KV antenna tuners. Matching devices, antenna tuners. Antenna tuner design from RZ3GI

Antenna matching device (ACS or antenna tuner) is an integral part of the radio. The device is required to match the donor antenna with the settings of the radio station connected to it or the transceiver. The matching device is most often performed by an individual block placed in the total chain near the input antenna cable in the radio (transceiver).

Classification of ACS.

The most popular are the following ACS:

- antenna tuner with unbelievable settings. Designed to work in a narrow frequency range;
- matching device for antenna on discrete LC elements;
- an antenna matching device based on chains with distributed parameters;
- antenna tuner with availability manual setting;
- antenna tuner for receivers with automatic configuration.

Buy the matching device of any kind, the price of which is at an acceptable level, you can in the company "RadioExpert".

Why should I buy radiobes in "RadioExpert"?

Online store "RadioExpert" is distinguished by the presence of a number positive characteristicswhich are not always peculiar to companies with a similar activity.
The main advantages should be attributed to:

- the company maintains the sale of radiosters directly from manufacturers. It should be noted that suppliers are world-famous companies that are generally accepted leaders in the field of radio engineering. Thus, on the site you can buy a powerful reinforcing device, tuner, a radio and other similar products of production not only Russia, but also the USA, Japan and other countries;
- buy radio services, the price of which is low, can be remotely via the Internet. Resource is shipped to anywhere in Russia and the CIS;
- all goods from the price list provides a guarantee;
- an online store provides complete information support for customers. Thus, if you want to order radiosters inexpensively, but you cannot make a choice yourself, contact consultants. Employees will readily voiced all the operational characteristics of a product and its value.

"RadioExpert" - the number one store for radio amateurs. In the catalog on the site you can find almost any radiostics from all countries of the world. We will be glad to see you among customers!

Send this note I prompted the article in. It was described in itthe design of an antenna tuner, assembled by the T-shaped scheme with good broadband and excluding adjustment when the frequency changes within the same range. Such a scheme, depending on the type of antenna and operating frequency, can suppress harmonics by 10-15 dB.Since the capacitors of the variable capacity from the WEF radio, as recommended in, I did not have, I gathered a tuner on another scheme and with other, more common KPU. In addition, this tuner can work as the simplest antenna switch having an even load equivalent.

For coordinationa transceiver with various antennas can be successfully applied the simplest hand tuner,

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Let Anna Lisovskaya say


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Electric motor speed: Review of effective methods for determining the spindle speed

Sending mail is blocked, how to unlock?

the diagram of which is shown in the figure. It overlaps the frequency range from 1.8 to 29 MHz. The power supply to the tuner depends on from the gap between the plates of the capacitance of the C1 variable C1 applied than it is greater, the better. With a gap of 1.5-2 mm, the tuner kept power up to 200 W (maybe more - for further experiments of the power of my TRX was not enough). At the input of the tuner for measuring the CWS, one of the KSW meters can be included.Although when a tuner's joint work with import transceivers is not necessary - they all have a built-in function of measuring KSV (SVR). Two (or more) HFconnector TypePL259 allowto plugantenna, the "Options Switter" selected with the transceiver is selected using the S2 switcher. The same switch has the "equivalent" position, in which the transceiver can be connected to an equivalent of a load of 50 ohms. Using the relay switching, you can enable "Bypass" and antenna mode or equivalent (depending on the position of the antennas switch S2) will be directly connected to the transceiver.

As C1 and C2, standardKpe-2 withresteashabledielectric 2 h.495 pFfrom industrial household receivers. Their sectionsstrong through one plate. In S.1 The two sections connected in parallel are involved. It is installed on a plate from a plexiglass with a thickness of 5 mm. In C2, one section is involved.

S.1 - galleryHF Switch for 6 positions (2N6Pgalets from ceramics, their contacts are connected in parallel).S2.- the same, but for three positions (2N3P,or for a larger number of positions depending on the number of antenna connectors).

CoilL.2 - Wound naked copper Wired.=1 mm (better silver), total 31 vIToK,windingfromsmallstep, externaldiameter 18 mM., taps from 9 + 9 + 9 + 4shit. Coil L.1 - also, but 10 turns. Coils are set mutually perpendicular.L2 You can solder with the contacts of the gallery switch, bending the coil by a semir. Tuner installation is carried out short thick (d.\u003d 1.5-2 mm) cuts of a naked copper wire.

TKE52PD type relays from R-130m radio station. Naturally, optimal option is the use of higher frequency relays, for example, type REN33. The power supply voltage is obtained from the simplest rectifier collected on the TWEC-110L2 transformer and diode Bridge KC402 (CC405) or to them like. Switching relays is carried out by the S3 "bypass" type MT-1 type installed on the front panel of the tuner. LA lamp (optional) serves as an inclusion indicator.

It may be that low-frequency bands are not enough C2 tank. Then, in parallel C2, it is possible to connect the P3 relay and the S4 relay or its second section or additional condensers (select 50 - 120 PF - in the diagram shown by the dotted line).

Ed. - On the Internet there are similar schemes in which the capacity of the C2 analogue on the 3.5 MHz range reaches 600 PF. In this case, C1 is absent, and the coils L1 and L2 are straight or ball versions with an inductance of 10 µg.

On the recommendation taken from the publication, the axis of the KPU is connected to the control handles through the segments of Dühnite benzososlang, which serve as insulators. For their fixation, tap clamps are usedd.\u003d 6 mm.

The tuner was made in the housing from the "Electronics-Contour-80" set. Several large sizes of the body than the tuner described in, leave sufficient space for the improvements and modifications of this scheme. For example, FNH at the entrance, which coarse the symmetrizing transformer 1: 4 at the output, an inserted KSV meter and others.

For efficient work Tuner should not forget about the good grounding it.

Literature:

1. O.Platonov. Antensed tuner. - Radio, 2009, No. 8, p. 58.

2. I.Podgorny. Antenna tuner. Radio, 1994, №2, p. 58.

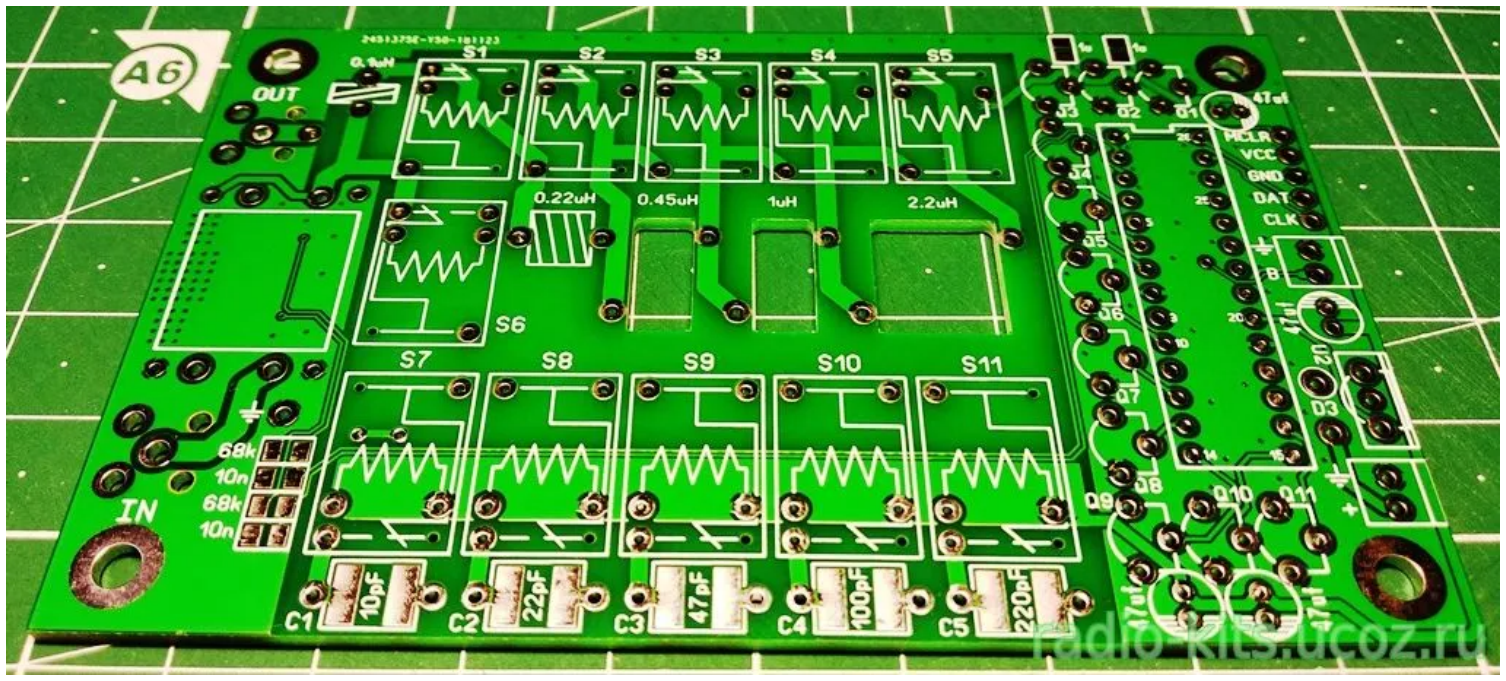
Ivan block.

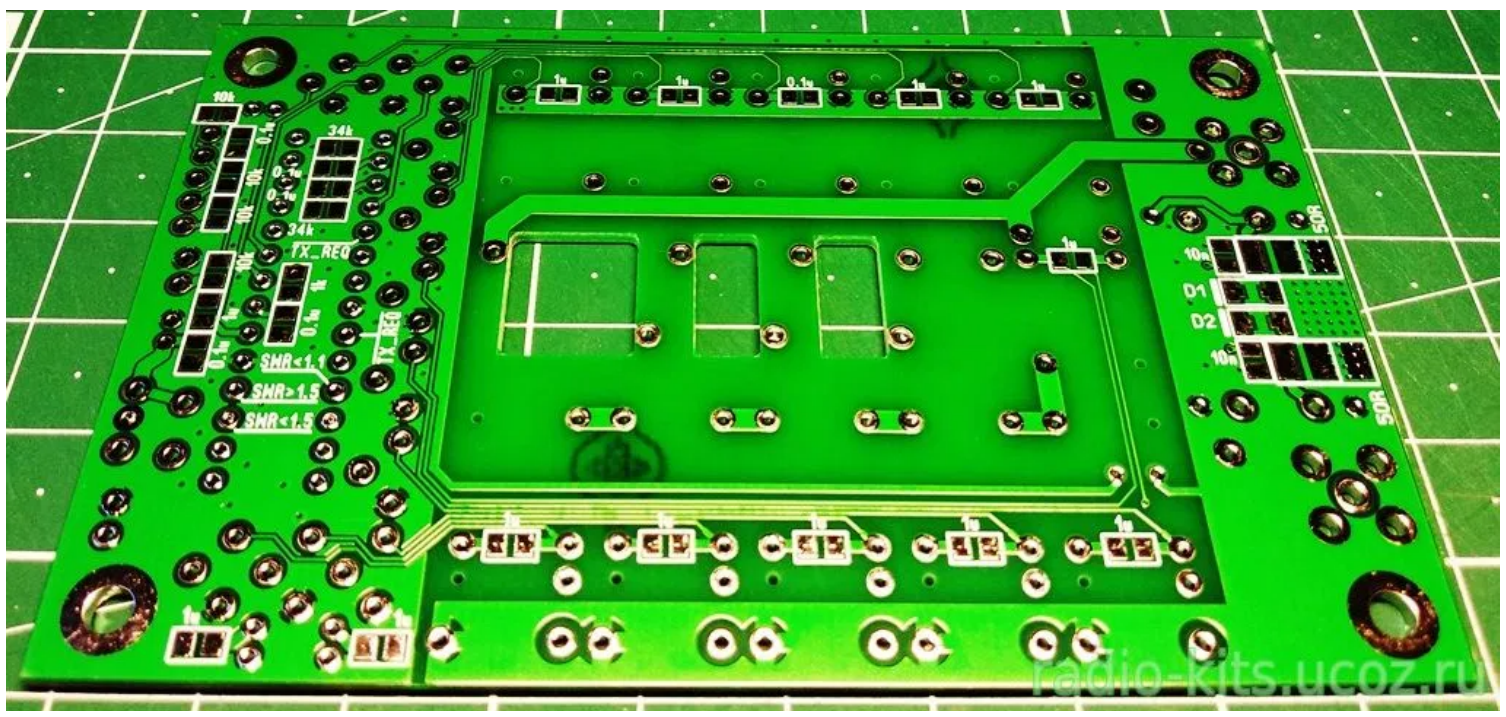
Automatic Antenna Tuner ATU-100 MINI 5X5

The kit is designed for self-assembly of a simple small-sized automatic antenna tuner ATU-100 mini 5x5 developed by David N7DDC, which, thanks to its small dimensions and simplicity, can be built into existing structures with an output power up to 100 watts. You can get acquainted with this and many other no less interesting designs on David's website www.sdr-deluxe.com
PCB sizes 100x62 mm. It has a microprocessor PIC16F1938, five inductors, five high-voltage

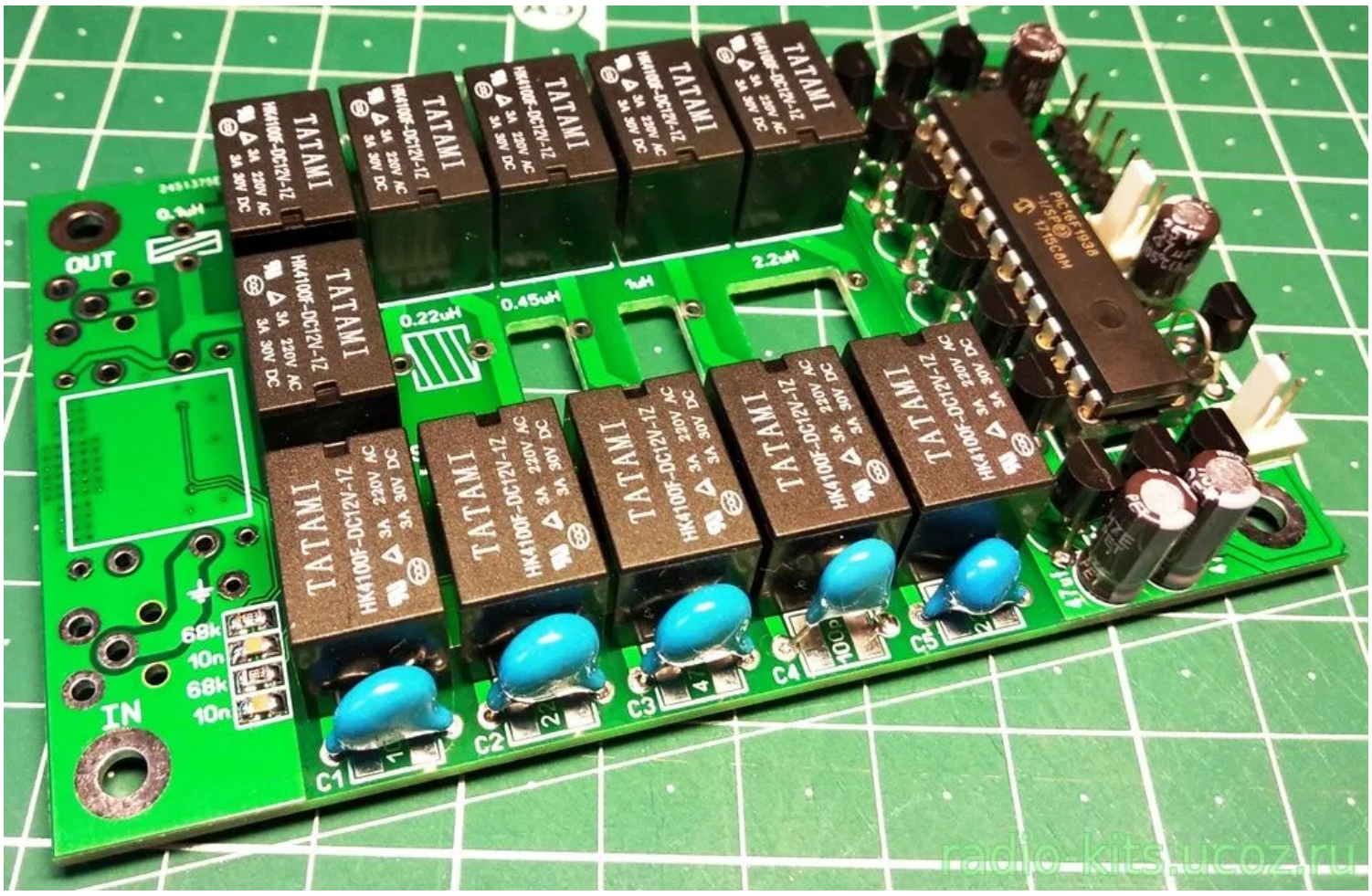
capacitors, relays for switching them, relay control transistors and a direct and reverse power circuit type "Tandem Match". The usual "M-shaped" matching scheme is used. The design of the tuner is simple and technological, collected without errors the device starts immediately, does not require a complex setting or special calibration.

