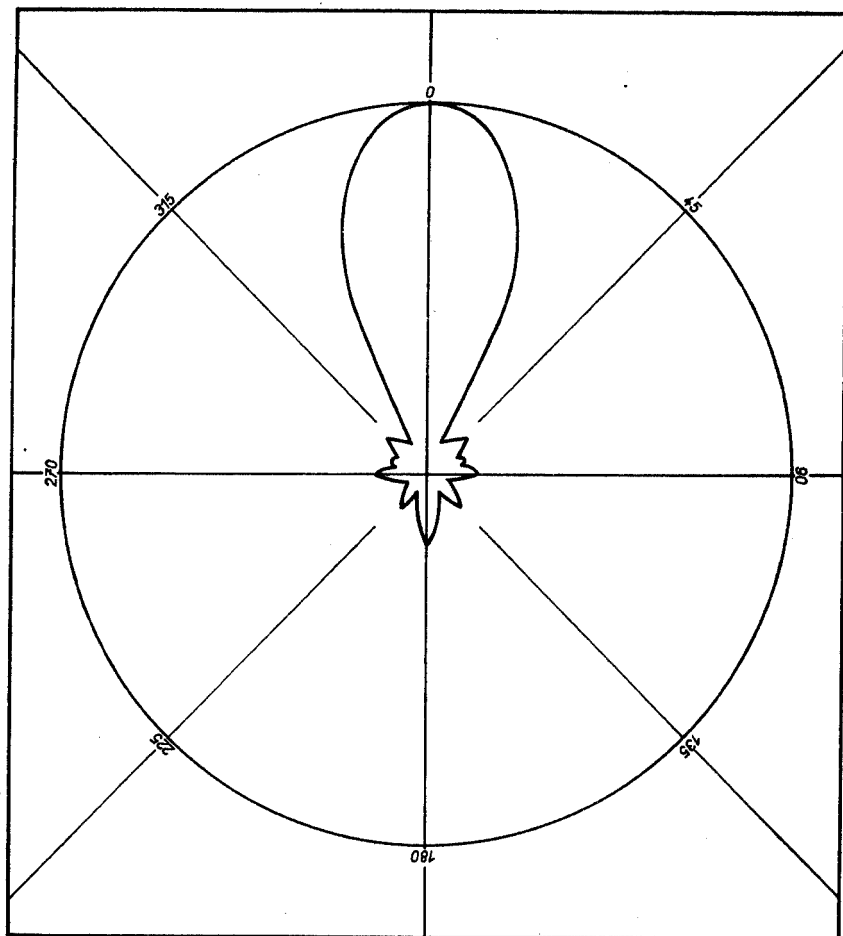


Fig. 68. Radiation diagram of a 30 meter wire horizontal antenna at
52 MHz

Polarization: Vertical

Plane: Horizontal

Height 1 m

Cable length 30 m

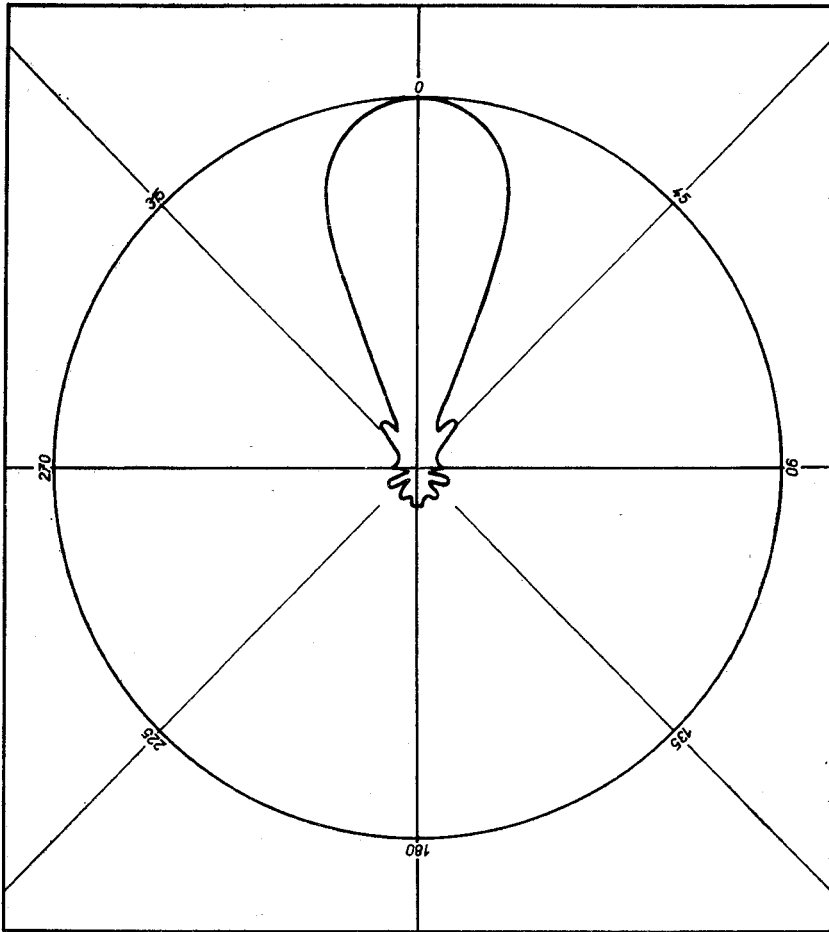


Fig. 69. Radiation diagram of a 30 meter wire horizontal antenna at a frequency of 50 MHz

Polarization: Vertical

Plane: Horizontal

Height 1 m

Cable length 30 m

315. When we compare the gains of both antennas, we find that, in the case of a 30-meter wired directional antenna (semicircular) at a height of less than 4 m where the gain is not significantly different, it is better to use a horizontal directional antenna for a faster and faster construction. Radiation diagrams that were measured in the same way as for the wire directional antenna

(semicircular) are shown in Figures 67, 68 and 69.

316. Generally speaking, this antenna can be used both in straight and rugged terrain. Because this antenna is directional and at a height of 6 to 8 m of the semi-circular antenna, the radiation angle 43° to 50° has to be routed.

The antenna is routed by a bushel so that the resistor placed in a plastic box is pointing to the opposite radio station (See Figure 59). The deviation from the straight line should not be greater than $\pm 5^{\circ}$.

317. The antenna range is determined by the antenna height, the terrain profile, the distances of surrounding objects and the accuracy of routing.

318. The advantage of using a semicircular directional antenna is its directionality, which makes it difficult to listen to the enemy.

The connection can be secured in such a way that the radio station can be housed in a hiding place (ditch, etc.), thus protecting the operator from the enemy.

The construction of the antenna for operation is relatively simple and fast.

319. The antenna creates the SYP conductor 0.75, its end is terminated by a pin, the second body with resistance and counterweight.

Counterbalances are from LSi conductor 0,5.

At both ends of the antenna there are pairs of anchor lines and tensioners that anchor the antenna.

In the middle of a 30 meter radiator, a loop is formed from the cord and the antenna is pulled out into the working position by means of a snapping cord.

The anchor lines are a sliding tube that is used to construct the

antenna above the ground (insert a support between the node and the tube).

The antenna is wound together with anchor lines, an impedance transformer, and coil reels (reel).

Before wiring the antenna on the coil, it is necessary to tie the impedance transformer into the coil gap, to wind up the counter-ended ends and then to the antenna with the anchor lines.

Separately, a cord with a snap-hook is wound on a smaller coil, whereupon the antenna is pulled out if necessary into the working position. The coil should be wound from the side of the sling.

CHAPTER 5

OPERATION

1. Storing and wearing

a) Storing the radio station kit in the transport case

320. The deployment of the individual parts of the RF-10 radio station is shown in Fig. 70. The transport case molded from the foam polystyrene is divided into pens in which the set is stored. The trunk is enclosed with a list of the kit and a diagram of its layout. Store in chassis the kit in all modes of transport.

