

Power Amplifier “UM-U-2017” 30-40 Watts

This broadband power amplifier allows to obtain the peak power approximately 30-40 watts at 50 Ohm of load when the input voltage is about 100 mV. The irregularity of amplitude - frequency characteristics of Power amplifier - not more than 0,5 dB in the frequency band 1-30 MHz.

The RF signal from the input of the amplifier goes to the base of transistor VT1 (KT646), which is the first stage of the PA. In the circuit of the transistor included the broadband transformer TR1. The power supply of cascade is +12V coming from the TX control unit RX/TX transceiver. The quiescent current of the cascade is 20-30 mA.

The penultimate stage of the amplifier working in a mode of class AB assembled on transistor KT920A (VT2). The bias voltage is set by the diode VD1 (KД208). The quiescent current of 40-50 mA set by selection of resistor R7. Resistors R9 and R10 form a chain of negative reverse line improves the linearity and stability of operation of the cascade. If necessary, the frequency response can be adjusted by the selection of elements C10,R8. Power of cascade is +12V. The load of cascade is transformer TP2

The final cascade of the amplifier assembled on the push-pull circuit with transistors VT3, VT4 (KT922Б or 2T922Б). Voltage bias is regulates by transistor KT815 (KT817) and diodes VD2 and VD3 КД510 (1N4148, КД522). The quiescent current of the output transistors is set by resistor R17. For thermal stabilization of the operation of the cascade the diodes VD2 and VD3 have thermal contact with the housings of transistors VT3, VT4 and VT5 transistor with heatsink (cooler). Correction circuit C15, and C17 R12, R14 reduce the gain in the low frequencies, and C24, in conjunction with the primary winding TP3 raise the frequency response near the upper boundary of the operating range. Load of cascade is the broadband transformer TP3. Power supply is +20-24V. The maximum current of the output is 1.8..2.4A.

Structurally the amplifier is assembled on a double-sided PCB with dimensions 124x60 mm. Transistors VT2, VT3, VT4 mounted on a common radiator – duralumin plate thickness of 3-5 mm. the Size and location of holes for the assembly of the radiator (cooler) are shown on diagram below.

Broadband transformers TP2 and TP3 are soldered directly to the printed conductors of the Board. For assembly of the inductor Dr3 use a ferrite coil 10x6x3. Wire MGTF (pink) 0.35mm. 18-20 turns. Transistor VT5 should be mounted to the radiator (cooler) through the insulating gasket.


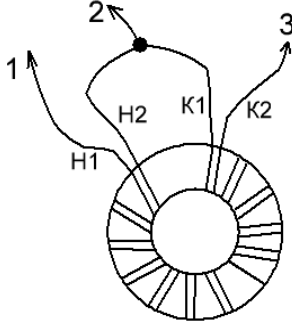

Adjustment

1. To input of amplifier, connect two resistors: 50R (between input and GND pins) and 250-300R to input. It needs to avoid the high level of input signal. The max RF on input – not more than 100mV. Need to check how much RF at output from motherboard of your TRX and make it <100mV if necessary.
2. Connect the Dummy Load 50R at output of amplifier. It needs to avoid of damage of output MOSFET. **DO NOT POWER ON WITHIOUT DUMMY LOAD OR GOOD ANTENNA (SWR<1.5)**
3. Mount the good Radiator to MOSFETs. **DO NOT POWER ON THE AMPLIFIER WITHOUT THE RADIATOR**> it will more ~2-5 seconds and MOSFET will be damaged. Also, if radiator is too hot during the adjustment – power OFF the unit and wait for few minutes while it will have normal temperature.
4. Apply 12V to power supply pin (+12V and GND). AC current must be 0. No heat places. Just the power amplifier must be on “hold”
5. Then, apply +12V to “+TX” pin. The power amplifier should wake up all elements would be working except the output MOSFET. AC current value ~160-200mA. If you have the Current in this range and everything is stable, no heating elements -> go to next important step.
6. Look to the R17 potentiometer. The pins of this resistors are not connected to the middle pin. It means, that it has a constant max value of resistor. This is not mistake on PCB. It was done to avoid the damage the MOSFET if forget to tune the resistor to max value at the first power on. So, what do we do? First of all, make a shorting link between left or right pin and middle one. Then, measure the resistance. It must be maximum value. During the adjustment we will accurately and slowly tune the potentiometer back – decreasing the value of resistance. AC current of MOSFET will increasing and output power would be higher.
7. Connect ~16-17V to pin “+U” that are going to MOSFETs. Look to Current value. It must be the same as was before - ~160-200mA. If everything is fine, start tuning of potentiometer R17. Accurately, slowly. No rush, because when MOSFET will start working – it take some time to for heating. So,

Current could be increased. As stopped, play with R17 again. Set ~400-600mA of current. After than, slowly increase the power supply from 16V to 20-24V. The max Current value of unit must be not more that 2A. It is 40Watt at 20Volts.