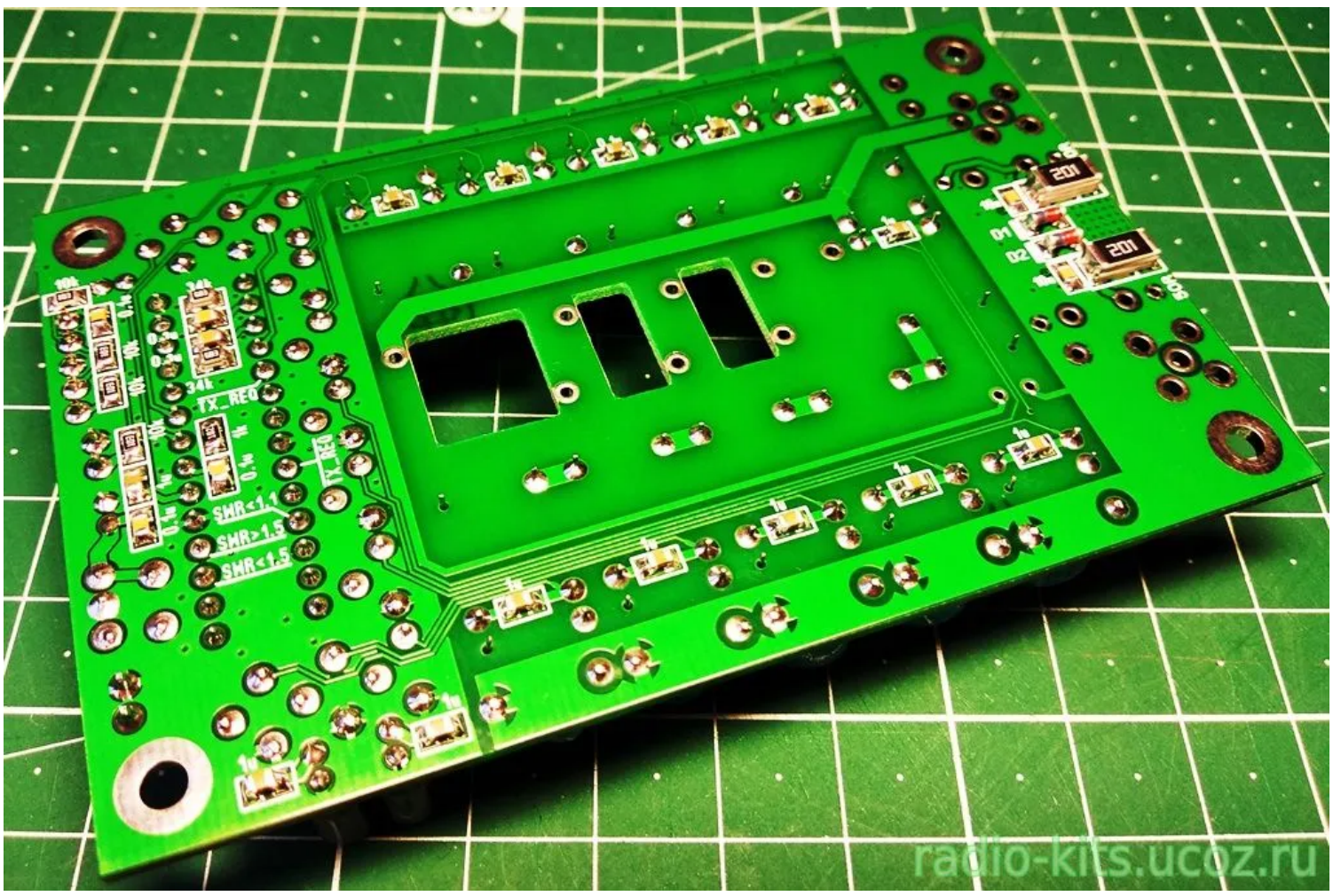
To start the coordination process, it is sufficient to press the button connected to the corresponding connector or close the output using the transistor if it is possible to control the tuner from the transceiver. A unique smart algorithm used in the device allows in most cases setting in 0.1 - 0.5 seconds, and the maximum time spent on the search for the best combination does not exceed two seconds. Thus, there is no need for any additional measures to accelerate work, which causes the limiting simplicity and reliability of the device.
Tuner can be used and how external device In a separate case, including remotely to configure directly at the antenna.
The device allows you to connect to the processor programming a standard two-line display from the I2C control bus, which displays the most important information (output power, CWW and set in the process of coordination ratings of capacity and inductance). A variant of the simplified trio-level LED indication of the result of the antenna coordination (CWS<1.1, KCB<1.5 и KCB>1.5). This can be useful when using a tuner as part of a homemade amplifier or to control the tuner, located remotely.

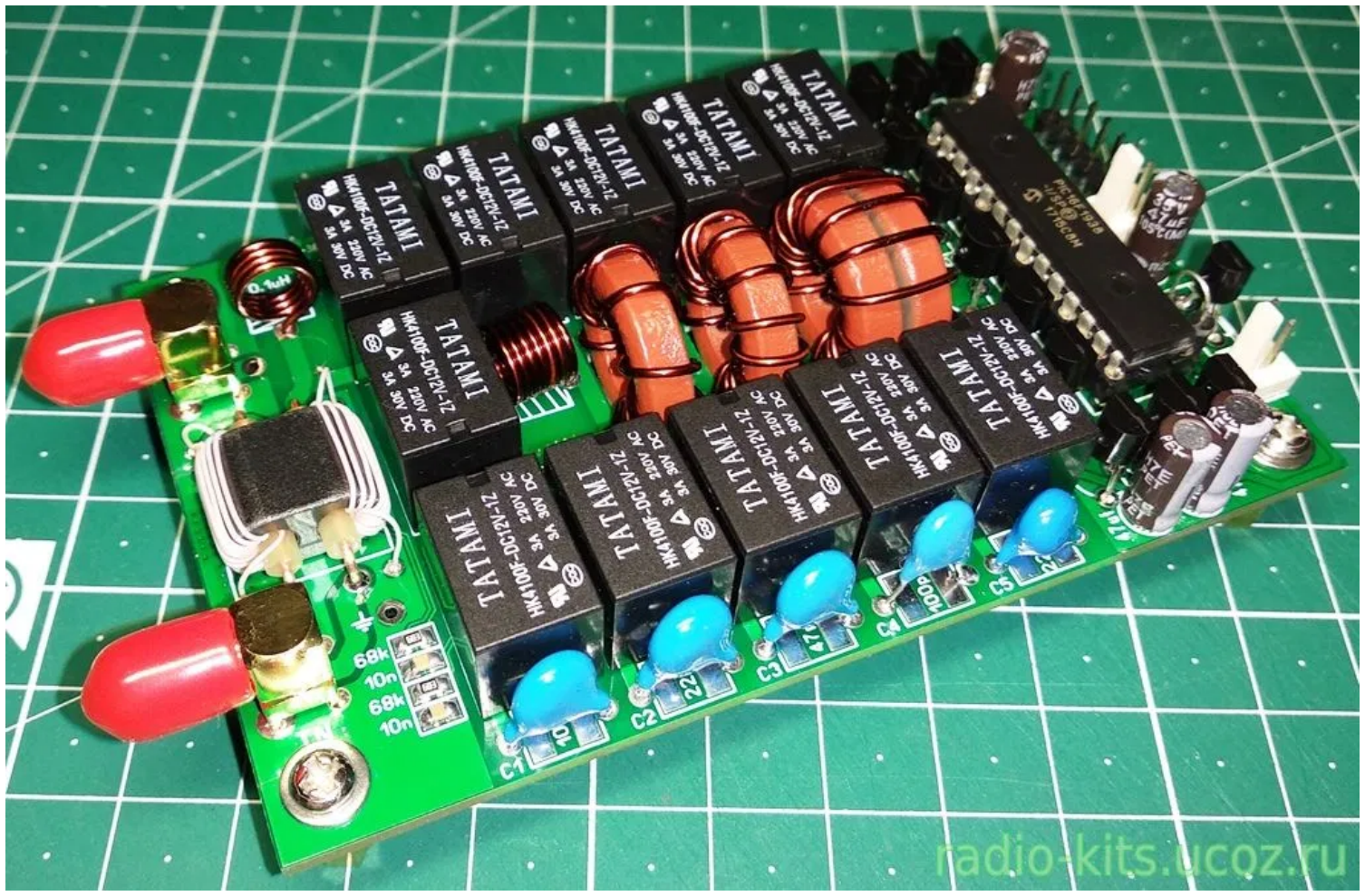


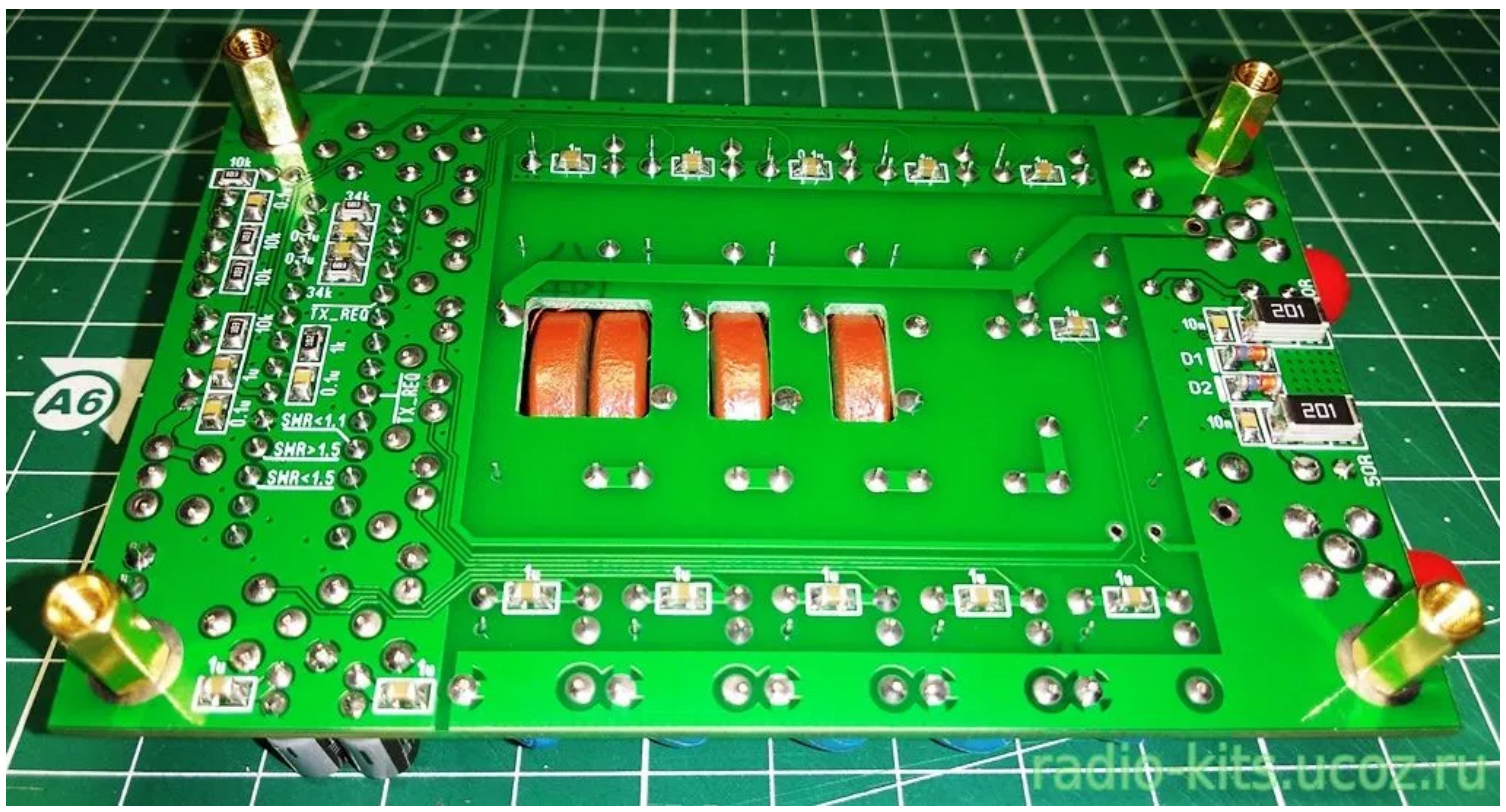


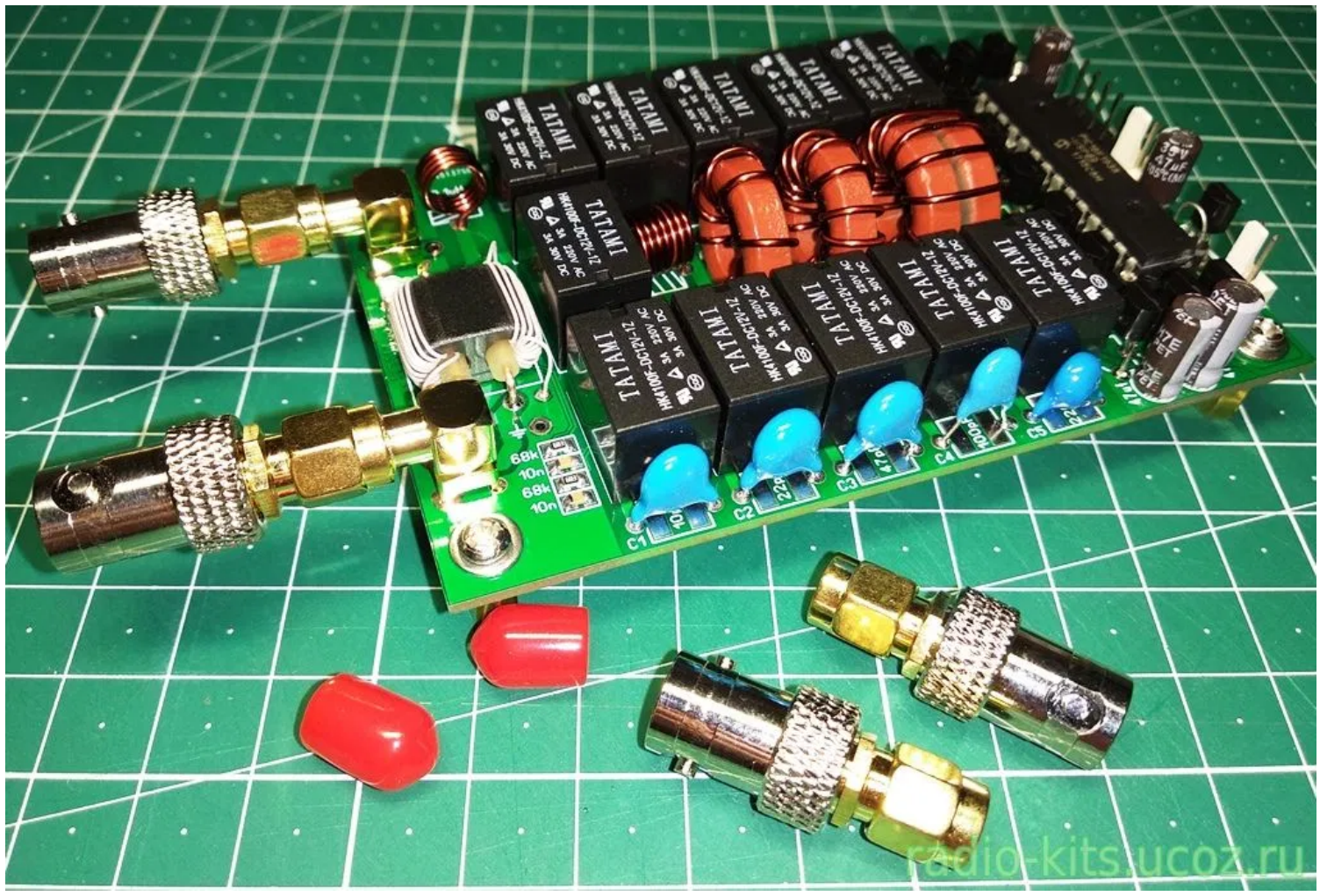
Started assembly :)