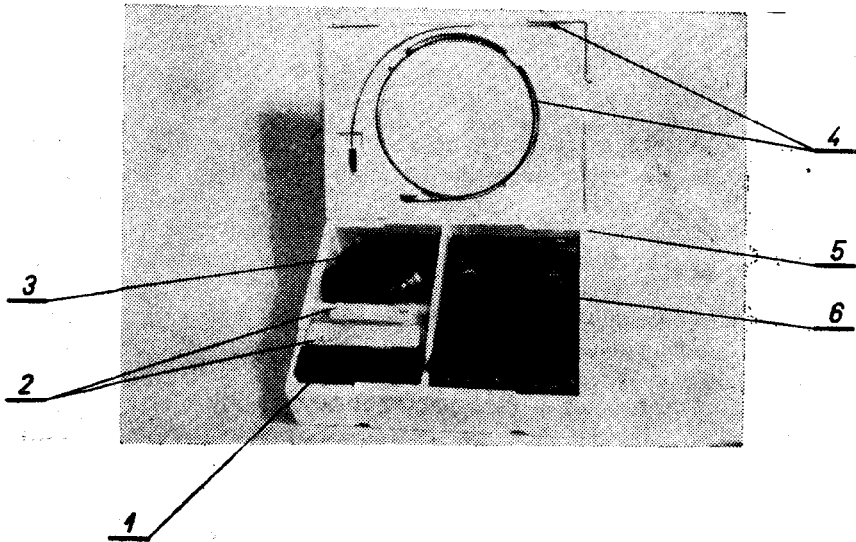


Fig. 70. Storing the kit in the carrying case

1 - Battery cabinet in the bag; 2 - wire antennas; 3 - handset; 4 rod antennas; 5 - carrying case; 6 - radio station in the bag

b) Wearing

321. The portable radio station RF-10 is equipped with a bag and saddle strap. The straps allow the wearer to be wearing a bag

without a bag on his back and chest. Both the radio station and the bag have pins on which the straps are clamped. The straps are shortened by pulling the free ends. Each zipper is divided and the way through the pair of staples ensures that the joint of the two parts of the straps is self-locking. The upper end of the straps is marked in blue.

322. The normal operation also allows the radio station placed in the bag when the cover of the bag overlaps the radio station panel. If the panel is protected from rain, dust, etc., the radio station lid is turned on. Operation of the radio station is also possible after the previous settings of the controls. The antenna and cords of the acoustic transducer are discharged through openings in the lid, which are released when the caps of holes sewn from the inside of the lid are opened (see Figure 9).

323. The "back" and "chest" positions are the working positions of the radio station. It is also possible to carry a radio station on the shoulder. Under exceptionally favorable conditions for short distance connections, this position may be used. As a work, however, this position can not be used.

The position of the radio station on the back is shown in Figures 74 to 76b. The radio station is also attached to the bag under the belt by a clipping strap on the underside of the bag under the belt (Figure 76c). A front view of this method of wearing is shown in Figure 74.

The position of the radio station "on the chest" is shown in Figures 71 to 73. The radio station can be attached by one strap in the waist, the other around the neck (Fig. 713). When using the bag, it is secured with a strap bag strap (Figure 73). Another possibility of attachment is in Figure 72. The straps are crossed to the back so that they do not slip with their shoulders.

For both of these positions ("back" and "chest"), two are used The same length of the straps from the set. The replacement source, which is part of the kit, is stored in a separate bag. Possible ways of wearing are shown on Fig. 76.

Attention! It is strictly forbidden to wear the radio station as a bag on the side! This "position" significantly distorts and deforms the radiation characteristics of both rod antennas! ,

Further options for carrying the radio station at these positions are given in Figures 77 and 78. When using the protective jacket, the "back" position is not suitable.

2. Preparation for operation

324. Procedure. We remove the radio station together with the accessories from the shipping trunk. The radio station is plugged into the bag by a power supply. The battery packs are permanently installed in the battery box, which is replaced as a replacement if necessary. If the radio station has been stored for a long time, the power supply has been disconnected and stored separately.



Fig. 71a. Soldier with a radio station in the "chest" position - front view



Fig. 71b. Soldier with radio station in the "chest" position - front view



Fig. 71c Soldier with radio station "on chest" - side view



Fig. 71d. Soldier with radio station in the "chest" position - side view



Fig. 72a. Soldier with a radio station in the "chest" position - a rear view



Fig. 72b. Soldier With a radio station in the "chest" position - a rear view



Fig. 73. Radio station in the position "on the chest" - position of the radio



Fig. 74a. Soldier with radio station in the "back" position - front view



Fig. 74b. Soldier with a radio station in the "on the back" position - front view



Fig. 75a. Soldier with a radio station in the "back" position - rear view.



Fig. 75b. Soldier with radio station in the "on the back" position, machine gun in the "breast" position



Fig. 76a. Radio station in backpack - Rear view - Replacement source vertically



Fig. 76b. Radio station in backpack - Back view - Backup source horizontally



Fig. 76c. Attaching the battery bag to a belt

a) **Battery connection**

325. If the source is to be replaced prior to operation, remove the source with the battery box from the bag.

When disconnecting the power source, press the locking spring at the bottom of the radio station cabinet toward the panel and eject the battery box in the direction of the arrow marked on the battery box.

When connecting a charged power source, insert it with four pins into the hinged holes at the bottom of the radio station so that both the source connector and the radio station are on the same side. For ease of differentiation, the sides of the radio station and battery boxes are also marked in white. Push the battery box to the radio station and slide it in the opposite direction of the arrow so that the locking pin on the battery box fits into the opening of the locking spring at the bottom of the radio station (Figure 81).

326. The battery box may be connected to the radio station by means of the cable provided in the extended accessory of the

radio station. This method is used in heavy frost; The battery box has an operator under the outer garment.



Fig. 77. Soldier with radio station in the "chest" position - with connected rod antenna and headset.



Fig. 78a. Soldier with radio station in the "on the back" position



Fig. 78b. Soldier with a radio station in the "chest"



Fig. 78c. Soldier with radio station in the "chest"



Fig. 78d. Soldier with the radio station in the "chest" position - means of the FCHC in the standby position



Fig. 78e. Soldier with a radio station in the "chest" position with a protective cape attached.



Fig. 78f. Soldier with a radio station in the "back" position and a protective mask

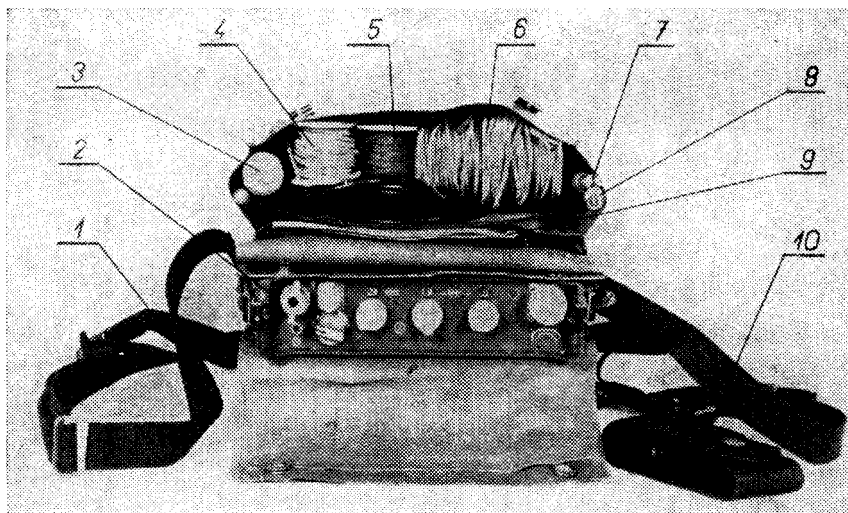


Fig. 79a. Store the radio station set in the bag

1 - carrying strap; 2 - radio station; 3 - handset; 4 - suspension antenna on spool; 5 - rope on spool; 6 - Directional antenna on spool; 7- 0.5 metre rod antenna; 8 – 1.5 metre antenna; 9 - documentation; 10 - transverse strap

327. Informative control of sources can be done by pressing button covered by a rubber disc on the battery box, marked "+". Pressing the power light will light up. This check verifies whether the source has a defect. However, it does not check the charge status of the battery. Light bulbs can also be used for emergency lighting of the panel when operating in dark.

b) Holding into a bag

328. When using a radio station in the bag, plug the radio station into the back pocket with softening pads and a separate lid to turn on the switch. There are holes for connectors in the lid. The radio station must be in the bag so that the connectors (for acoustic converter and antenna connectors) on the panel are always at the far side of the operator's body. Strip the stand against the straps on the top of the side of the bag.

329. The centre compartment is for radio station and rod antenna. We will add additional radio station accessories to the top pocket, which is expected to be used later in operation. The

storage in the bag is shown in FIG. 79a.