- We recommend to set not more than 1-1.5A for first time. You may play with that at any time and increase the power.

Transformer TR1.

Coil	Necessary components	Assembly details
<p>TR1 transformer</p> 	<p>10x6x5 toroid. Wire 0.28mm. Two twisted wires.</p> 	<p>7 turns</p>  <p>*H2 – means start point of wire #2 *K1 – means end point of wire #1, etc... ** To make wires twisted – recommend the following: put wires together; fix start points of wires somewhere on workspace; put end points to screwdriver (or electrical drill). Accurately rotate the wires. Make 2-3 twists per 1cm.</p>

Transformer TR2

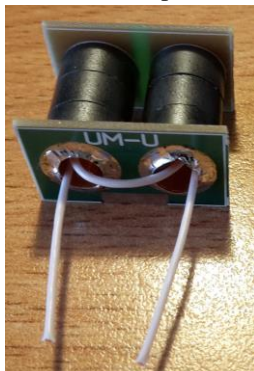
Necessary elements: Toroid 10x6x5 (6 pcs) or 10x7x12 (2pcs); Wire MGTF 0,35mm (pink) – 150mm; PCB for assembly T2; Copper foil

<p>Step1. Prepare toroid, wire, foil and PCB. Divide the PCB to two board of the same size (by the line in the middle). Cut 2 same pieces of foil with size 18x18mm.</p> 	<p>Step 2. Make a cylinder from the foil using the rod or the drill bit with diameter of 5.0-5.5mm</p> 	<p>Step 3. Merge THREE toroid (if use 10x6x5) and put the cylinder's foil inside of the coils (on picture below an example with 2 toroid).</p> 
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Step 4. Construct the boards (see the picture below). The ends of the foil should be soldered to the PCB by the circle.



Step 5. Make the winding – 2 turns.
Wire 0.35 (pink).



The last step – mount the transformer to main PCB and solder it. The ends of the wires soldered to the places on the PCB according to the scheme.

Transformer TR3

Necessary elements: Toroid 10x6x5 (8 pcs) or 10x5x20 (2pcs); Wire MGTF 0,35mm (pink) – 150mm; PCB for assembly T2; Copper foil

Step1. Similar to TR2 - Prepare toroid, wire, foil and PCB. Divide the PCB to two board of the same size (by the line in the middle). Cut 2 same pieces of foil with size **23x18mm**.



Step 2. Make a cylinder from the foil using the rod or the drill bit with diameter of 5.2-5.5mm



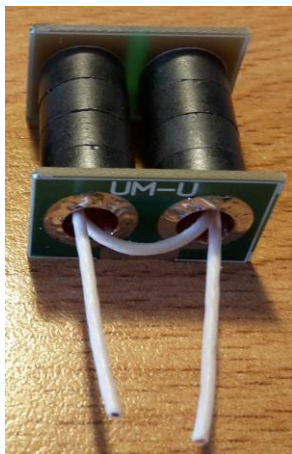
Step 3. Similar to TR2 - Merge **FOUR** toroid (if using 10x6x5) and put the cylinder's foil inside of the coils (on picture below an example with 2 toroid.). Get two similar elements.



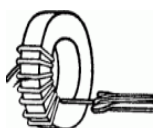
Step 4. Construct the boards (see the picture below). The ends of the foil should be soldered to the PCB by the circle.



Step 5. Make the winding – 2 turns.
Wire 0.5 (pink).



The last step – mount the transformer to main PCB and solder it. The ends of the wires soldered to the places on the PCB according to the scheme.



Inductor Dr3

Necessary elements: toroid 10x6x3.; Wire MGTF 0.35mm (pink). 19-20 turns.

Diagram of radiator (cooler)