TATAMI
HK4100F-DC12V-1Z
3A 220V AC
3A 30V DC
OUT
IN
0.22uH
0.45uH
1uH
2.2uH
68k
10n
68k
10n
C1
C2
C3
C4
C5
radio-kits.ucoz.ru


201
201
D1
D2
TX_REC
SWR<1.1
SWR>1.5
SWR<1.5
radio-kits.ucoz.ru

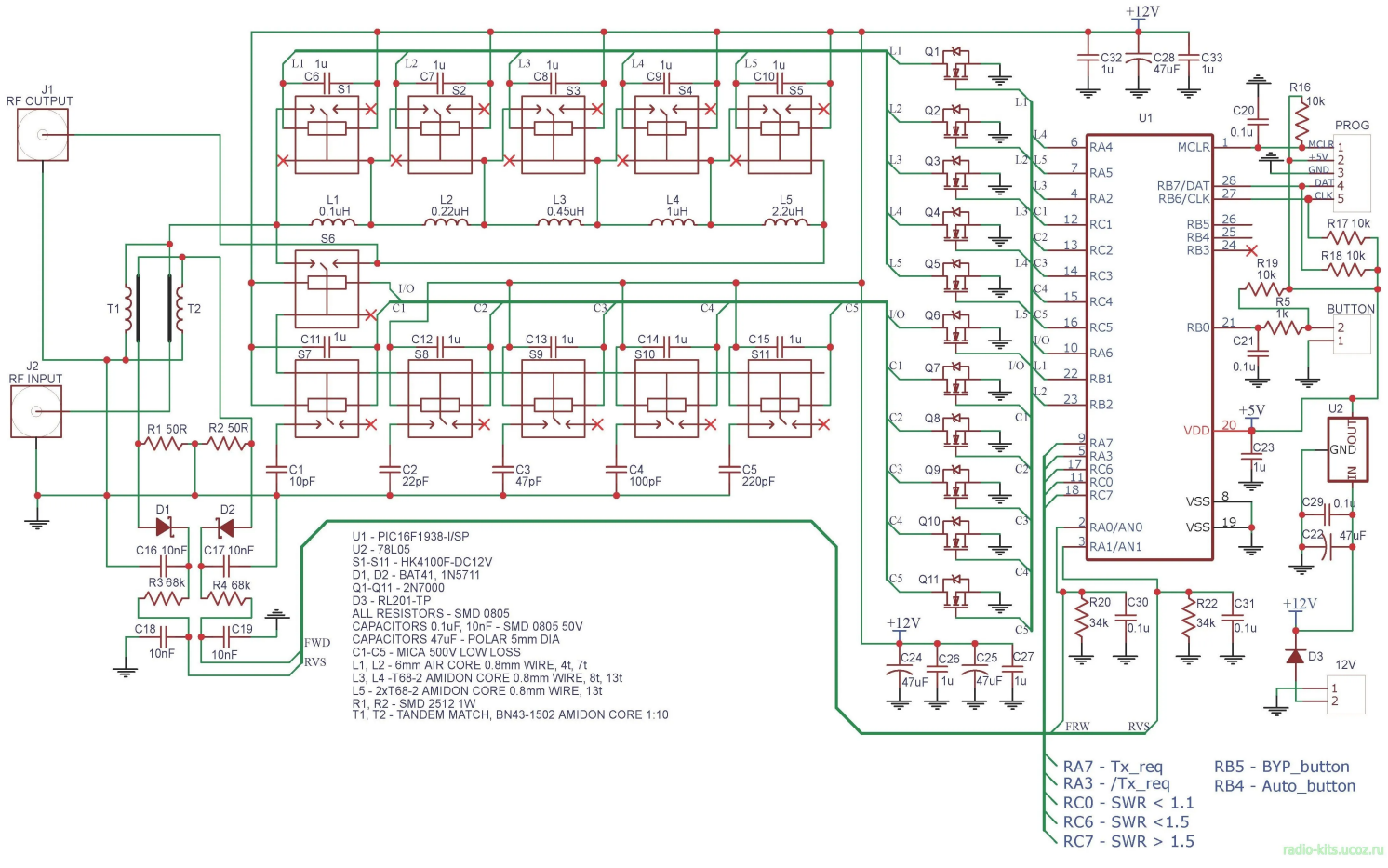

TATAMI
0.1uH
68k
10n
68k
10n
C1
C2
C3
C4
C5
radio-kits.ucoz.ru

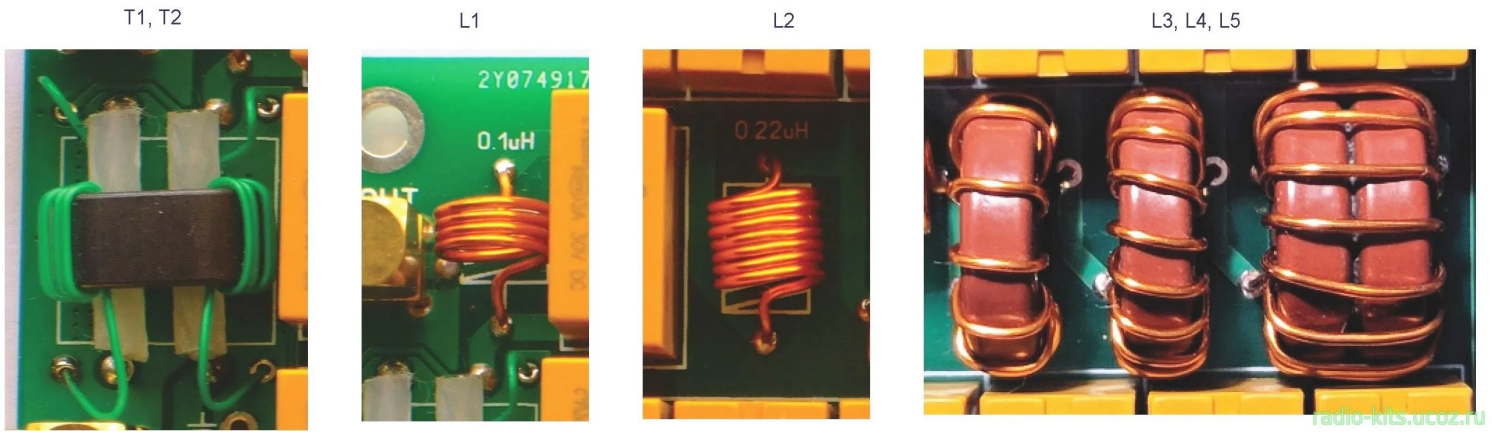

A6
SWR<1.1
SWR>1.5
SWR<1.5
TX_REQ
TX_REQ
201
201
D1
D2
50R
50R
radio-kits.ucoz.ru



The main characteristics of ATU-100 MINI vehicle:
Range of permissible supply voltages: 10 - 15 volts of DC
Maximum consumption current: 300 mA
Maximum working passage: 100 watts
Maximum possible measured power: 150 watts
The minimum power required to start setting: 1 watt
Minimal Possible Measured Power: 0.1 watts
Measurement step at power up to 10 watts: 0.1 watts
Measurement step at power above 10 watts: 1 watt
Power measurement accuracy: 10%
Maximum established inductance: 4 μH
Minimum inductance installation step: 0.1 μH
Maximum Set Capacity: 400 PF
Minimum setting step capacity: 10 PF

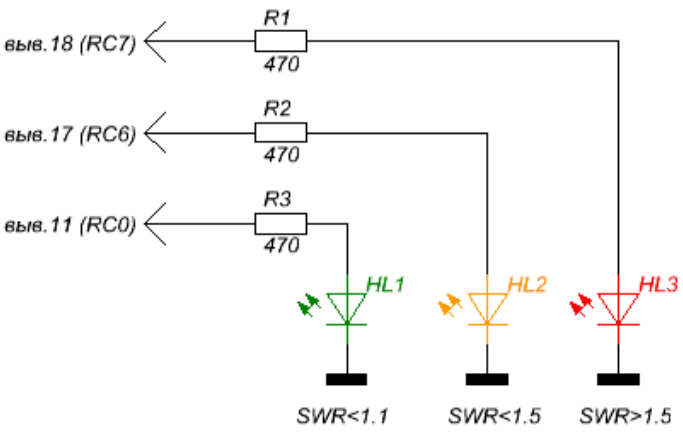
As can be seen from the characteristics, relatively small installed inductance and the container cause a certain compromise. This tuner will not be able to coordinate greater mismatch at frequencies below 7 MHz, for this you will have to use broadband transformers to bring the resistance to more or less close to the 50th value, after which the tuner will lead the mismatch in small limits. From 7 MHz and above it is able to coordinate almost any "rope". The tuner scheme is also shown in the figure below:



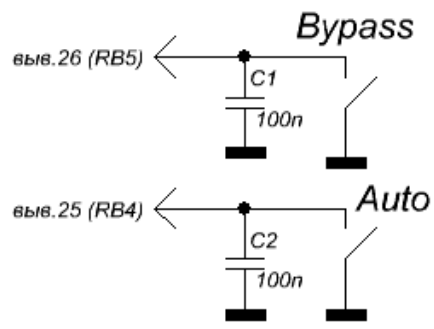


In the firmware version 2.2 A the glorite of which is noticeably more efficient than the algorithm of previous versions both in manual and automatic mode. So, for example, even at 3.6 MHz, the load in 100 ohms (KSV \u003d 2) leads to almost 1, while with previous versions only slightly reduced the KSV to about 1.5. All also R.**it is eliminable to set up the setting with any type of transceiver output signal, now it is not necessary to feed the continuous carrying carrier from the transceiver to configure. You can "allek" into the microphone, blow into it, give a series of points or a dash or simply work as usual, the tuner will wait for a suitable signal and will set up as it arrives. Then if you do not have the ability to connect to the transceiver so that it gives the carrier on request (hello to the owners of Yaesu), now it is not a problem. You can not connect. To make this mode normally work in SSB, it was necessary to raise the minimum power threshold to set up to 5 watts.**
In view of the fact that in the firmware 2.1, 3 control buttons are relevant - In addition to the main button "Tune" (it is short when you press the reset button), two more buttons can be added to the front panel, this is the "AUTO" button (Auto-tuning mode Tuner) and "Bypass" (bypass).

Connecting LEDs simplified trio-level LED indication of the result of the antenna coordination (KSV<1.1, KCB<1.5 и KCB>1.5) and additional buttons must be made according to the following scheme \u003e\u003e\u003e. On the board, these contacts are not bred, i.e. It will be necessary to appear directly to the conclusions of the microprocessor with thin flexible MHTF wires (included in the composition of the dial). Blocking capacitors C1 buttons, C2 size 1206 are best soldered from the bottom of the board directly to the conclusions of the microprocessor.



Подключение светодиодов



Подключение дополнительных кнопок

Little video operation tuner 5x5

Discussion of the design on the forum \u003e\u003e\u003e

Included set (see. List below) For self-assembly there are high-quality two-layer printed circuit board With metallization of holes, mask and labeling and all radio components installed on it: "stitched" microprocessor Pic16F1938-I / SP with a diP28 collet panel (firmware version 3.0), resistors, condensers, diodes, transistors, ferrite rings and a binocular core, Winding wires, connectors, relays. The printed circuit board is designed to install small-sized corner connections SMA, in some cases it may be more convenient to immediately install the standard UHF antenna connectors of the RF (UHF) SO239 (PL259), the slot on the housing or an angular SMA for the soldering on the board - when ordering a set, you can select the desired type of antenna when ordering a set connector, the price will remain unchanged. You can also choose (order) Color LCD indicator: gray signs on yellow-green background or white signs on blue background.