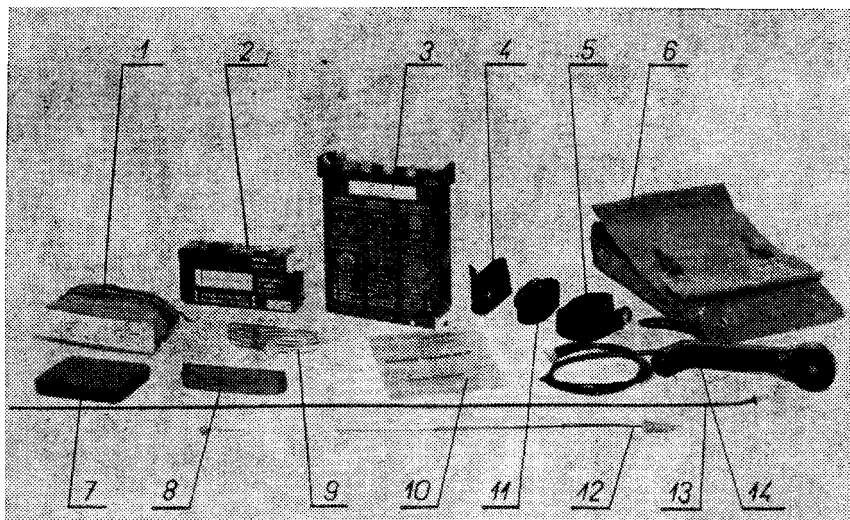


Fig.79b. Set of radio station removed from the bag

1 - directional antenna on coil; 2 - battery box; 3 - radio station; 4 - the transverse strap; 5 - carrying strap; 6 - radio station bag; 7 - Set of backup components; 8 - suspension rope on spool; 9 - suspension coil antenna; 10 - log book; 11 - 0.5 metre rod antenna; 12 - 1.5 metre rod antenna; 13 - 1.5 metre rod antenna; 14 - handset

3. Front panel controls

330. The layout and shape of the control and connection elements on the panel are chosen with regard to ease of operation and reliability of setting and connecting elements. The signaling elements are clearly arranged on the panel and marked with marks. The tags are also used with the connection elements and the operating mode switch. The marks on the radio station panel are selected according to the markings used. As far as atypical signs are concerned, they are chosen to best reflect the type of radio station operation.

The layout of the elements on the radio station panel is shown in Figure 80.

4. Connect the handset

331. Connect the microphone (fig. 81) via the 19-pin connector (position 3), then attach the cover (position 4) to the connector on the radio station panel (position 8). The handset connector has a key that ensures the correct connection. After insertion, tighten the lock nut to the radio station connector.

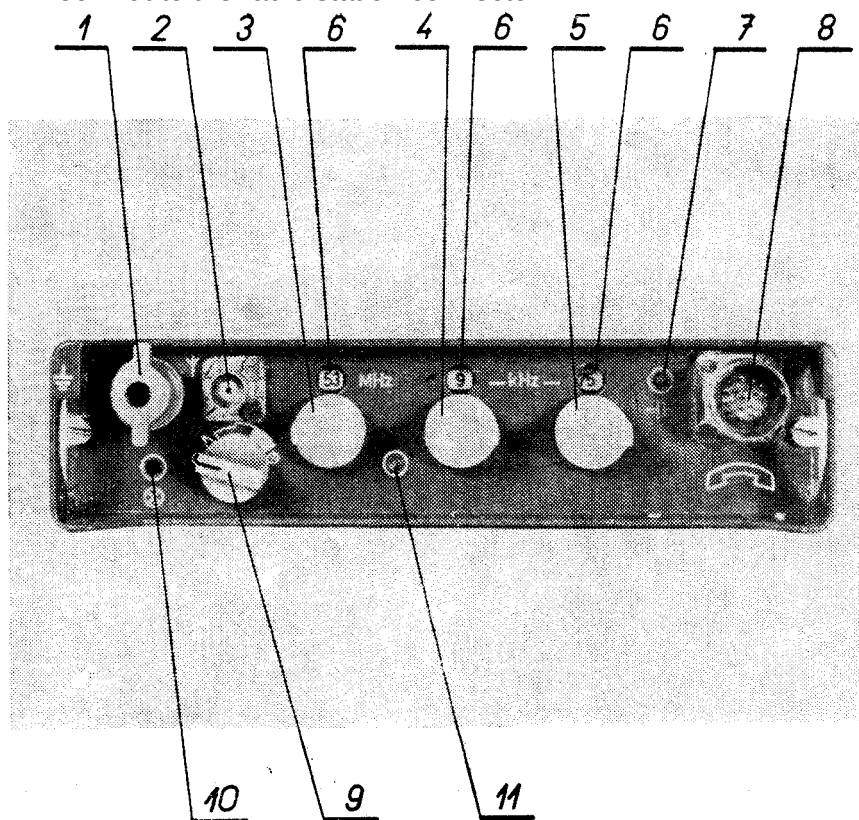


Fig. 80. Radio station front panel

1 - Routine antenna connector; 2 - Coaxial connector for wire antennas, 3 - first frequency switch (MHz); 4 - second Frequency switch (kHz); 5 - third frequency switch (kHz); 6 - frequency indicators, 7 - Resource status indication; 8 - 19 - pole connector; 9 - overloading mode of operation; 10 - Transmitting light bulb; 11 - glowing glow

5. Choosing, building and connecting antennas

a) Rod antenna 1.5 m long

332. This antenna is the basic type of antenna used in set. It is connected to the radio station by inserting it into the antenna connector on the radio station panel & it is secured with a wing eccentric (Figure 80 item 1). It is used when operating a radio station in moderately wooded and medium-terrain terrain for up to 5 km.

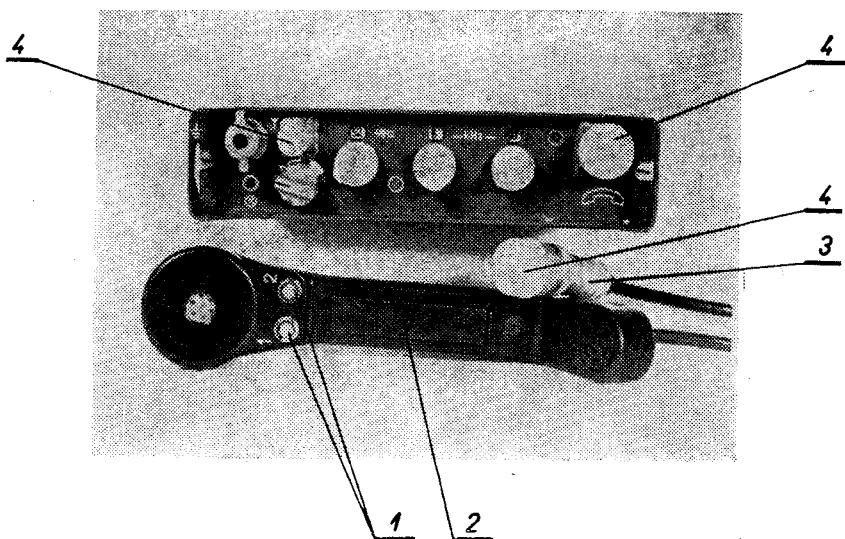


Fig. 81. Radio station with handset

1 - push-buttons; 2 – PTT Key; 3 - 19 pin connector; 4 - protective caps

The working position of the radio station is "on the chest" or "on the back" (Figures 71 to 78) fixed to the operator's body as high as possible.

333. Care must be taken to keep the antenna upright. The rod antenna, in particular when obliquely, does not radiate evenly in all directions along with the body of the operator. It is advisable for the

operator with the attached radio station to rotate so that the end of the antenna is directed from the opposite radio station.

The radio station can also be used on the ground. However, the range depends on the electrical properties of the soil.

334. Site selection. The site should be selected whenever possible in such a way that there are no more obstacles such as houses, dense forests, etc. in the vicinity of the radio station. The stations in the passageways, under the bridges, inside the buildings are fundamentally inappropriate. Preferred locations are elevated, with direct visibility towards the opposite radio station. When connecting over longer distances, the operator needs to find a location where the signal from the opposite station is strongest. When searching for a location, you can move a few steps forward or aside. The largest range is when the radio station is located on the back and when the operator is stationary towards the opposite radio station.

It is not advisable to use this antenna when making a connection. When making connections, it is recommended to use 1.5-meter rod antennas for short distances and, in good conditions, to switch over to a short antenna.