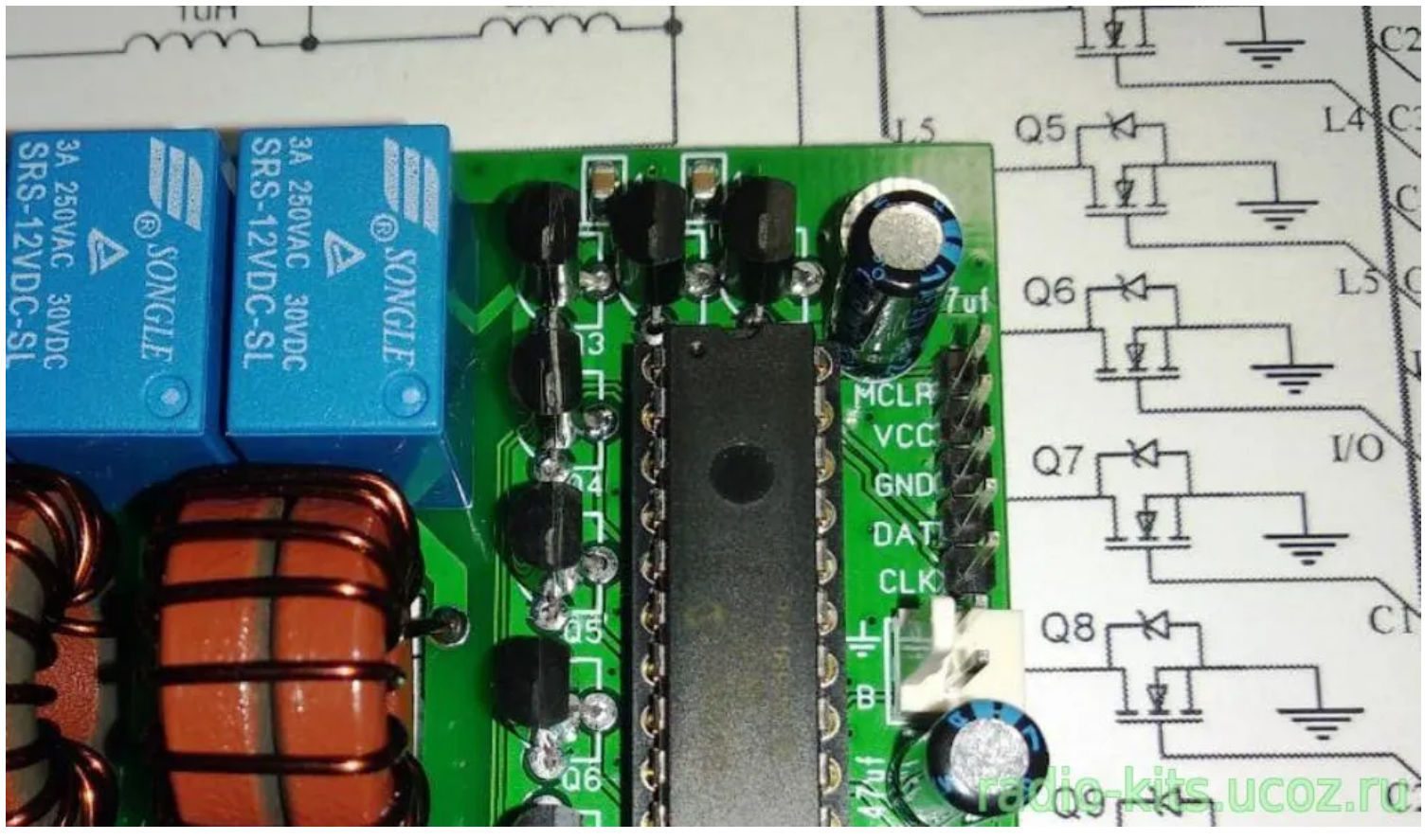
The 5x5 tuner set is offered in several options for configuration:
1. Bilateral printed circuit board with metallization of holes, mask and marking (100x62 mm) - 140 UAH.
2. Double-sided printed circuit board with metallization holes, mask and labeling + full set parts (including LCD 1602 PCF8574 IIC / I2C with backlit), installed on it - 1020 UAH.
3. Collected and proven tuner board with LCD 1602 PCF8574 IIC / I2C with backlit - 1400 UAH.

By default, the set is equipped with: SMA connections for mounting in a fee, 2x16 LCD display with gray signs and yellow-green backlight.

If necessary, you can order adapters:
SMA / BNC - 50 UAH / PC.
SMA / SO239 - 80 UAH / PC.

The composition of the set for assembling the tuner can be seen

Connect the display to the tuner board:

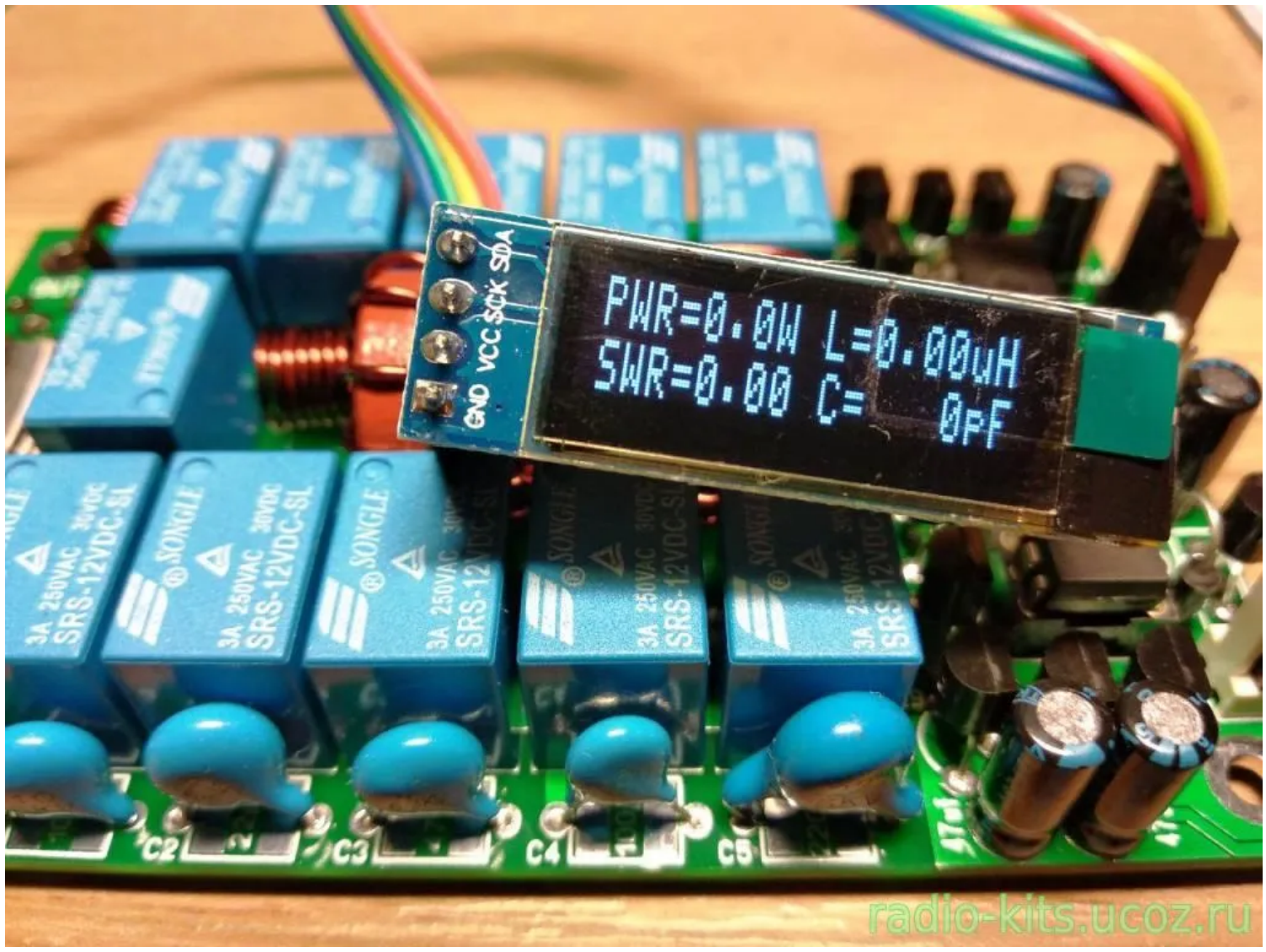


Please pay attention! The contrast of the image LCD display can be adjusted independently. To do this, an instant resistor is installed on the I2C adapter board (in the photo square blue). To reduce power consumption, for example, in the field, the display lights can be turned off - remove the jumper on the adapter board. Alternatively, switching on / off the backlight can be organized using a toggle, while it is enough to connect it to pin contacts on the I2C adapter boards instead of jumper :)

Connecting two-level displays 1602 with an I2C adapter is performed by a 4-wire loop. Contacts on the tuner board are connected to the contacts on the I2C adapter board in the next combination (the tuner card contact is the contact of the adapter board):

MCLR - not used
VCC - VCC.
GND - GND.
Dat - SDA
CLK - SCL.

WHITE Oled. DISPLAY

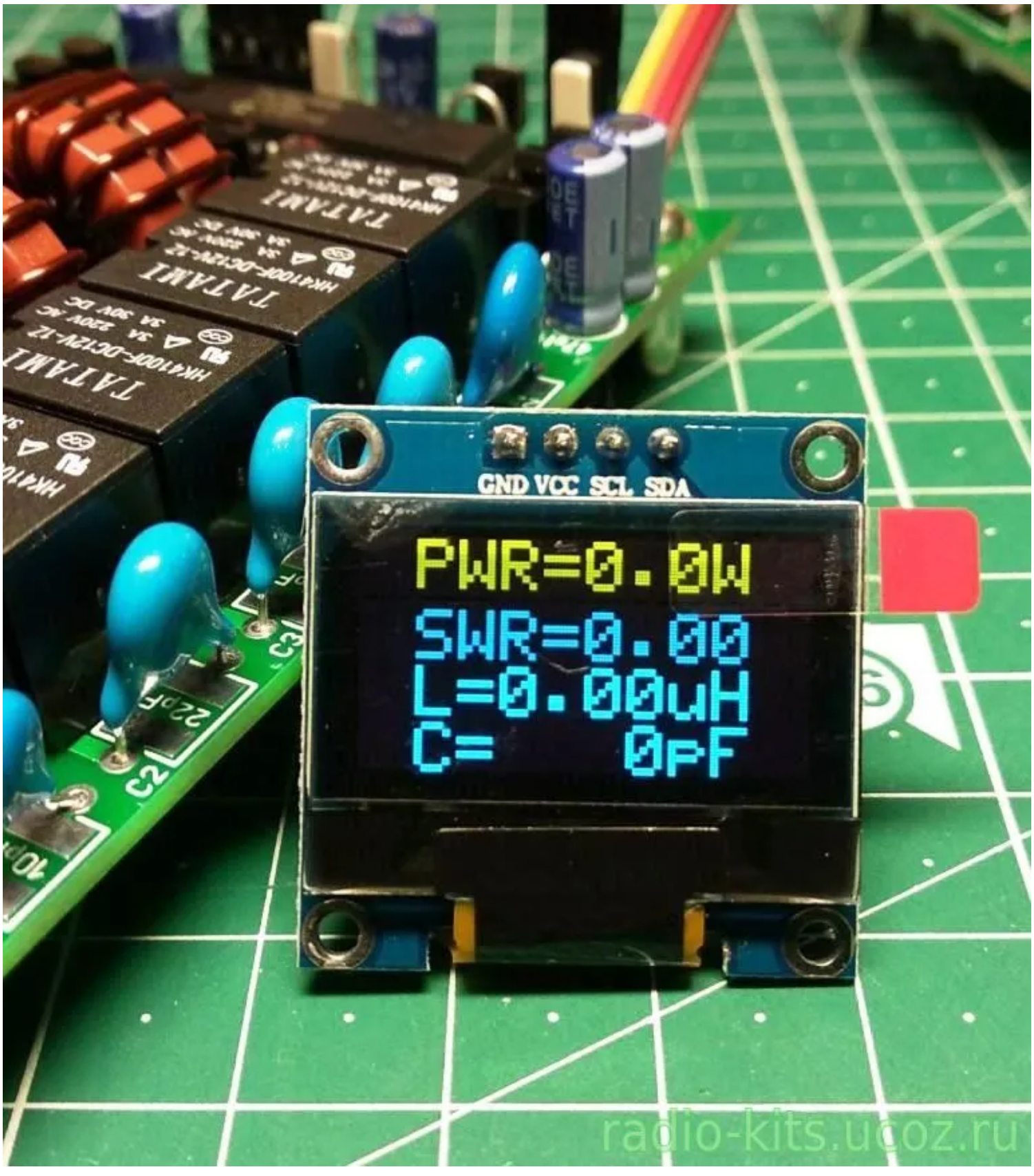


BLUE Oled. DISPLAY

Connecting two-level OLED displays is performed by a 4-wire loop. Contacts on the tuner board are connected to the contacts on the display board in the following combination (tuner card contact - the display of the display board):

MCLR - not used
VCC - VCC.
GND - GND.
Dat - SDA
CLK - SCK.

Blue-yellow Oled. Square display (still there White and Blue)

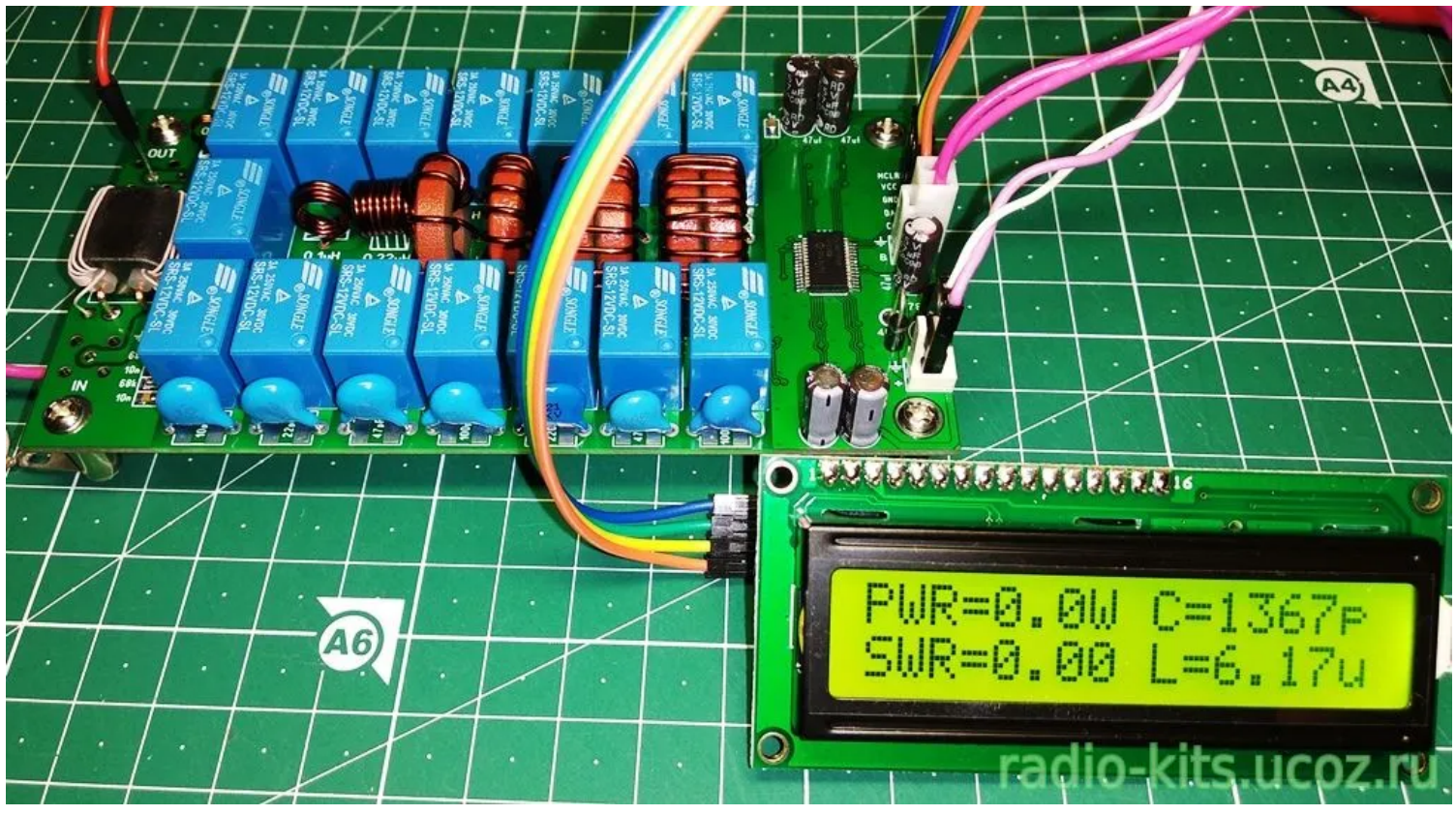


Connecting square :) OLED displays are performed by the 4-wire loop. Contacts on the tuner board are connected to the contacts on the display board in the following combination (tuner card contact - the display of the display board):

MCLR - not used
VCC - VCC.
GND - GND.
Dat - SDA
CLK - SCL.