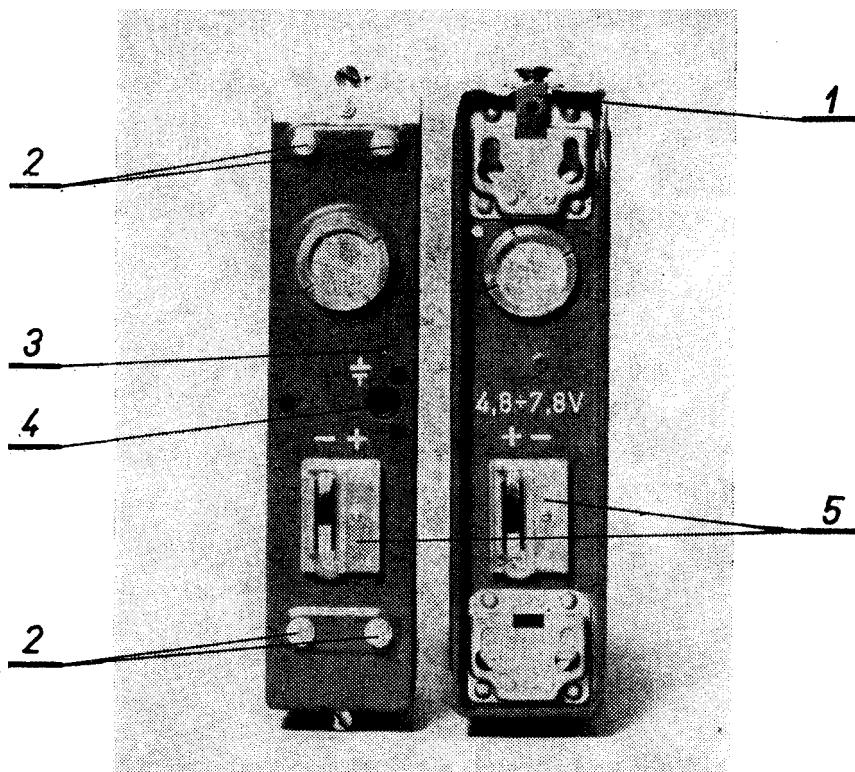


Fig. 82. The battery box lid and the bottom of the radio station
 1 - locking spring; 2 - connecting pins; 3 - control bulb; 4-button; 5 -
 source connector

b) Aerial antenna 0.5 m long (shortened)

335. The connection of this antenna is exactly the same as the previous type. It is used in those cases where the longer antenna either interferes (in the objects) or would be defective at the station's greater reach (eg at the command station). The reach of a radio station in medium-forested and medium-terrain is 1 km. The features of the radio station with this antenna are the same as 3 using the previous antenna type.

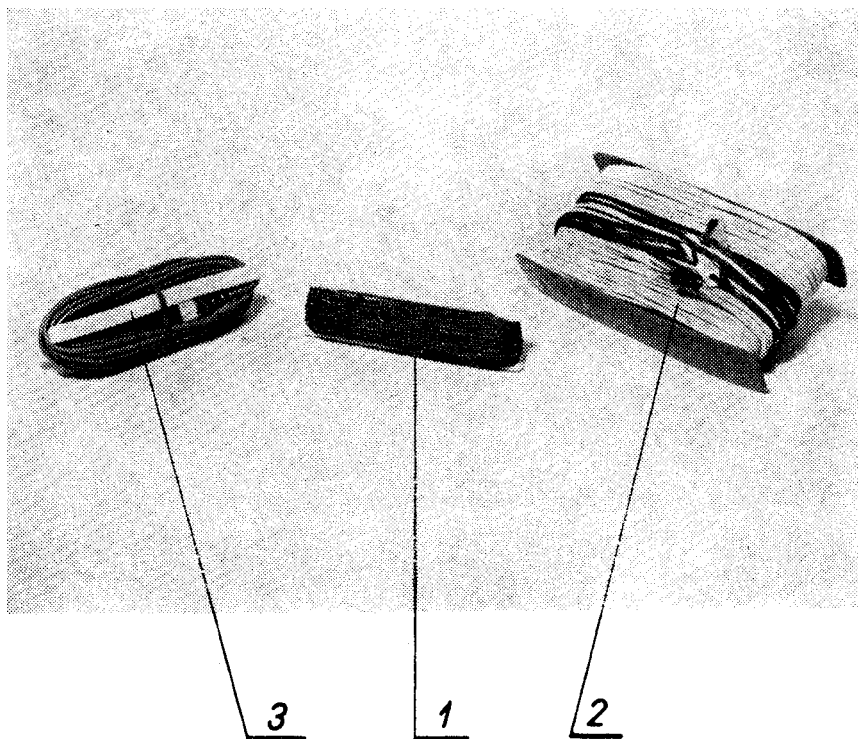


Fig. 83. Wired antennas

1 - hanging rope; 2 - directional antenna; 3 - suspension antenna

c) **Suspension antenna**

336. This antenna (position 3 in Figure 83) is intended to increase the radio station's reach within 10 km. It is suitable for on-site operation, namely: in the woods and rugged terrain, trenches, bunkers and buildings.

The method of use is shown in Fig. 84.

337. The antenna connects to the radio station directly or via an extension coaxial cable. The suspension antenna should be suspended as high and vertical as possible (Figure 85). The antenna must not hang on metal posts and masts.

338. The suspension antenna is wound onto a plastic spool (Figure 83). At the end is the eye to which the para cord is attached. At the end of the string, a heavy object is attached, which moves the string over the branch of the tree. Using this cord, pull the antenna up.

We protect the coaxial connectors (on the panel and the antenna) against dirt by plastic caps.

d) 30 meter wire half-array directional antenna

339. In Figure 83, the directional antenna is wound (position 2). This antenna is used for on-site operation for up to 20 km distance even in rugged terrain. It is necessary to align the antenna. The antenna is aligned using a compass and a map. The antenna must be constructed in such a way that the load resistor placed in the cylindrical plastic body is directed towards the opposite station (see Figure 88). The deviation from the direction must be less than $\pm 10^\circ$. Failure to observe this condition means reducing the range.

340. Antenna building. We will unfold the antenna freely on the ground in the direction of the opposite radio station. In the center of the antenna is the eyeliner cord, into which we put the carabiner with separate chelon cords. At the other end we consider a heavier object weighing about 1 kg (stone, attack knife, etc.). The cord must be loosely circular by about 75 cm in order to allow it to be easily thrown up to 10 m high. The end of the string is reversed through the branch.

The most suitable height to the top of the antenna is 8 m from the ground (the height of the white mark on the chimney line to the carabiner). We stretch the antenna and anchor the ends with guy lines to the pins. The built antenna is shown in Fig. 86.

341. Connect the antenna to the radio station using an impedance transformer (Figure 89). The transformer has two marked sockets and a coaxial connector that connects the transformer to the radio station. The sockets are threaded as well as the appropriate bananas. Insert the banana from the antenna into the socket marked "Y" and screw it into place. Plug into the socket marked "-_L-" and screw in the banana of the

counterweight, which is freely spread out on the ground. The angle between each arm of the counterweight is about 120°. Similarly, we spread out the counterweight also on the end of the antenna termination resistance (Figure 88).

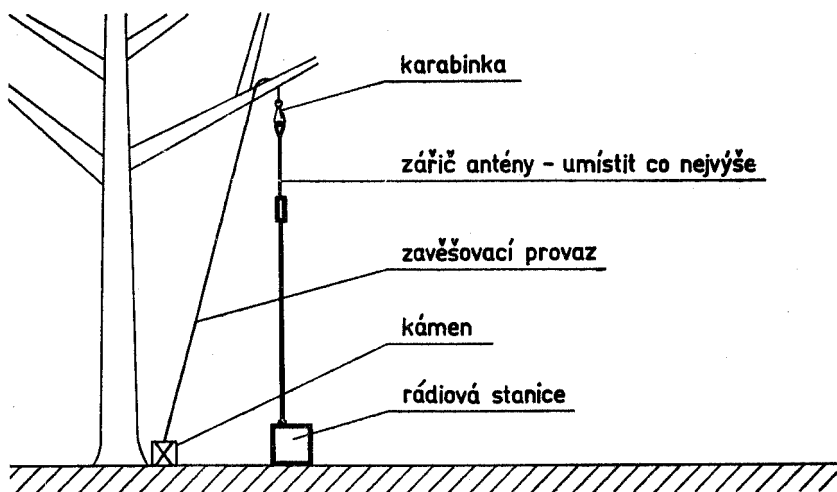


Fig. 84. Suspension antenna



Fig. 85. Using the suspension antenna in the field

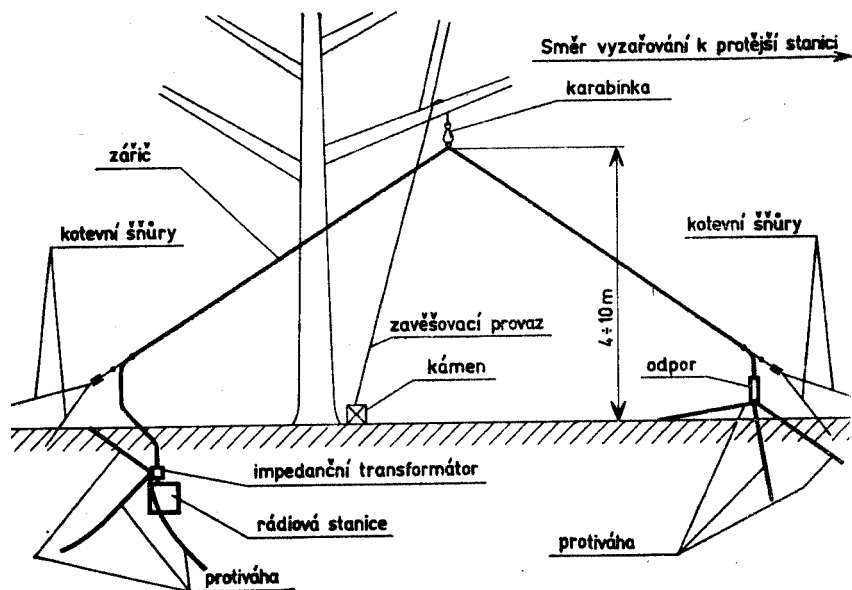


Fig. 86a. 30 meter wired half-array antenna

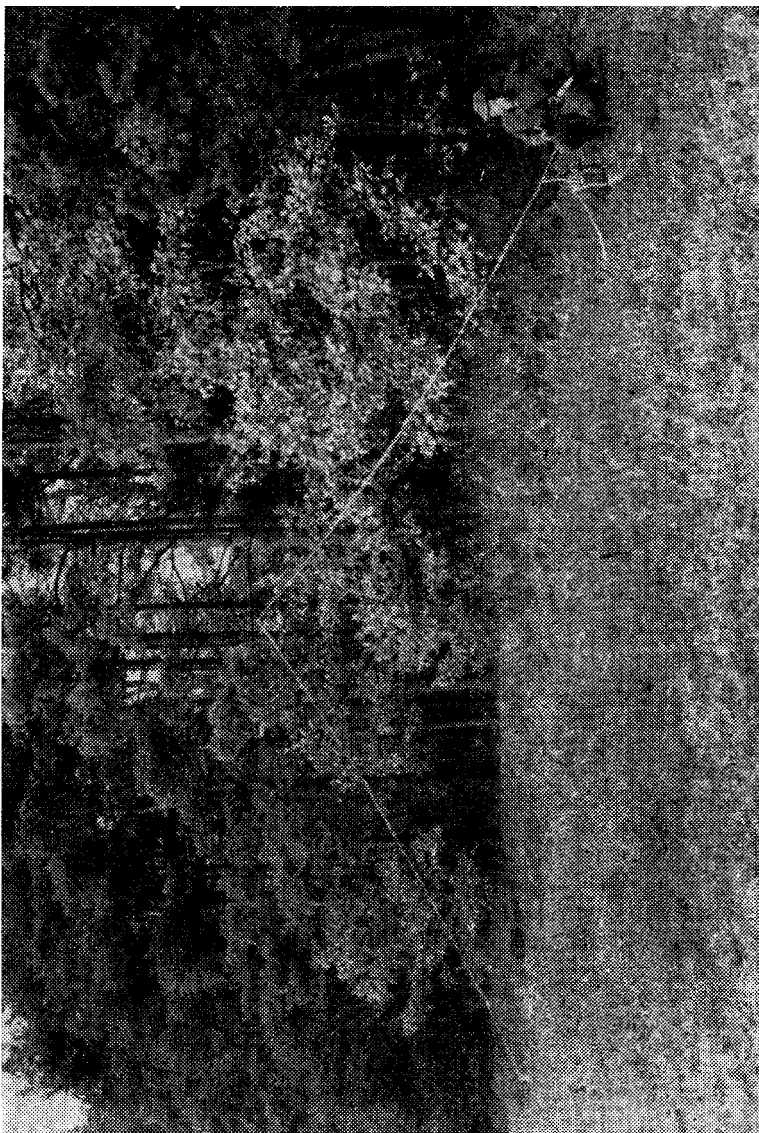


Fig. 86b. Using a 30 meter wire half-circular antenna in the field

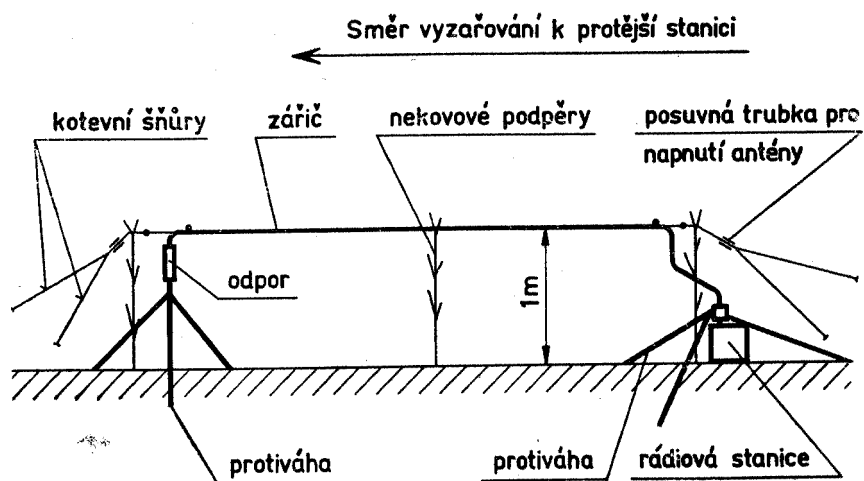


Fig. 87a. 30 meters. Wire horizontal antenna

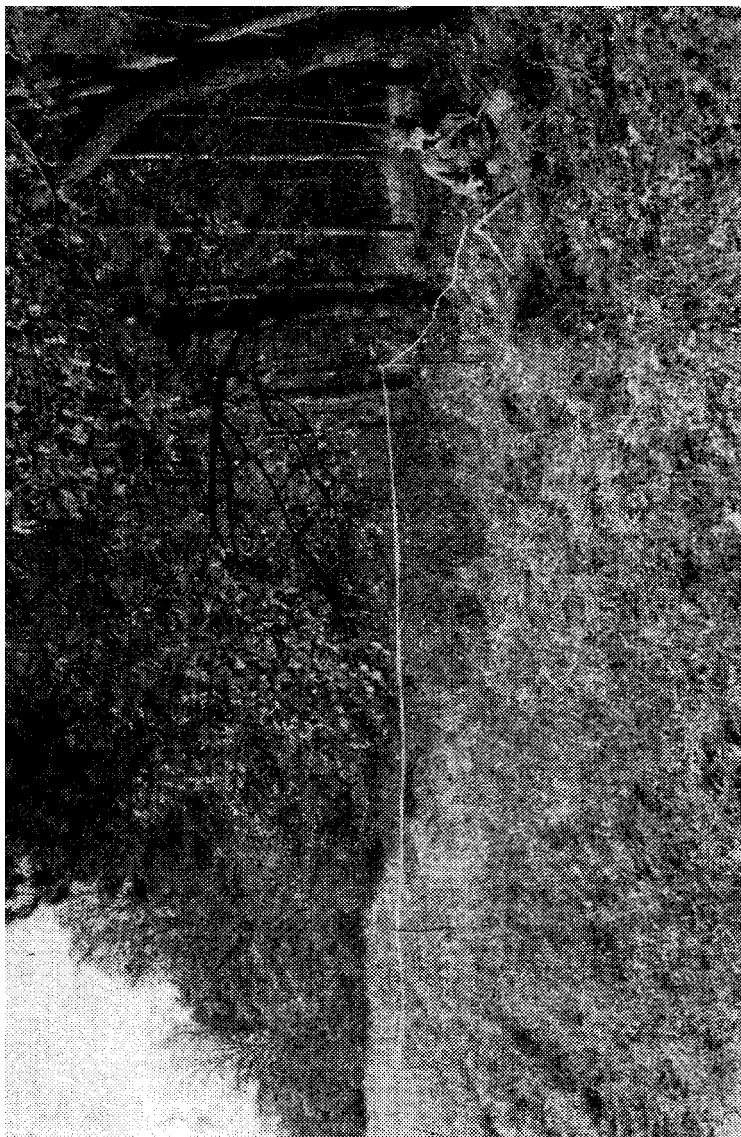


Fig. 87b. Using a 30 meter wire horizontal antenna in the field,

e) **30-meter wire (horizontal) directional antenna**

342. If it is not possible to erect an antenna higher than 4m in the given terrain, it is preferable to mount the antenna horizontally (see Fig. 87). We place the antenna freely on the ground in the

desired direction to the opposite radio station. Secure the anchor lines at the ends with anchor pins. The antenna still remains unstressed, the cords length control element is about 0.5 m from the anchor pins. We support the antenna at the ends (at the point of the eyelet) and in the middle of the support posts so that the height of the emitter (s) is about 1 m above the ground. In addition, we tighten the antenna. The antenna connection to the radio station and the counter position is the same as the previous antenna. The range of connection with this antenna is 10 to 15 km.

It is possible to connect an antenna to trees or wooden objects.

6. Check the radio station before operation

343. Before starting a radio station's own inspection, it is necessary to check the radio station and accessories for mechanical damage.

a) Checking the receiver

344. With the connected source and one of the acoustic transducers, switch the mode switch (see Figure 80) to the transmitter control position marked "&". Glows on the radio station panel indicate a power-on. Permanent glow can also occur. However, the red light bulb must not be lit. "" "lr" "There is a significant noise in the handset, if no noise is heard, the radio station must be switched to another free channel, so that none of the frequencies listed in the table If the noise in the handset does not appear in this case, there is a fault in the radio station and it needs to be repaired and disappears in the handset by switching the operating switch to "A".