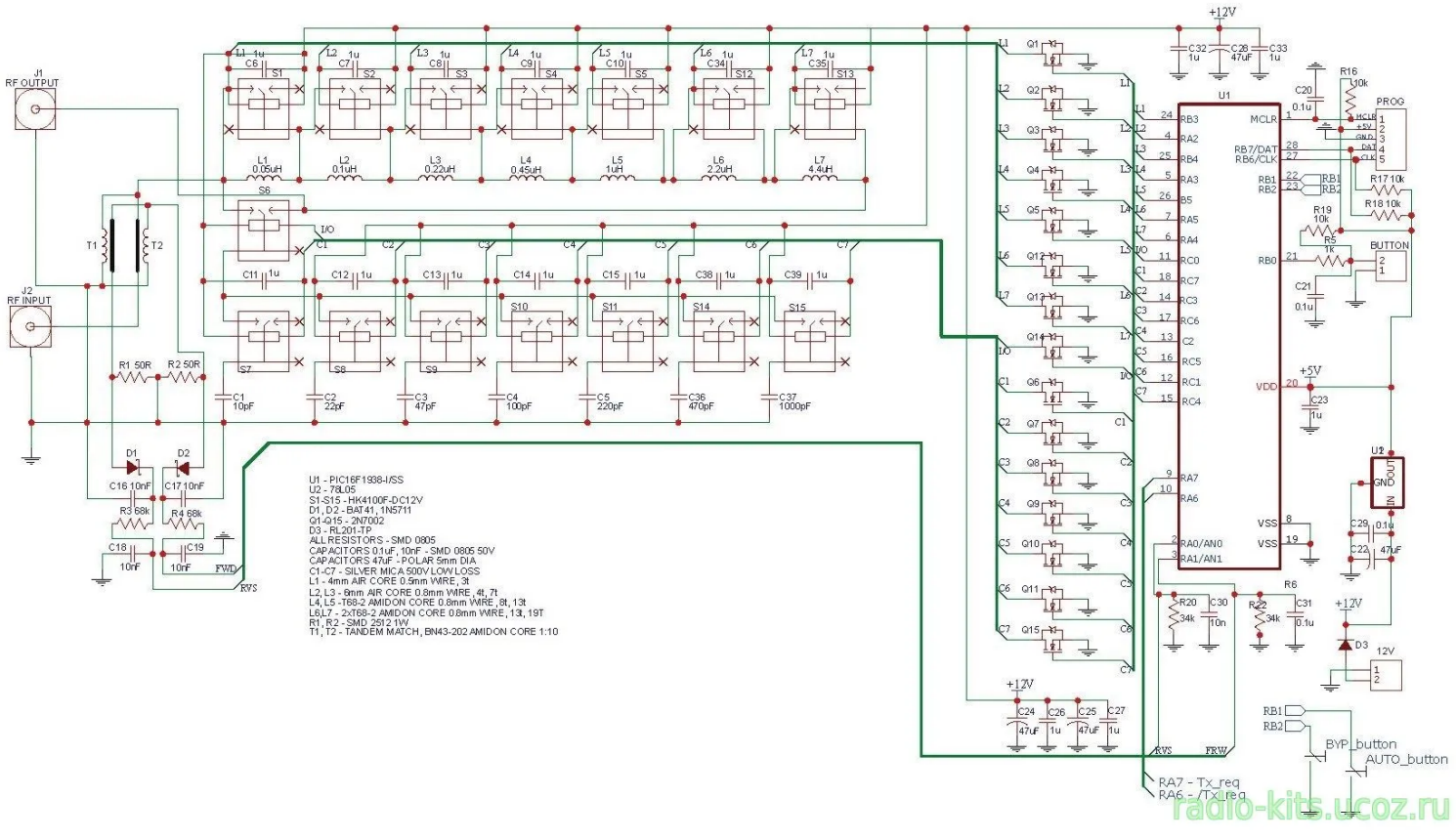
Automatic Antenna Tuner ATU-100 MINI 7x7

The kit is designed for self-assembly of a simple small-sized automatic antenna tuner ATU-100 mini 7x7 developed by David N7DDC, which, due to its small dimensions and simplicity, can be built into existing structures with an output power up to 100 watts.
The size of the printed circuit board is 120x62 mm. It has a microprocessor PIC16F1938, seven inductors, a seven of high-voltage capacitors, relays for switching them, relay control transistors and a direct and reverse power circuit of the Tandem Match type. The usual "M-shaped" matching scheme is used. The design of the tuner is simple and technological, collected without errors the device starts immediately, does not require a complex setting or special calibration.

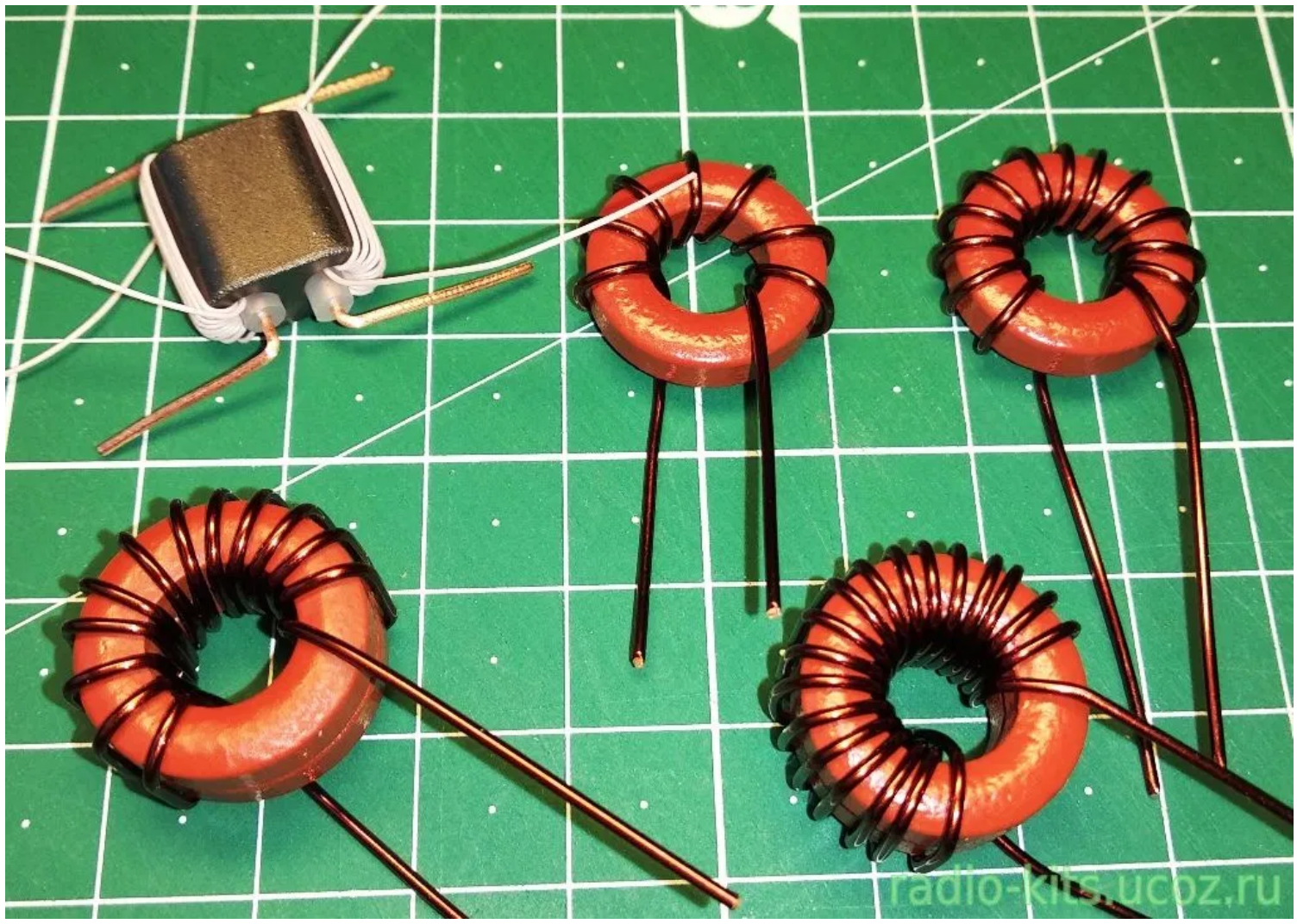


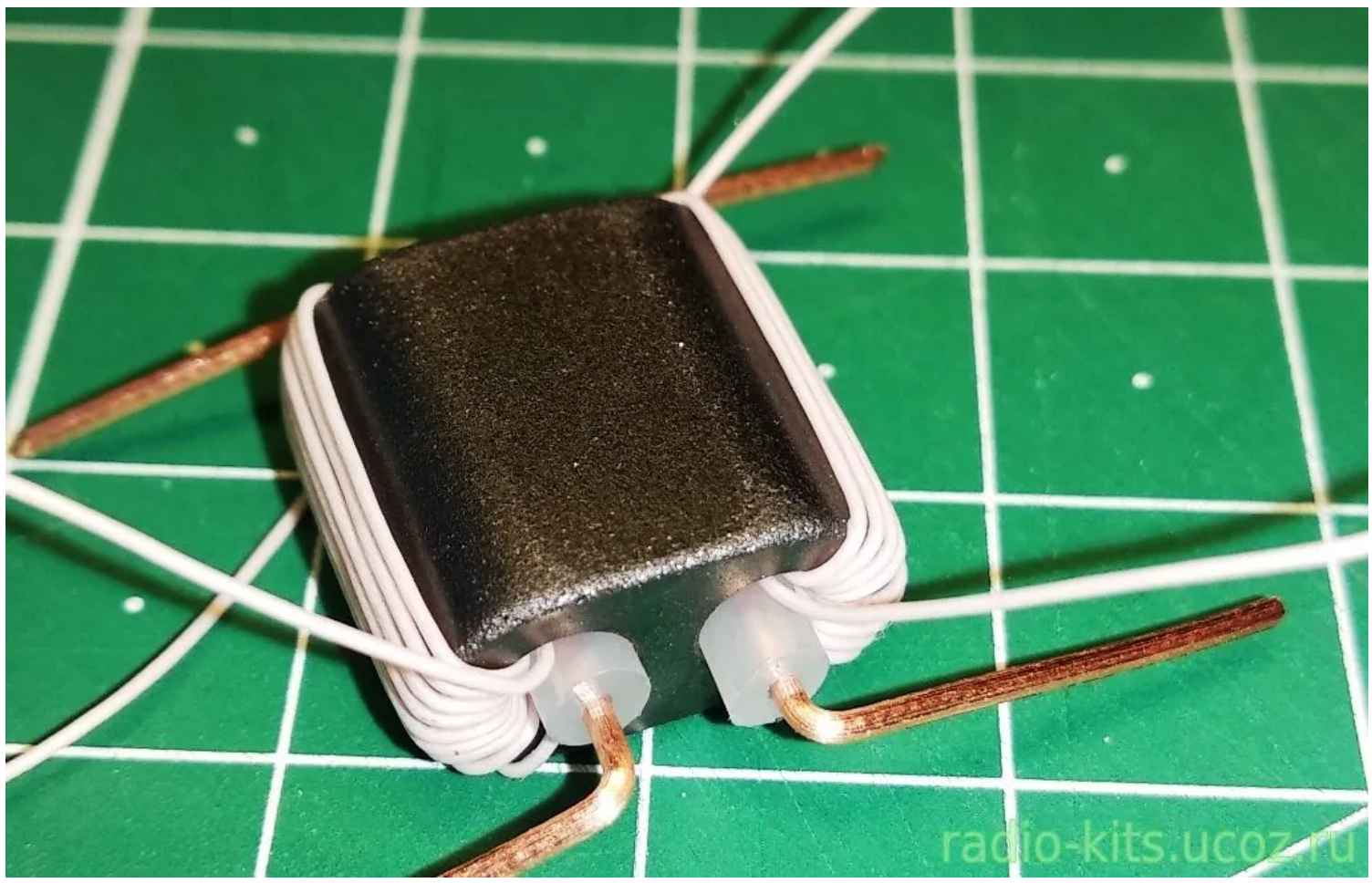
All the above taper 5x5 is true for this tuner :)

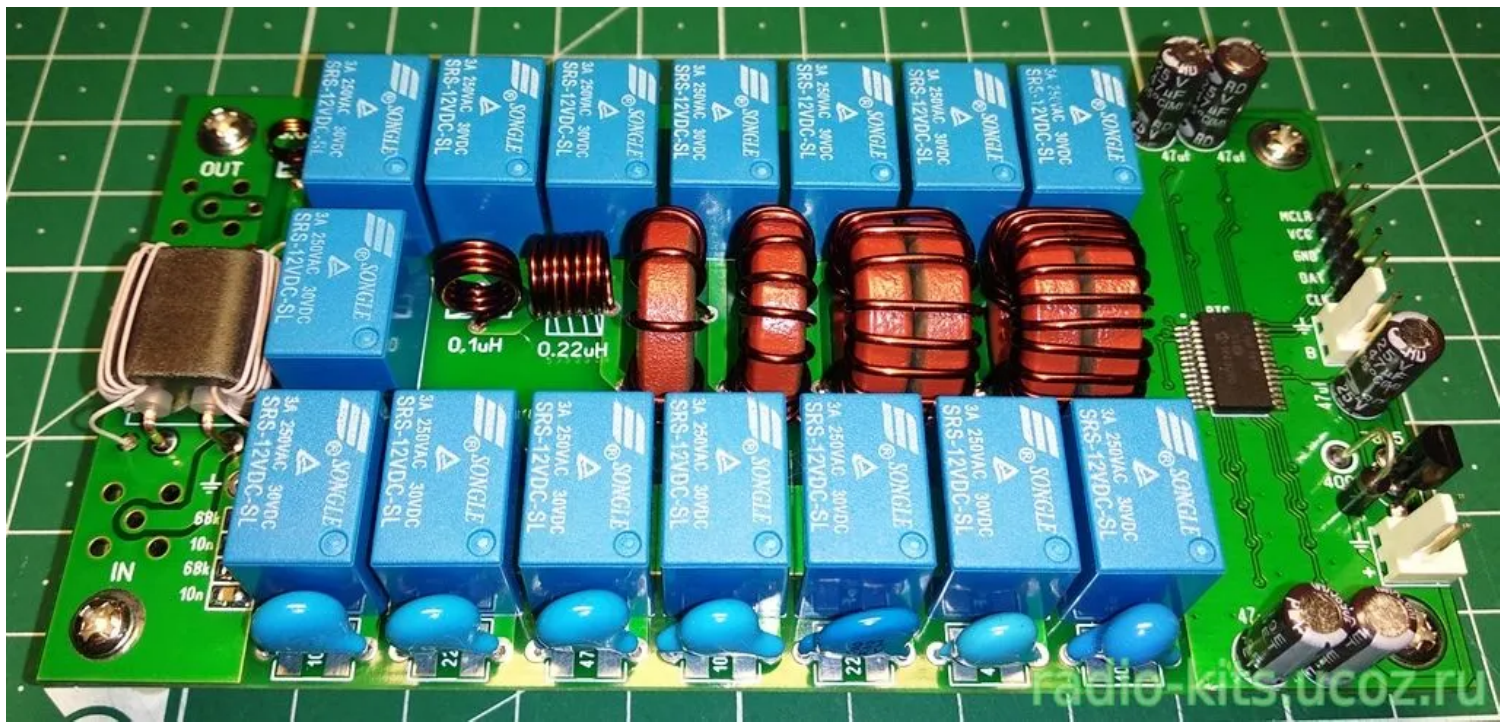
Tuner Scheme:

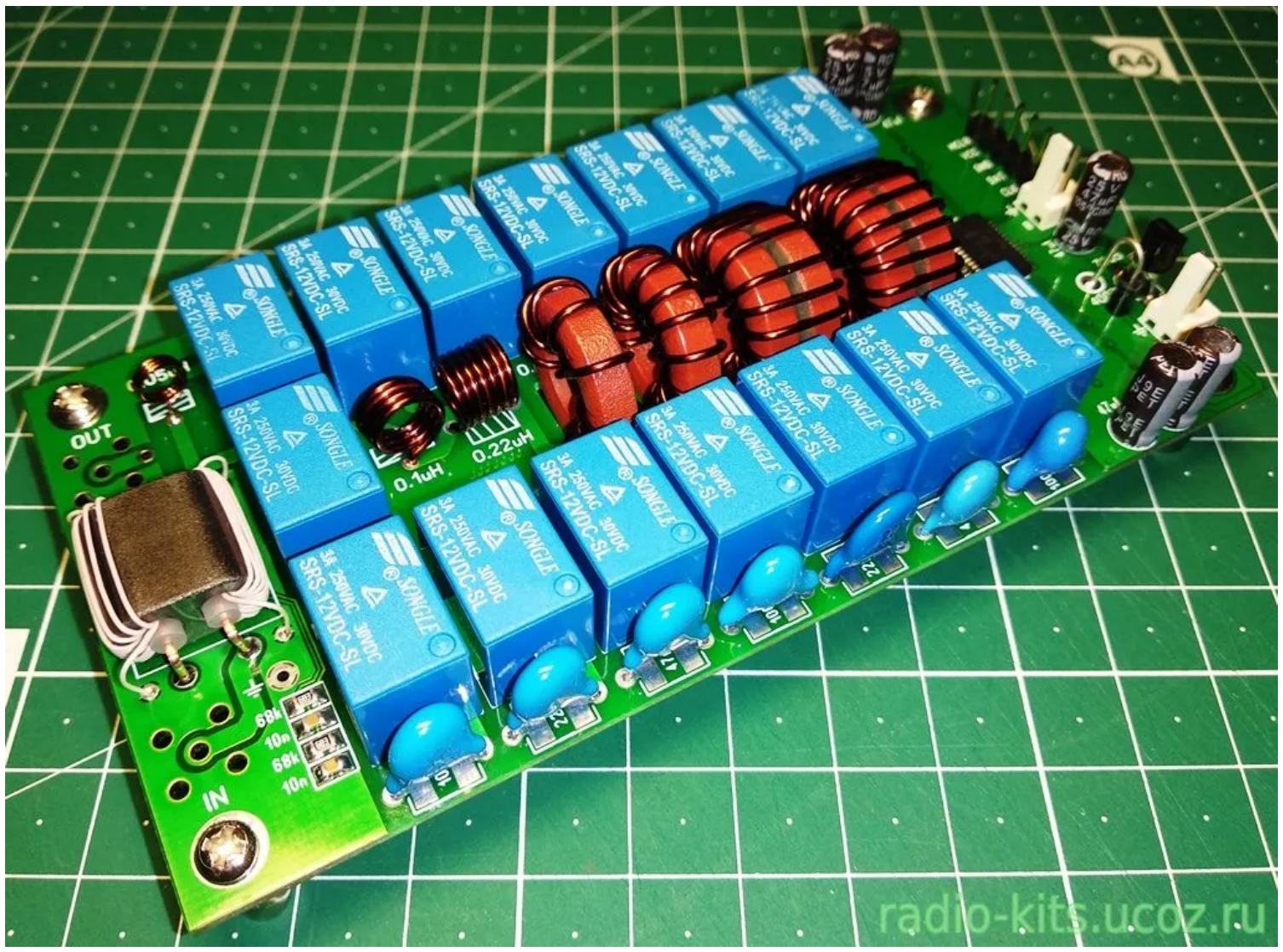


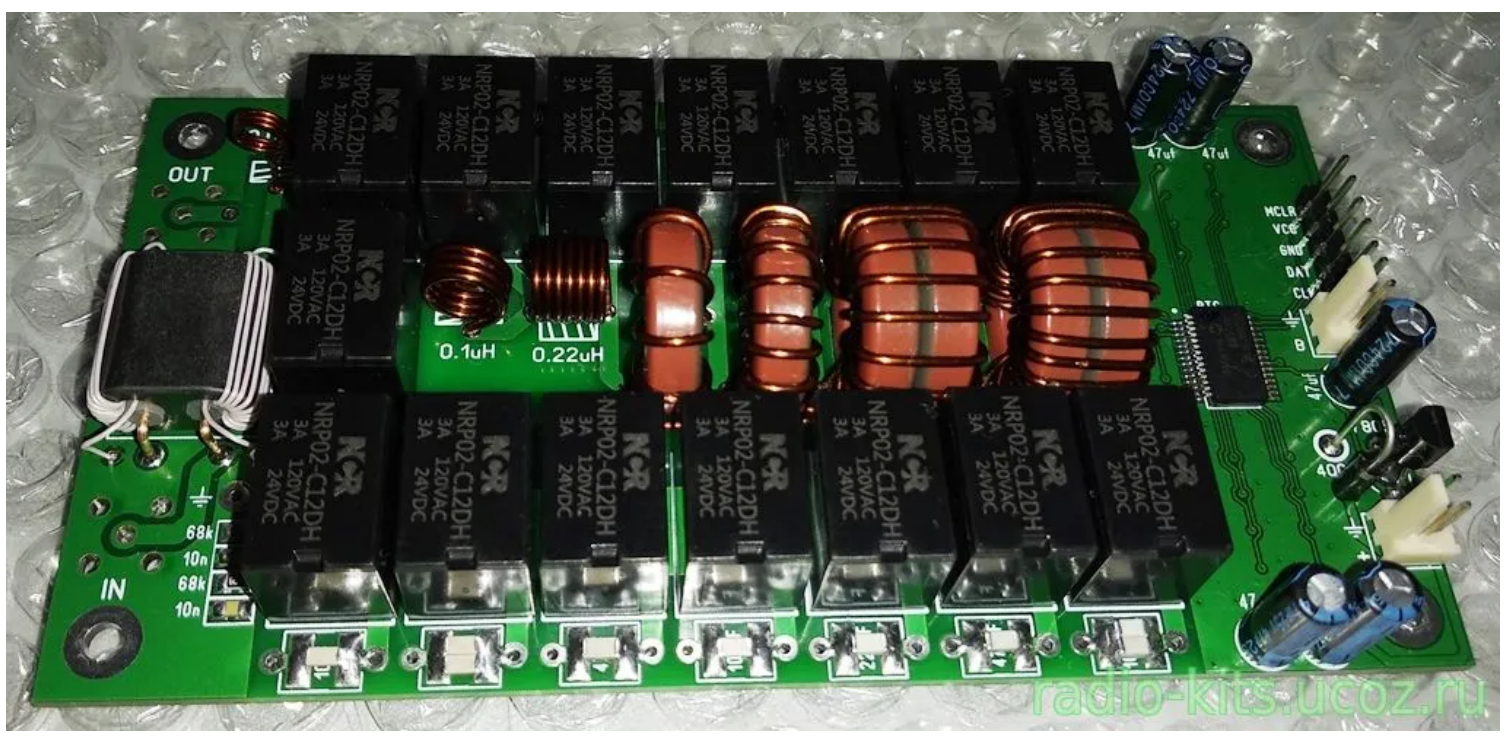
Connecting additional "Auto" and "Bypass" buttons, if necessary, it is performed by fivecams B1 and B2 located on the back of the board.


radio-kits.ucoz.ru


radio-kits.ucoz.ru


OUT
IN
0.1uH
0.22uH
SONGLE
SRS-12VDC-SL
radio-kits.ucoz.ru





Small video operation tuner 7x7

Работа тюнера ATU-100 mini 7x7 конструкции N7DDC, кусок провода 8 метро...

A set of tuner 7x7 is offered in several options for configuration:
1. Bilateral printed circuit board with metallization of holes, mask and labeling (120x62 mm) - 165 UAH.

2. Double-sided printed circuit board with metallization of holes, mask and marking + full set of parts (including LCD 1602 PCF8574 IIC / I2C with backlit), installed on it - 1150 UAH.
3. Collected and proven tuner fee with LCD 1602 PCF8574 IIC / I2C backlit - 1550 UAH.
Brief description of the tuner is attached.
4. When ordering with OLED display, the rise in price is 100 UAH.

By default, the set is equipped with: SO connectors for mounting on the panel, 2x16 LCD display with gray signs and yellow-green backlight.

The composition of the set for assembling the ATU-100 EXT 7x7 tuner can be seen

Brief description of the device from the author of the structure (for firmware 3.0)

Actual firmware version 3.0

When ordering an automatic antenna tuner, please indicate:
1. Delated type of antenna connectors: SMA, BNC or SO239 (PL259)
2. Desired indicator: LCD display with gray signs on a yellow-green background or white signs on a blue background.
3. OLED display with white / blue signs rectangular (indication in two lines) or square (indication of four lines).

Sets for the assembly and the assembled fees with a complete set of high-voltage 1 ... 2 kV capacitors of size 1206 with zero TKE - Dielectric NP0.
These capacitors were checking under load, so to speak :) Check three options Capacitors are made at my request to Karpelian Volodya (R2AJI). Video laboratory work Laid on his channel Ham Radio Channel, this video:

Orders can be issued through the form or by phone indicated in the section

All the peaceful sky, good luck, good, 73!

In Wednesday of Radio Pitors-shortwaves, the antenna tuners of MFJ of various modifications are popular, including the power of 1 ... 3 kW. The author of the article has repeatedly had to see the "insides" of the tuners of this firm, failed. It is possible that with more "delicate circulation" of such deposits and it is possible to avoid, but this is not a factor of high reliability of the tuner. Also, an important role is played by their cost ...

Currently, a multitude of radio components from the military equipment of the USSR, removed from weapons, but quite suitable for amateurs structures appeared on the CIS's radio rolls.

Having studied the information on manual T-tuners MFJ and various "homemade" devices, the author collected the tuner to the maximum passage of 3 kW in the radio amateur bands of 1.8 ... 30 MHz, applying the corresponding components.

The device is a finished design and allows you to:

1. Connect to power amplifier (mind) external load of 50 Ω via the KSV meter and the power supply.

2. Communicate two antennas through the KSW meter and the power flow rate is directly without tuner.

3. Connect one antenna to tyuer through the KSW and passage meter and coordinate the load equivalent to the resistance of 10 ... 1000 ohms in the range of 1.8 .... 30 MHz.

4. Measure the CWS in the connected antenna-feeder system with a minimum power of 50 W at a load of 50 ohms.

5. Measure the power of the passing signal in three intervals: 0.3 kW, 1.5 kW, 3 kW.

6. Suppress outward emissions (at least 10 dB).

Schematic scheme Antenna tuner is shown in Fig. 1. The transmitter signal is supplied to the XW1 connector and through the primary winding of the T1 transformer T1, the KSV meter and the passage of power is entered on the power transmission direction selection switch - SA2. In position 1 of the SA2

switch, the signal enters the XW2 connector to which the impending load with a resistance of 50 ohms to the appropriate power is connected. This mode is required to configure. lamp amplifier Power to eliminate the capacitors of the capacitance variable (kP) P-circuit. It often happens that radio amplifiers in the P-circuit of lamp power amplifiers use capacitors with fairness with small gaps, for example, three-, five-piece kPs with a 12/495 or 17/500 section section capacity at best.

Fig. 1. Concept of antenna tuner

In positions 2 and 3 of the SA2 switch, the transmission signal can enter the XW3 and XW4 connectors, respectively, to which the antenna feeder devices with a wave resistance of 50 ohms are connected. In position 4 of the SA2 switch, the transmission signal will go to the tuner and then on the XW5 connector to which the anorthophyer device with a resistance of 10 ... 1000 ohms can be connected.

The tuner is made according to the T-shaped diagram and consists of two kPes C6 and C7, coils with a variable inductance L1 and capacitors C8, C9 connected by automatically switches of SA3 and SA4 when rotating rotors KP C6 and C7 rotation.

When measuring the power supply of the RF signal, it is removed from the secondary winding of the transformer T1 through the VD1C3R3 circuit and through contacts 1, 2 or 3 of the SA1 switch and the corresponding additive resistors R4-R8 enters the RA1 measuring instrument.

When measuring the CWS, the signal is removed from the secondary winding of the T1 transformer, is detected by the VD1C3R3 and VD2C4R3 circuits, through the contacts 4 or 5 of the SA1 switch from the R3 resistor engine enters the RA1 device. Chain VD1C3R3 - Detector Direct Wave, Chain VD2C4R3 - Reflected Wave Detector. The variable resistor R3 set the arrow position of the Arrow of the RAP1 to the final division of the scale in position 4 of the SA1 switch. In position 5 of the SA1 switch, the testimony of the KSW is read. The measuring device of the RAAR has two scales: the scale of passing power and the CWW reference scale.

The main nodes in the design are applied from the consistent-symmetrical device of the R-140 radio station. The measured capacity of capacitors C6 and C7 - 26 ... 206 and 26 ... 209 PF, respectively. The thickness of duralumin plates of the rotor and the stator KPE - 3.7 mm. The gap between the plates of the rotor and the stator with the introduced rotor - 7 mm. The rotors of these kpa are rotated without restrictions on 360 o (Fig. 2). When choosing a kope of another type, it is necessary to pay attention to the thickness of the plates, since thin plates at high power signal can be bend, thereby contributing to the HF break. The KP used has powerful brush switches from brass. With their help, additional C8 and C9 - K15U-1 capacitors are connected to the nominal voltage of 3.5 kV and reactive power 8 kv.

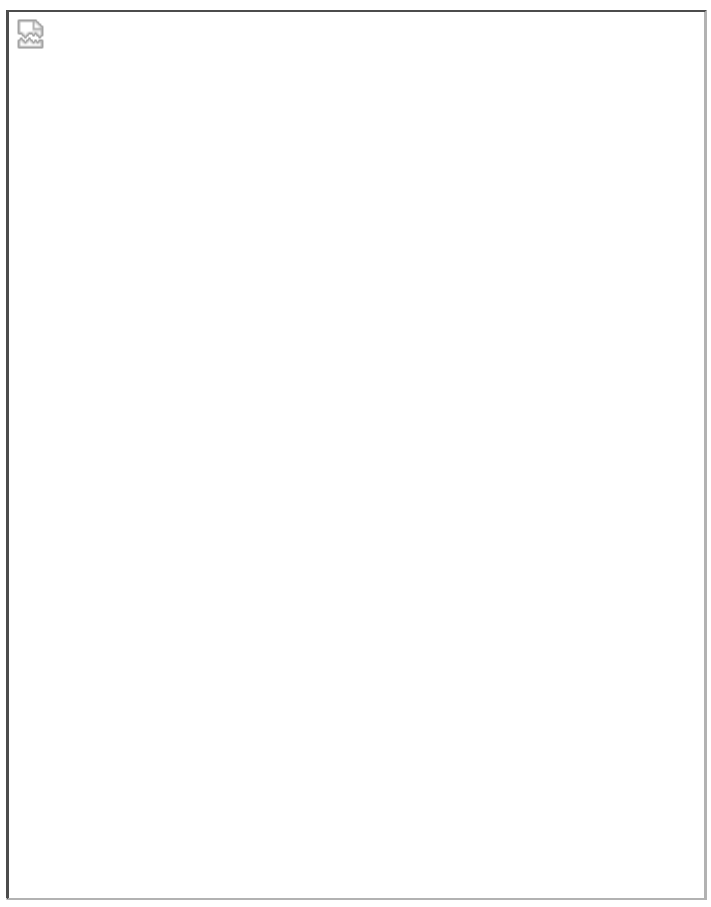


Fig. 2. Rotors KPE

The cylindrical variometer L1 is also from the R-140 radio station. Its coil is made with a copper tire of 10x1.2 mm and contains 22 turns with a pitch of 6 mm. The variometer can be applied from other equipment, but not with the worst data.