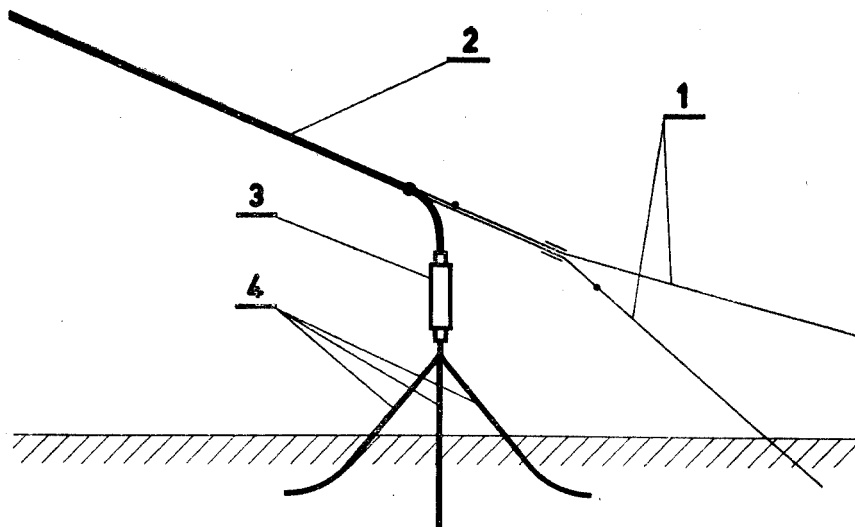


Fig. 88. Termination resistance with radial
1 - anchor lines; 2 - radiator; 3 - terminating resistor; 4 - radial

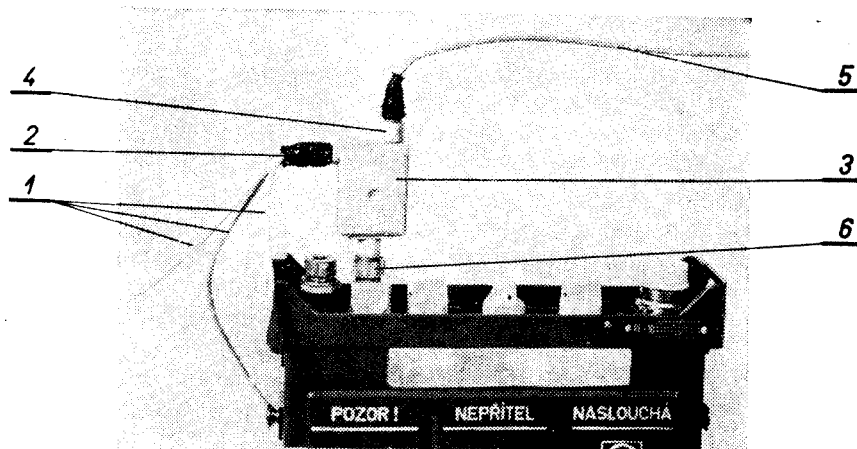


Fig. 89. Impedance transformer with radial
1 - radial; 2 - radial banana; 3 - impedance transformer; 4 - antenna banana; 5 - Antenna; 6 - coaxial connector

b) Checking the transmitter

345. The mode switch remains in the position labelled "8". The antenna is disconnected from the radio station. On the handset handle, press the key (figure 81). The green bulb labelled "&" is lit

on the radio station panel (Figure 81). If this bulb does not light up, there is a fault on the radio station and it needs to be repaired. When checking with the connected antenna, the procedure is the same, but the bulb is lit by a lower brightness. Where possible, it is advisable to carry out a short distance control.

c) Source control

346. When checking the transmitter and the receiver, the red bulb must not light on the panel labeled "+". If it lights up permanently, the source is already drained and needs to be replaced.

7. Tuning the radio station

General Provisions

347. After preparing, checking the radio station and connecting the antenna, the radio station can be tuned to the specified frequency. The radio station is tuned by setting three switches in the middle of the radio station panel (Figure 80).

348. The first switch labeled "MHz" marked with "44" to "53" is used to set the frequency from 44 to 53 MHz in steps of 1 MHz.

The second switch labeled "kHz" (center) with the numbers "0" to "9" is used to set the frequency in steps of 100 kHz.

The third switch labeled "kHz" with the numbers "00", "25", "50" and "75" is used to set the frequency in steps of 25 kHz.

349. The switches are equipped with stops. The frequency range of the radio station can be read through the relevant frequency indicators on the panel. In the other operating switch positions, the frequency switching scales are not illuminated. In the "&" position of the mode switch, the scale of the switches in the viewports is illuminated to ease the tuning of the light.

8. Setting the mode switch

350. The switch has the following positions:
- "O" radio station off;
 - "A" so-called "economical" operation, AF output 0.05 to 0.1 mW - compressor on;
 - "aa" so-called "economical" operation, AF power 2 2 mW - compressor off
 - "a" so-called "economical" operation, power output; 30 mW-compressor off;
 - "-" traffic with noise ", AF power; 5 mW - compressor off;
 - "noise" mode, power output 30 mW compressor on - channel switch scale illumination - transmitter power control position.

The location of the switch is shown in Figure 80.

351. Set the switch to the position appropriate for the given conditions by the connection.

For good off-road conditions, we use the switch positions "A" and "(Intermittent receiver operation)". The sensitivity of the receiver will not deteriorate during this operation. This significantly prolongs the radio station's battery life. In cases of bad terrain conditions and long distances to the opposite radio station, we will use the "Q" switch position.

352. It is always advisable to use so-called "traffic with sum" ("Q" position) only if it is possible to switch to so-called "idle" (intermittent reception).

Note. When using a 1.5 m long rod antenna, it is not allowed to cut it by bending, bending, or attaching the antenna end to its heel.

9. Adjust the volume

353. The receive volume is controlled by the mode switch and is always assigned to the selected radio station operation. At the same time, the Dynamic Frequency Stroke Limiter (Compression Amplifier) is switched on or off. This changes the call volume to the

microphone needed to reach the full frequency of the radio station when broadcasting.

10. Shutting down the noise limiter

354. The noise limiter is controlled by the operating switch, except for the "o" and "8" positions, the noise is off. The radio station with intermittent reception (so-called "economical" operation) operates without a signal. No receiver noise is heard in the headphones. In the "o" and "3" positions, the receiver noise is well heard in the handset, if the radio station does not receive a signal, etc. The noise limiter operation does not impair the sensitivity of the radio receiver. If the mode switch of the radio station is switched to "A" "What" is turned off and the radio station switches to so-called "economical" operation.

11. "RECEIVE" switch "TRANSMIT"

355. This switch is located on the handset. The handset has a key to press to switch from receive to transmit.

12. Warning

356. There are two buttons on the handset above the reception and broadcast button (Figure 81).

When a radio station is switched to the broadcast of any of these buttons, the radio station sends a beep.

13. Resource control during operation

357. During the operation of the radio station, especially at the time near the end of the battery operating time (one charge), we sometimes check, especially when transmitting, that the red light bulb on the radio panel does not illuminate (Figure 80). Its permanent light signals a discharge of the source. The source needs to be replaced!

14. Safety of operation

358. During the operation of the kit, especially when operating in vehicles, marching with a rod antenna, when operating with a suspension antenna and directional antennas, care should be taken to avoid contact of the antennas with overhead power lines.

15. End of operation

359. Turn off the radio station by turning the operation mode switch knob to "O" when it is finished. No other controls need to be adjusted. Disconnect the antenna and the handset. We both place it in the bag in the prescribed manner (Article 321).
360. If the radio station will be out of service for a long period of time, the 19-pole radio station and handset's connector, antenna coaxial connectors of the radio station and the impedance transformer must be covered with plastic caps (Figure 81).

CHAPTER 6

MAINTENANCE

1. General provisions

- 361. The radio station kit is designed with regard to its high resistance to external influences as well as mechanical damage in terms of technical conditions. By adhering to the principles of maintenance and care of the kit, it is possible to reduce damage during operation, transport and storage, or to extend the life of the whole kit. The following guidelines must be followed:
- 362. For the service life of the radio kit, follow the instructions in the operating instructions carefully.
- 363. Do not place the kit unnecessarily exposed to direct thermal and solar radiation, dust, rain, corrosive environments, and excessive vibration.
- 364. The stops of the rotary switches, buttons, etc. do not expose to excessive strain.
- 365. If the radio station is out of service (when carrying it, etc.), the connectors must be protected by the protective caps.
- 366. After operation, make sure that the mode switch is set to "O"!
- 367. It is not permissible to carry the radio station by the connecting cables or the antennas.
- 368. All portable or antenna cables must not be bent at an acute angle. This reduces their service life. Do not use violence when pulling the suspension or directional antenna. Do not disconnect the cable connectors by pulling the cable.

369. The antenna rods must not be subject to frequent bending. The rotation of rod antennas to a smaller diameter than the width of the bag is not permitted.
370. The strap ends attached to the suspension pins of the radio station or battery box must not be over-stressed in the direction of the pivot pin axis.
371. When the radio station is stored for a longer period, all parts of the kit must be stored in the shipping container. The exception is the resources that need to be recharged during storage.

2. Basic treatment

372. Keep the radio station dry and clean, especially acoustic transducers, to protect against rain and water.
373. The contact and connector parts of the connectors must be kept clean. Cleaning should be done with a dry cloth or brush.

When cleaning the contacts of the 19-pin connector on the radio station panel, the source must always be disconnected!

374. The wire antenna wires must be protected from corrosion once a year by resistin ML.
375. Once every six months it is necessary to unscrew the passages of radio station cabinets and sources, dry the set for at least one hour at a temperature up to 50 ° C. The same must always be done when the set is exposed to excessive humidity.
376. To facilitate the screw connection of the 19-pin connector, it is necessary to lightly lubricate the threads of the panel connector with frost-resistant grease every three months.

To improve the function of the hinges for connecting the source at the bottom of the radio station, it is necessary to lubricate the edges of these hinges with frost-resistant grease approximately

once every three months.

377. The passages of the radio station cabinet and dust battery box must be cleaned with a dry brush. The mud can be cleaned with clean water directly on the radio station or at the source. If grease is contaminated, it is necessary to unscrew and clean the vents in clean gasoline and dry after cleaning.

378. The following parts must be conserved once a year with Resistin ML: radio station and source pins, screw heads holding the set panel and the source cover, hinges and connecting pins for the source, the stopper key pad.

379. If the radio station is immersed in the water, the connector contacts and the radio station connector are cleaned immediately, as well as the sources of clean water, a cling or a brush of mud and dirt. After thorough drying, apply a weak layer of grease-resistant grease on the functional surfaces of the connector and connecting cap.

3. Technical Treatment No. 1 (TO1)

380. We perform the Technical Treatment No. I on a regular basis every quarter of a year (regardless of whether the radio station has been deployed) or after each deployment takes more than seven days.

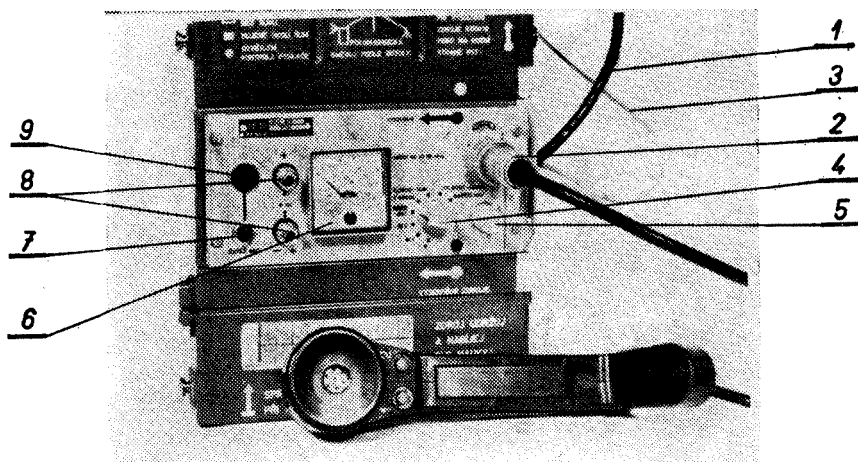


Fig. 90. Control device KZ-10

1 - cable with 19-pin connector; 2-panel 19-pin handset connector;
3-coaxial cable with connector; 4 - switch switch; 5 - a box for
setting the nf level; 6 - I measure the arrival; 7 - "LOAD" button; 8 -
clamps; 9 - "LOAD"

Part I of the technical treatment No. 1 is the execution of all works under Articles 373 to 380. The inspection of the parameters of the radio station and the state of the power allows the KZ-10 control device. The check of important parameters is informative and simple, it is intended only for technical treatment no. The check allows to decide whether any fault can be identified and removed, or hand over the station for repair.

381. The device allows to check the battery voltage, to check the consumption of the set and to check the power of the transmitter. Check the sensitivity of the receiver, whenever you use the radio to operate. In addition, the built-in measuring device of the KZ-10 can be used to measure DC voltages up to 10 V and up to 30 volts.

Note. The KZ-10 control device is described in detail in United-21-57 / 2.

a) Connection of the control device

382. From the radio station Disconnect the power supply. We connect the control device in its place to the radio station box. (Power Supply) to the bottom of the KZ-10. The method of connection is the same as the battery box connection to the radio station cabinet. Connect the cable with the 19-pin connector to the radio station panel connector (see 8 in figure 80) instead of the handset. Connect the handset to the connector (see figure 2, fig. 90) of the control device. Coaxial cable with connector (position 3, figure 90) is connected to the radio antenna rack antenna connector (position 2, fig. 80). The radio station assembly and the KZ-10 monitoring device are shown in Figure 90.

b) Checking the radio station

383. Check the battery. Set the switch (position 4) to "VOLTAGE". The radio station is off. The gauge (position 6) shows

the voltage of the sources. Pressing the "LOAD HOLD" button (position 7) loads the batteries with the current corresponding to the maximum subscription of the radio station, simultaneously the "LOAD THE BURNER" light (position 9) lights up.

The rated voltage of the power supply is 6 V. The fully charged source has a voltage of 6.5 to 7 V. The value must not drop by more than 0.5 V when the "BATTERY LOAD" button is pressed and must not be less than 5.5 V. If the voltage Sources less than 5.5 V, you must charge the power immediately.

384. Check radio station consumption. Set the switch (position 4) to "set COLLECTION". We switch the mode switch to the "-" position. The meter (position 6) must show 230-300 mA. When switching the handset button to the transmitter, the meter reading is 750 to 950 mA. When switching the mode switch of the radio station to one of the "A" positions and "the subscription tax is 80 to 150 mA when received. The meter pointer is unstable - oscillated. The radio station operates in so-called "economical" operation - with intermittent reception. However, you need to verify by listening in the handset whether the radio station receives any signal.
385. Check the sensitivity of the receiver. The radio station is switched to the "Q" position. The set is tuned to the frequency shown on the panel of the KZ-10 control device. Set the switch (position 4) to KZ-10 to "SHUT". The gauge (position 6) is set by the knob (position 5) to full deflection. When switching to the "SIGNAL" position, the deflection drops below 20% of the earlier displacement.
386. Transmitter performance check. If the radio station is switched to one of the "A" or "Q" operating mode switches, the switch (position 4) of the control device is in the "RF POWER" position. We press the handset button, the radio station switches to broadcast, the gauge of the gauge (position 6) shows at least a red field marked "1 W". This check can be performed without the KZ-10 connection between the radio station and the battery box, without connecting the handset to the control device (the handset is connected to the radio station). It is sufficient to connect the connector (position 3) to the coaxial connector on the radio station

panel (position 2 in Fig. 80). Thus, the KZ-10 can be used to measure the power of the radio station separately.

387. If any of the checks do not agree, the radio station must be handed over for more accurate verification of the parameters by the ZZ-10 for the Technical Treatment No. 2.

c) Voltage measurement

388. The KZ-10 can be used as a voltmeter for DC voltages in the range of 0 to 10 V and 0 to 30 V. Measured voltages are connected to the terminals (position 8 Fig. 90) according to the marked polarity and the voltage is read on the meter (position 6) . Selecting both measuring ranges is done by the switch (position 4).

Note. We disconnect the KZ-10 control device in the opposite way than connecting it. It is first necessary to turn off the radio mode switch (position "O") and switch (position 4) of the control device (position "O"),

4. Battery maintenance

389. Radio station batteries are very important to maintain and service the demanding part of the kit. Their value is considerable and the influence of the technical state and the charge of batteries on the combat value of the radio station is essential. Therefore, great attention should be paid to the maintenance and charging of the power supply.
390. There are two battery cabinets with charged batteries in the portable radio set. If the kit is out of service for a long period of time, the battery boxes should be stored separately from the kit, and every two months, the battery should be charged in the prescribed manner.
391. During storage, the battery capacity is reduced by about 25% in 15 days from the last charge, and it is necessary to count on the battery before using the kit. After a period of more than 15 days after the last charge, it is necessary to recharge the batteries before operation. The best ambient temperature when charging is $+20 \pm 10$ °C. Charging is done with a current of 450 μ A for 16

hours. When charging, the battery box must always be upward.

392. The battery voltage must not fall below 1.0 V per cell when operating. On the battery box terminals (source connector), the voltage must not drop below 5.0 V. If the voltage is lower than 5.0 V, the power supply must be charged. When operating with a radio station, check the status of the sources according to Chapter 5, Section 13.