SA2 - brush-type plug-in selection switch, ceramic with contact area of \u200b\u200bat least 7 mm 2. Switches with a spherical contact form are not suitable due to the small contact area. Switch SA1 - PGK 5P2N or other suitable type On radio camera.

The T1 transformer is wound on the magnetic phase of the K20X10X5mm sizes from ferrite 50Vc. The primary winding T1 is a copper conductor with a diameter of 3 mm and a length of 40 mm, on which the fluoroplastic tube is won. This conductor passes through a ferrite ring with a secondary winding, which is made in two parallel going stranded wires taken from the assembly loop. The wires in the PKV-isolation contain two veins of seven conduits of a copper lug-wire with a diameter of 0.15 mm. This winding contains ten turns wound uniformly over the ring. The ring is pre-wrapped with a tape from fluoroplast or lacker. The middle point of the secondary winding is obtained by connecting the end of one wire winding with the beginning of the second.

The author has long used this type of secondary winding in the manufacture of KSV-meters to 50 MHz, which has proven itself as the most optimal and reliable. It should be borne in mind that the upper output of the C1 condenser is connected to the conductor of the primary winding T1 after it (not from the connection of the input connector!). The tire of the general wire of the meter is made of a copper wire with a diameter of 3 mm. In one end, this tire is connected to the input connector enclosure, and the second to the cable fever going on the SA2 switch. The central wire of this cable is subfed to the conductor of the primary winding T1 after it.

CONDACTOR C1 - any suitable with air dielectric, C2 - KSO-1, CTC, KDK to a rated voltage of at least 250 V. Resistors R1, R2, R6, R8 - MLT-2. Variable resistor R3 - SP3-9A, SP3-4A or JV group V. Rainy resistors R4, R5, R7 - SP3-9A, SP4-1 groups A. Capacitors C3, C4 composed of two CDC capacitors with a capacity of 6800 PF included in parallel, C5 - KDK. All capacitors - on the rated voltage of 250 V. Diodes VD1, VD2 can be replaced with chosen diodes of D9ZH. The device of the RA1 - M24 with a current of full deviation of the arrow of 200 μA. You can apply another to a current from 50 to 300 μA with an appropriate correction of additional resistors. The minimum CWW control power depends on the sensitivity of the device. The author's version is 50 W. The choice of such power is made for considerations of the comfort of the tuner at the time of coordination with greater load resistance.

All RF connectors - CP-50-165F. To connect an equivalent of a load of 50 ohms, a 50-ohm connector of another type is applied to not be confused with other directions.

The tuner is mounted in the housing with dimensions of 480x320x300 mm from the generator G3-33. Rubber legs are screwed to the housing, in the rear wall, the holes for connectors are cut. Also on the back wall of the case installed the terminal "Earth".

The front panel of the tuner and the chassis are made of 1.5 mm thick and are a solid hard design. They are connected via semi-automatic welding (CAMP), but you can apply a cloud-screwing method of compounds. It is important that the design is sufficiently rigid, since the radio components used are relatively large sizes and mass. The HF connector mounting panel with dimensions 442x75x4 mm is made of duralumin and is fixed on the chassis from the back. The connectors are mounted with brass screws and nuts M3. Mounting petals made of fastening brass suitable size under brass nuts. In the design, all platforms under the screws, nuts, petals and connectors before installation are well cleaned. The front panel and tuner chassis are painted with the enamel of PF-115 gray. All inscriptions are made by the translation font (Fig. 3).

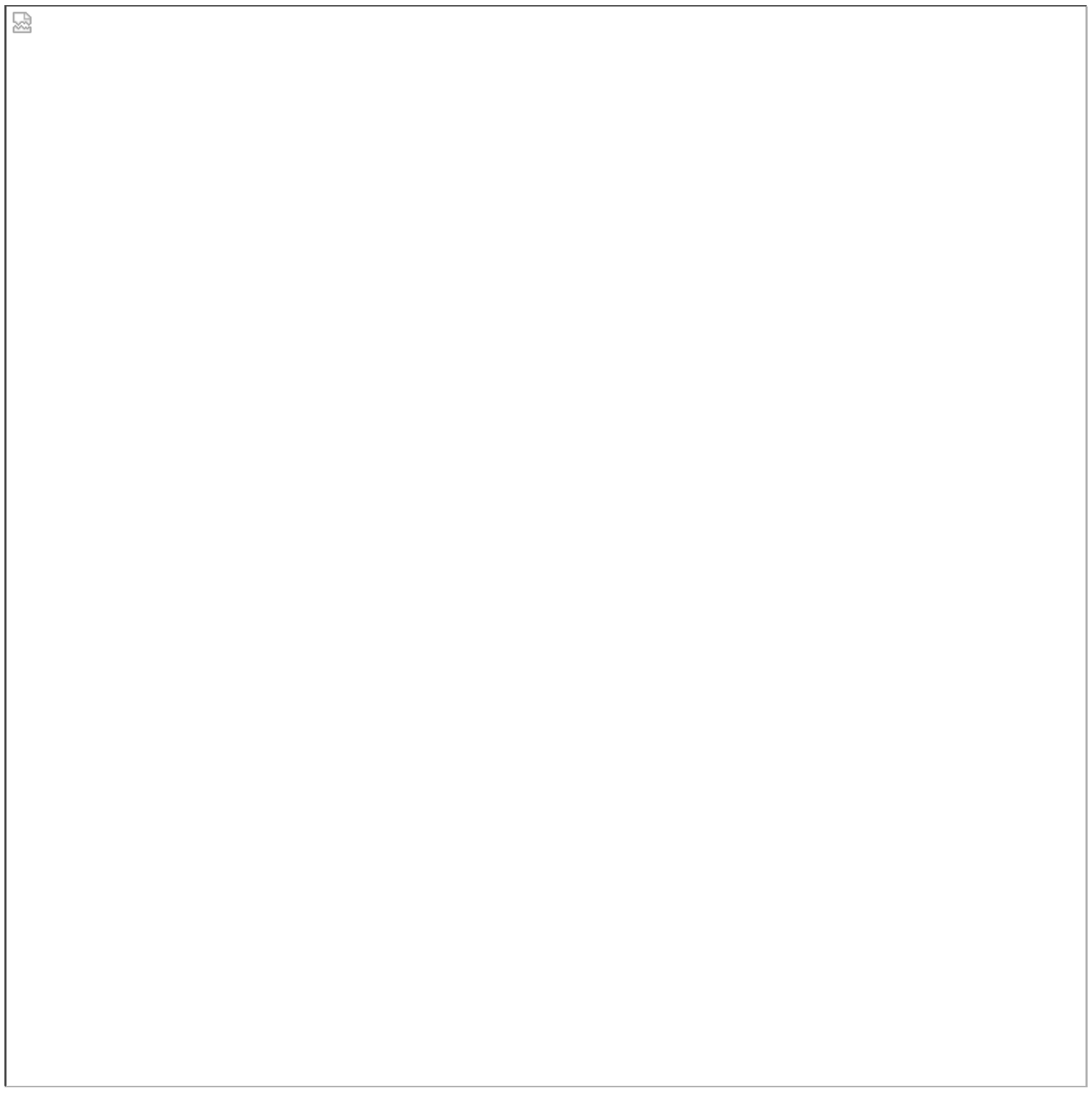


Fig. 3. Front tuner panel

In the side walls of the chassis in the mounting places, rectangular windows are cut out to reduce the installation capacitance. The nodes of the measuring device, the KSV and power meter are closed by boxed screens. The node of the KSW and power meter is additionally closed by a M-shaped screen from duralumin.

The layout of the tuner nodes is shown in the photo (Fig. 4).

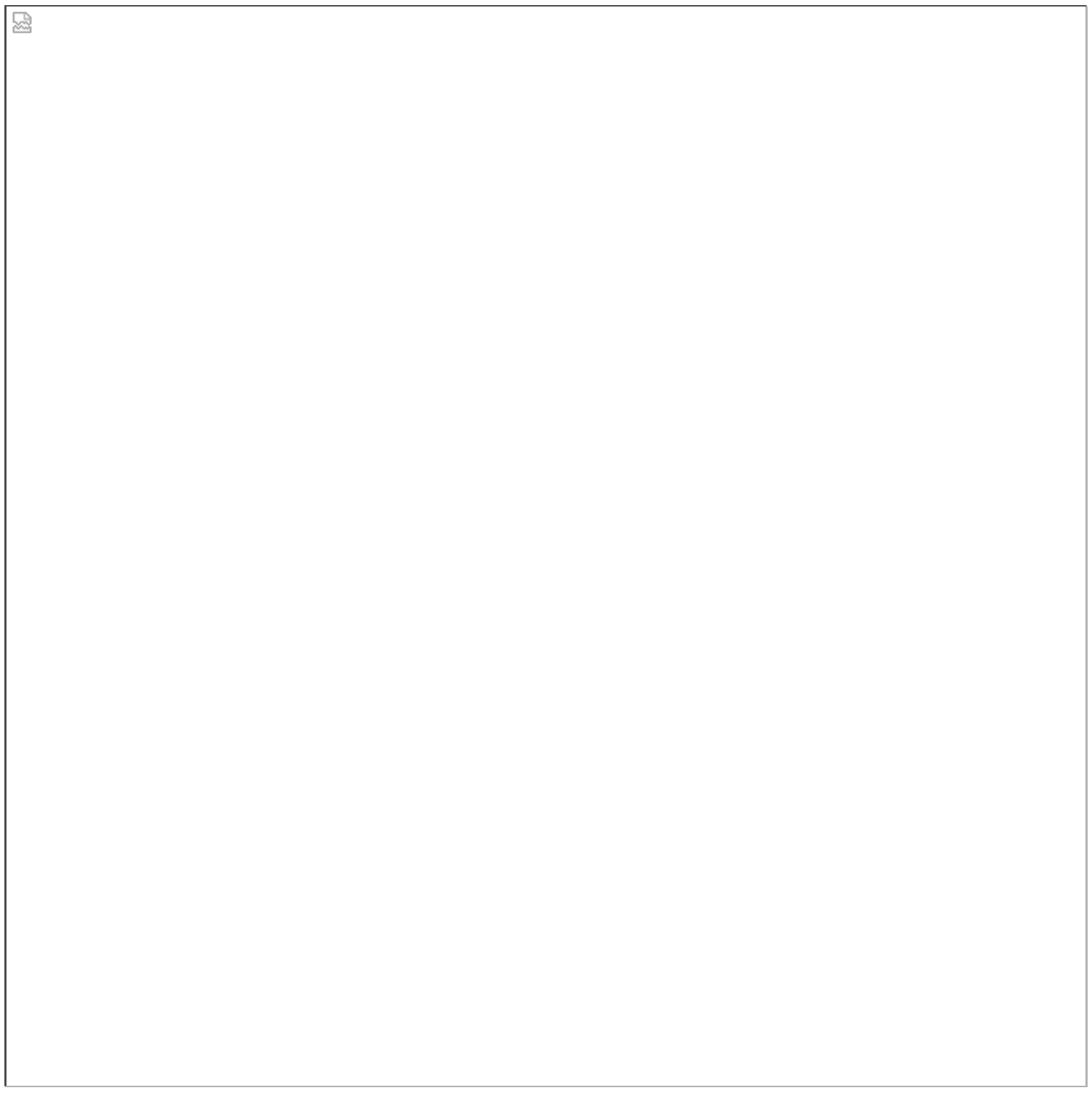


Fig. 4. Layout of tuner nodes

When installing the KPU should be taken into account that they are isolated from the chassis. Metal axis controls of the kpa are connected to the axes of the rotors of the KPU through insulating Casual couplings. Also on the axis of control fasten the discs with a diameter of 100 mm made of metal or plastic for the scales. The scales are made on the printer or paint on hand on dense white paper. Working field Scale Kpe - 360 o. In the front panel of the tuner under these scales at the place of the location of the hole. The holes are closed with plates of plexiglas with a thickness of 1 mm and are equipped with visits in the center. The scale of the device is made in the same way.

Capacitors C8 and C9 are mounted on the rear walls of the C6 and C7 housings, respectively. When the variometer is set, attention is noted that the axis of the variometer control is connected to its moving contacts. Therefore, the current-axis of movable contacts is connected to the nearest conclusion of the coil of the variometer and connect to the total wire - the plates of fastening of the RF connector. A modernized scale mechanism from the 10T-26 radio station is used as a varietar for the variometer. The variometer scale is also manufactured by the above method.

Mounting tuner executed coaxial cable RK50-9-12, designed for the passing capacity of more than 3 kW at CWS \u003d 1. The measuring unit of RA1C5R3 is connected by shielded wiring wires. The remaining connections are made with a 10x1 mm copper tire and a tube with a diameter of 5 mm along the shortest path. Details C1-C4, R1, R2, VD1, VD2 are mounted on a ceramic plate with mounting petals. As mentioned above, C3 and C4 capacitors are made up of capacitors of 6800 PF capacitors. Some are installed on the plate, and the second - on the SA1 switch. R4, R5, R7 trimming resistors are mounted on the chassis side panel to be able to regulate from outside (Fig. 5). There is also a hole for adjusting the C1 capacitor. SA1 switch position clamp must be somewhat weakened for softer switching. The SA1 switch axis is removed on the front panel of the tuner through the axis with two spring cardan. Variable R3 resistor is also installed on the front panel. Elements R3, PA1, C5 are closed with a box-screen. VD1 diodes, VD2 must be selected in a pair. Simplified selection - on measuring direct resistance digital meter Resisters. For a more accurate selection of diodes, you can use well-known techniques from the literature or the Internet.