If the radio station is out of order, always check it

Switch off - O-position of the mode switch.

393. The battery box has a self-adhesive label with columns for the source charging data and one block for the current number of charging. Recording must always be done after each charging of the source by specifying the end of the charging day. After writing the label, we will replace the label with a replacement from the set and enter the total number of the preceding charge in its side section. One table is enough to record 20 charges.

After each charge should be inspected and treat the contact of source connector.

394. When carrying out the technical treatment No. 1 (TO 1), it is necessary to open the battery box and a cloth or soft brush to clean the deposit of salt that may occur in some source cells.

CHAPTER 7

TRANSPORTATION AND STORAGE

395. The radio station may be transported by all common means of transport (cars, off-road vehicles, railways, aircraft, boats, etc.). For long transport in the shipping container, technical treatment No 1 under Chapter 6, Stage 3 must be carried out.

396. During storage, the set has a long-term ambient temperature of -22 to +35 °C at a relative humidity of 75% or less in a dust-free environment without chemical influences and mechanical vibrations. The packages in the shipping container can be stored up to a maximum of 5 pieces. During storage, it is necessary to ensure the maintenance of the source according to Chapter 6, Stage 5.

After two hours of acclimatization in an environment with normal conditions, the radio station meets all basic parameters and requirements according to the technical conditions (Chapter 1).

Technical treatment No. 1 is to be carried out 4 times per year under Chapter 6, Stage 3.

397. For long-term storage, battery boxes need to be stored separately from the radio station for reasons of battery recharging.

398. In short-term storage, the kit is held at a temperature of -35 to +50 °C at a relative humidity of 98%. During this storage, it is always necessary to carry out the technical treatment No. 1 according to Chapter 6, Stage 3.

CHAPTER 8

DEFECTS AND THEIR REMOVAL

1. All provisions

399. The radio station RF-10 is a complex electronic device. In most cases, the repair and load requirements require a set of sophisticated and cost-effective devices. Changes and repairs of the block or perimeter of the unit can only be carried out in fully equipped dwellings, while maintaining the repair methods according to the original and repair documentation.

400. Most repairs outside the fully equipped centers, ie with the use of a device for technical adjustment c.1 or c.2 (KZ-10 or ZZ-10), will focus on replacing fuses, clamps, accessories, or replacement on whole blocks set.

The steps to remove the load are processed in the following table.

2. Fault & Fault Table

No. 1.	Fault 2.	Cause 3.	Remedial Action 4.
1	Set is on, signaling glow not blinking or lit		
	a) The bulb "- + -" battery boxes (Chapter 5, page 13)	Blown source fuse	Replace fuse
		Defective battery	Replace the battery
		Interrupted battery connections	repair resources
		Burned source light bulb	Replace bulb
	b) source bulb glows faintly	The source is discharged	Charge source
	c) the light bulb is lit normally. On the handset connector of the set there is no 6 V	Contaminated or spring-loaded contacts of the battery box or cubicle connector	Cleaning, preservation of contacts (Chapter 6, page 1) Contact springs
	d) the light bulb is lit normally. On pin connector handset - 6N voltage 6 V - 5N not 5V - 12N not 12-14 V.	blown fuse	repair fuse
		Faulty voltage converter	Replace the inverter
	e) the light bulb is lit normally. At the terminals of the handset connector: - 6N is 6 volts - 5N is 5V - 12N is 12 to 14 volts	The glowing circumference is interrupted	Measure gauge circumference
		Faulty bulb	Replace the bulb

No. 1.	Fault 2.	Cause 3.	Remedial Action 4.
2	set switched on, mode switch in "Qi" position, receiver input without signal, no noise in the earpiece, signal glow flashes (light)		
	a) there is no noise in the handset	A faulty handset, its cord or connector	Replace the handset
	b) Nor is there noise in the authenticated handset, the SN connector of the SN connector is 5 V	Faulty panel nf connector	Repair or replace the nf connector
		Faulty AF amplifier	Replace amplifier and interrupter
		Faulty IF amplifier	Replace IF Amplifier
	c) Verifiable handset without noise, there is no 5 V voltage on the 5N connector socket	Defective stabilizer	Replace the stabiliser
	d) The verified handset is no noise, 5N is 5V	Incorrect noise limiter circuit function	Set or replace part of the amplifier and interrupter
3	<p>Rast on, glow flashing (on), "Q" in the "Q" mode switch is heard in the handset, "A", "noise" does not disappear, it only changes its level.</p> <p>Voltage at the terminals of the nf connector:</p>	Incorrect noise limiter circuit function	Replace or adjust part of the amplifier and interrupter

No. 1.	Fault 2.	Cause 3.	Remedial Action 4.
	- 5N is 5V - 6N is 6 volts - 12N is 12 to 14 volts		
4	Set switched on in some of the operating mode switch positions, "A", "what" ".". The signal glow flashes (on), the receiver is not receiving, the noise in the operating mode switch "is unchanged and the signal of the corresponding rhythm		
	a) the nf connector 11N does not have a voltage of 22 V if it switches to a frequency of 53.975 MHz	Faulty stabilizer 22.5 V	Replace the stabilizer part
	b) The nf connector 11N has a voltage of 22 V, set tuned to 53,975 MHz	Faulty divider in the frequency exchange	Replace the frequency switchboard
5	set on, the glow plug blinks (lights up), mode switch is in "Q" position, green bulb "Q" is not lit when the "RECEIVE - TRANSMIT" button is pressed		
	a) See fault 4 a)	Faulty stabilizer 22.5 V	Replace the stabilizer part
	b) the nf connector 5N	Defective	Replace the

No. 1.	Fault 2.	Cause 3.	Remedial Action 4.
	connector does not have a voltage of 5V	stabilizer 5V	stabilizer part
	c) The 4N connector terminal 4N is free of voltage at the frequency of 6.25 kHz	Faulty part of the reference frequencies	Replace part of reference frequencies
	d) The outlet of the nF connector 1N is free of voltage from 50 to 60 MHz	Faulty part of the reference frequencies	Replace part of reference frequencies
		Faulty frequency switchboard	Replace the frequency switchboard
		Faulty main oscillator	Replace the master oscillator part
	e) The antenna does not radiate power	Faulty transmitter	Replace transmitter part
	f) antenna radiates power, connection can be established with another set	Faulty bulb	Replace bulb
6	set switched on, control according to Chapter 5, Stage 6 complies, operating mode switch IN »A'S» d? ":" Will- "3 in the" \$ "position the bulb" \$ "lights up		
		Faulty extension inductance L851	Change the inductance
	a) No connection can be made to the rod antenna, with a suspension antenna or a long-range directional	Interrupted connection between antenna	Repair with soldering

No. 1.	Fault 2.	Cause 3.	Remedial Action 4.
	antenna, a connection can be established up to the range for the respective antenna	connectors	
	b) no connection can be established with any antenna; the antenna does not comply with Chapter 6, Stage 2	Interrupted C851 safety capacitor	Replace the capacitor
7	The set operates at all positions of the operation mode switch with degraded parameters, the voltage at the nf connector 6N is less than 5 V, the red bulb &, + - on the set panel is off		
	a) at point 117 of the PBX, the voltage of the source	Defective voltage indication circuit	Replace the frequency switchboard
	b) there is no power supply voltage at point 117 of the PBX	Burned bulb from 801	Replace bulb Z 801
8	Self-serving works normally, complies with all checks under Chapter 5, Stage 2 and Chapter 6, Stage 2, with rod antennas having normal range, when using a suspension or long-range directional antenna, the reach is	Mechanical damage to the antenna	Replace the antenna
		Mechanical damage, short circuit or broken connection cable or connector	Replace the antenna cable or connector, or repair soldering

No. 1.	Fault 2.	Cause 3.	Remedial Action 4.
	very small		
9	set works normally, complies with all checks under Chapter 5, Chapter 2 and Chapter 6, Stage 2, Runtime is short, with other source normal operation time	Discharged or insufficiently charged source	Charge source
		A defective battery	Check the battery packs, replace the defective cell
10	set works normally, occasionally drops reception or broadcast		
	a) Listening to headphones is lost	Cable or acoustic kit connector failure	Replace the kit
	b) In the position of the operation mode switch "n" "even in the near future, suddenly there is a sudden noise	Mechanical damage to the antenna	Replace the antenna
		Mechanical damage, short circuit or broken connection cable or connector	Replace the antenna cable or connector or repair the brazing
	c) The first time pressing the "RECEIVE - BROADCAST" button goes back to reception	Cable or acoustic kit connector failure	Replace the kit
	d) The first is still transmitting when you press the "RECEIVER - TRANSMIT" button, however, the modulation omit "	Cable or acoustic kit connector failure	Replace the kit
		Malfunction of acoustic kit microphone	Replace the kit

APPENDICES

Waveforms of pulse and a truth table "FOUR input divider (position 01161)

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