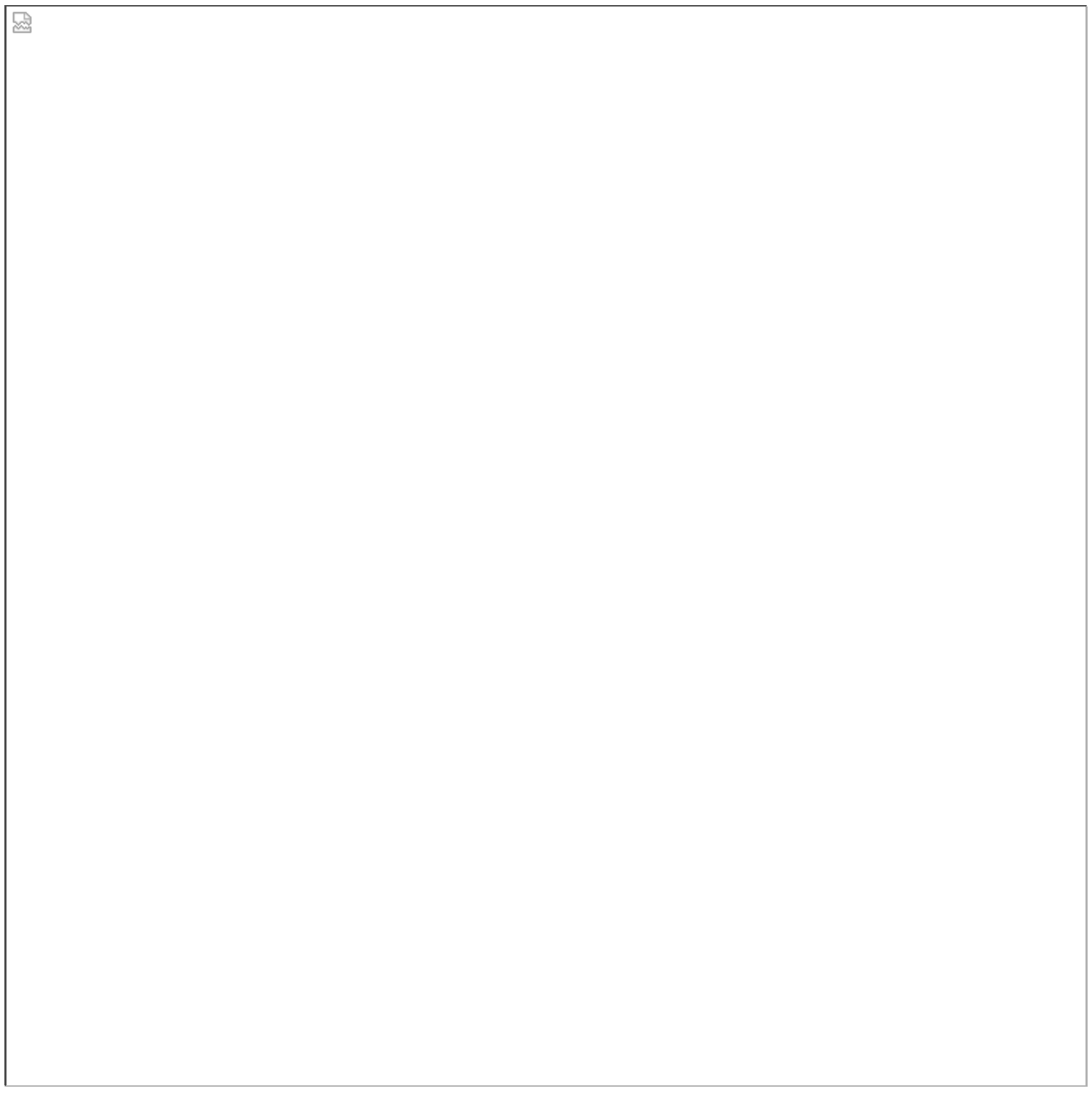


Fig. 5. Installation of resistors

All work on the establishment of the tuner is performed with strict compliance with electrical safety techniques! The setting is performed on the range of 14 MHz. On the other ranges, the results are quite acceptable, and no additional settings not required.

Initially check the correct installation of the entire device. After making sure that everything is in order, set the SA2 switch to position 1 ("50E") and connect to the XW2 connector the imperodent resistance of 50 ohm appropriate power. Connect the output of the transceiver or power amplifier to the XW1 connector. The engine of the variable resistor R3 is set to an extreme right position (movable contact is connected to the shared wire). The SA1 switch is set to 4 ("F", a straight wave). Include transceiver to transmission mode, adjust its P-loop to the load of 50 ohms and set output power 50 W. If the transistor transceiver has a transistor, then it is already set to 50 ohms. A variable resistor R3 is installed arrow of the device of the RAP1 to the middle of the scale. SA1 is translated into position 5 ("R", a reflected wave) and a dielectric diverter rotor a C1 condenser rotate. The arrow of the device RA1 goes to zero. Return SA1 to the "F" position and the R3 resistor set the Arrow to the final value of the scale. Switch SA1 to the "R" position and C1 capacitor set the Arrow to the zero scale mark. Repeat this operation and, if necessary, adjust the setting. This setting will correspond to a CWF equal to one. The KSV-meter scale is graded according to calculations by the formula

KSV \u003d (1 + U OTP) / (1-U OTP).

Instead of 1, the final value of the scale is substituted, instead of u - indications in the reflected wave mode. The resulting value will be the value of the KSW. For example, the entire scale has 100 divisions. The testimony of the reflected wave is ten divisions. We substitute these values \u200b\u200bin the formula and make the calculation:

KSV \u003d (100 + 10) / (100-10) \u003d 1.22.

The resulting value will correspond to the CWW at this point of scale. In this way, you can calculate the entire KSV meter scale. Variating the numbers in this formula, you can deduct the scale in the desired

values.

Next, configure the passing power meter, which has three multiple measurement limit: 0.3 kW, 1.5 kW and 3 kW. To configure the RF-voltmeter with a voltage measurement limit of 400 V. For these purposes, voltmeters are suitable, which have in a set of RF voltage. Why up to 400 V? Because with the power of 3 kW on the load of 50 ohms there will be a RF voltage of 387 V, with a capacity of 1.5 kW - 274 V, at 0.3 kW - 123 V. These values \u200b\u200bare obtained by calculation by the formula

In the same formula, the intermediate values \u200b\u200bof the trap power meter scale are determined. It should be noted that the power scale is nonlinear, and it will not be possible to use the linear scale of the RA1 device to refer to the power.

In the mode of the pass power meter, the R3 variable resistor engine is set to zero. Translate switch SA1 to position 1 (0.3 kW), zero transmission level. R4, R5, R7 trim resistors are set to the maximum resistance position. Smoothly fed the input signal and control the RF voltage on the load of 50 ohms. When the voltage 123 is reached in the R4 trim resistor, the arrow of the RAP1 device is set to the final value of the scale. This provision will correspond to the power supply of 0.3 kW. The meter in other positions of SA1 is adjusted in the same way in accordance with the RF voltages, the values \u200b \u200bof which are given above. Initially, the addition resistors R6 and R8 have a resistance of 200 com and 470 com, respectively. When setting, you may have to pick them up. They provide smooth adjustment by adjustment resistors R5, R7.

Intermediate power values \u200b\u200bare obtained from the formula. Many values \u200b\u200bto create hardly follows. Enough, for example, digitize such: 100 W, 200 W, 250 W, 300 W. The multiplier will give: 0.5 kW, 1 kW, 1.25 kW, 1.5 kW or 1 kW, 2 kW, 2.5 kW, 3 kW.

Plug to tyuer ground (terminal X1), load resistance 50 Ohms (XW2 connector), the output of the transceiver / amplifier (XW1 connector) and the agreement with the antenna (to the XW5 connector).

Transfer S2 switch to position 4 "TUNER". Includes the transceiver in the reception mode and rotate the L1 variometer knob before obtaining the maximum noise of the ether. Set the transmission power of the order of 50 W and the setting of C6 and C7 capacitors achieve a minimum of the CWS. In practice, it is better to rebuild the C6 capacitor with a small step, then produce an accurate adjustment to the minimum CCS capacitor C7. If necessary, adjust the coil L1, but this is last. The procedure is repeated until the minimum CWS is achieved. When it is obtained, you can increase the output power of the transmitter.

It should be borne in mind that the minimum CWW can be obtained in different combination of the positions of the tuner handles.

Upon reaching the minimum of the CWS, check the power given to the transmitter, and make sure that its ALC system has not reduced it significantly. If it still happened, you should look for a minimum CWW with a different position of the variometer. To do not look for the tuner settings every time, it is useful to make a table of the position of the settings for the ranges of the ranges.

It must be remembered that the tuner setting should be performed at a capacity of less than 100 W! Power to increase only after adjusting the tuner and not to use the transmission mode for a long time with high CWS.

Some reminders. If the feeder feeder is applied with a length of a multiple odd number 1 / 4λ (taking into account the shortening coefficient), the feeder turns into a high-alone transformer. If the feeder length is multiple with a ball number 1 / 4λ, then we have an antenna input resistance repeater. That is, the input resistance of the antenna will be connected to the tune. This should be taken into account when building both single-band and multidia-band antennas in order to obtain their maximum efficiency.

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Opinions of readers

sergey / 10/10/2018 - 10:54
Greetings! Where to order Syo?

A typical antenna tuner is two condenser variables and a variable inductor inductor. It sounds like something that is not difficult to make himself. Let's find out if it is, and that in the end it will turn out for money. That the steps described later could repeat anyone, it was decided to use exclusively components

that are free and large quantities Sold online.

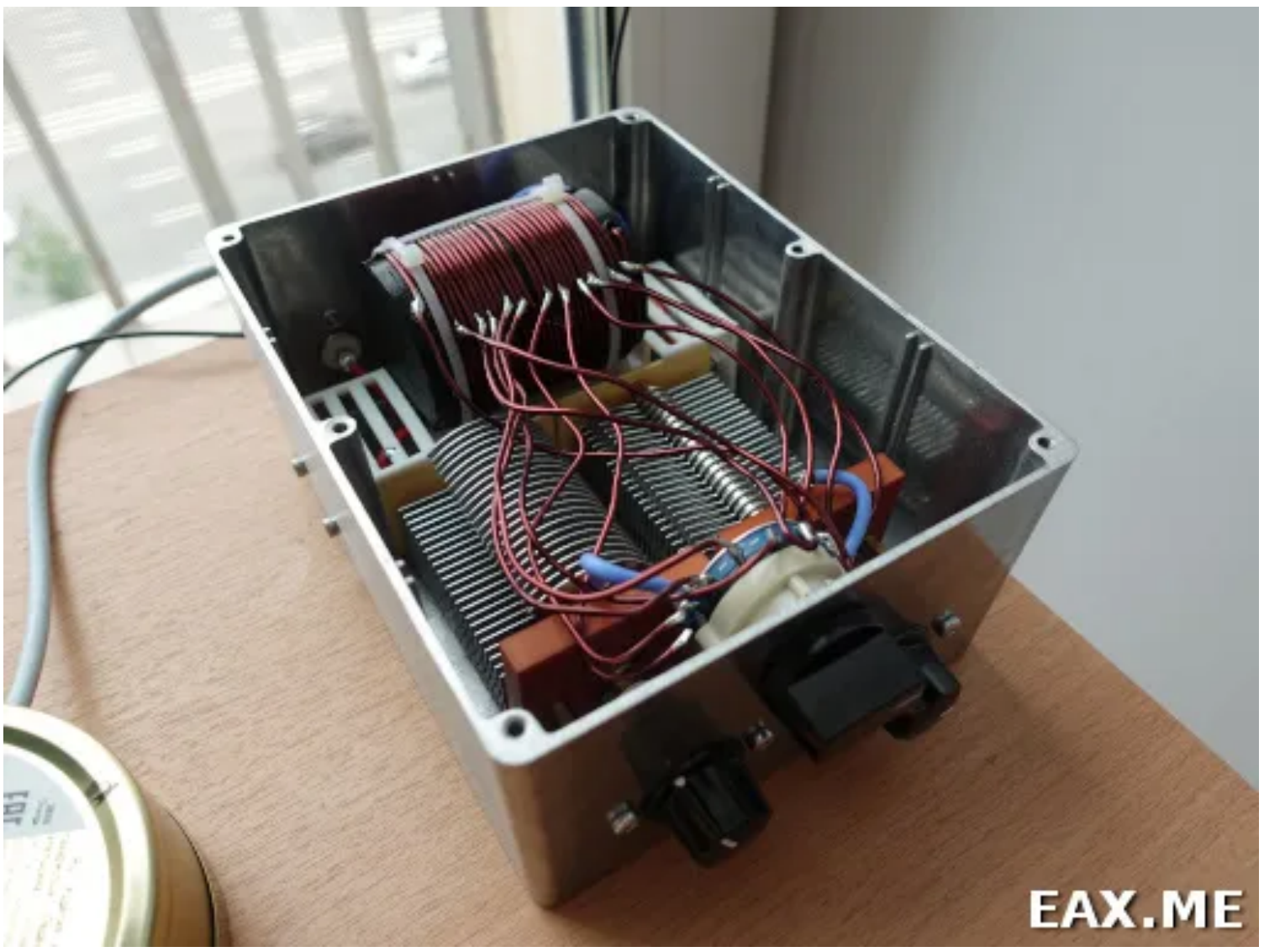
Here are these components and where they were purchased:

Variable capacitors 22-360 PF per 1 kW - 2 pcs, 74.40 $;
Enameled wire with a diameter of 1.5 mm - 1 pcs, 7.65 $;
Galette switch for 12 positions - 1 pcs, $ 5.2
Handle for the gallery switch - 1 pcs, 0.85 $
SO-239 connectors on the panel - 2 pcs, 2.76 $
Connector for connecting two wires - 1 pcs, $ 1;
Metal housing 165. x. 127 x. 75 mm - 1 pcs, 12.25 $;

The price of capacitors includes shipping. They arrived very quickly, somewhere in a week or so. To all of the listed, it is worth adding some nylon screeds, bolts, nuts and racks M3, as well as a couple of short wires. They are effectively worth nothing.

When there are all components on the hands, the task is to connect them to the T-figurative scheme already familiar to us, only instead of the antenna there will be connectors for its connection:

Here is what the resulting tuner looks like, view with a lid:



Must admit that the intertwing segments of the wire between the gallery switch and the coil look not very elegant. It would be possible to achieve a more successful location of the components using a wide side of the housing as a facial. But I didn't want to drill a hole for the gallerting a thick column on this side (see photo), and in the end the components I posted, as I posted.

The coil was wound on the frame with a diameter of 45 mm and a length of 60 mm. I got 29 not very smooth turns. The measured inductance of the coil was 25 microns. The coil frame was printed on a 3D printer with plastic PLA. A small "bench" was also printed, which performs two functions. First, it allows you to fix the coil without using glue and drilling holes in the bottom of the housing. Secondly, with its help, the capacitors are additionally added to the bottom of the housing. They hold perfectly and without a "bench", but something I wanted to reinforce it. The source code of both models for OpenSCAD along with STL files can be found in this archive.

If you do not have a 3D printer or a familiar with a 3D printer, it is not scary. The exact dimensions of the coil and its inductance are not very important. You can wind the wire on a piece of plastic bottle, a thick PVC pipe or something like that. The thickness and length of the frame can safely compose ± 10mm from those that I used. The number of turns is also not critical. In the antenna tuners, the inductance is used

somewhere from 14 μg (in MFJ-971, according to the testimony of my LRC meter) to 37 microns (in MFJ-949E, according to information from the network). You will probably get into these borders. "Strike", as can be seen from the description of its functions, is not a mandatory element of the tuner. The coil can be fixed in the housing by any way convenient to you.

The tuner was tested on the same "long wire" antenna, which I tested MFJ-971. In the ranges 15, 17, 20, 40 and 80 meters everything is configured excellent. In ranges 10, 12 and 30 meters, KSV does not want to fall below 3. This can be explained by the fact that with the same number of taps I used a greater inductance than that of MFJ-971. Accordingly, in my tuner, inductance is selected with b *about*riding step. That is, for these ranges, it is not possible to accurately choose the necessary inductance. But it turned out that, unlike MFJ-971, my tuner is able to configure 23 meters of wire for a range of 160 meters with KSW 2.8.

If desired, you can experiment with different inductors and the position of the taps. Or replace the gallery switch to a similar, but having 24 positions (there is on eBay). However, I decided not to invest time in all this. First, 10 and 12 meters now there is still no passage, and 30 meters I'm not so much needed. Secondly, it is possible to provide several external transformers and use one or another depending on the situation. For example, in MFJ-971 there is a built-in balun 1: 4. I think my tyuner does not prevent such a tune. But this is the topic for another post. Finally, thirdly, no one has canceled the opportunity to correct the size of the antenna for a specific tuner.

For test radio communications, the ranges 20, 40 and 80 meters are selected as the most popular. The transmission was carried out in SSB and FT8 modes with a power of 100 W and 40 W, respectively. Correspondents gave good reports, quite ordinary for this antenna.

For money, 104.36 $ plus a couple of free evenings. The official price of MFJ-971 is $ 139.95, but in Russian online stores you will find it somewhere for $ 163. Thus, the project came out cost-effective. At the same time, 70% of the cost were variables condensers. They can be found cheaper on the bulletin board qrz.ru, extract from old radio engineering or even make yourself.

As always, if after reading the post you have left some questions, or you have something to add it, feel free to leave comments.

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