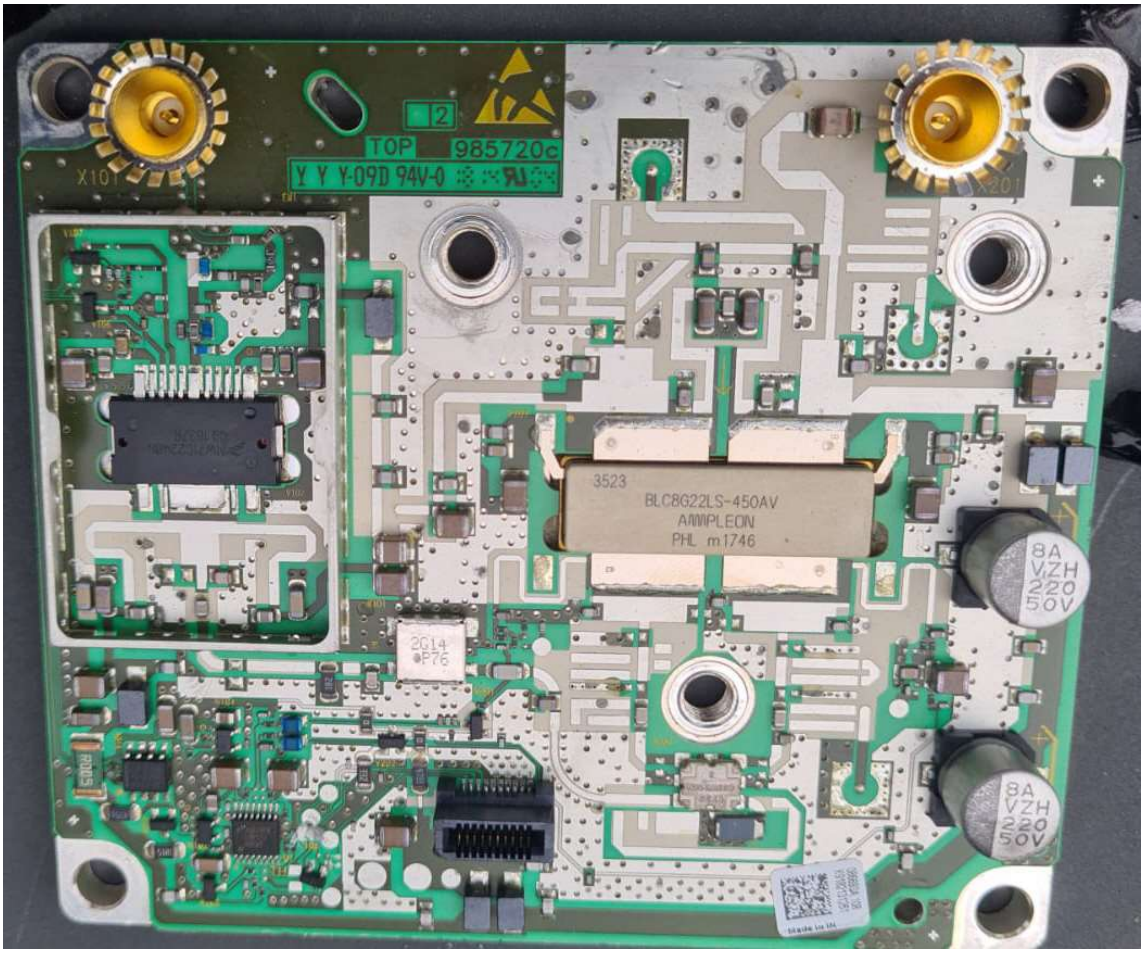
Modification of SSPA UMTS power amplifier module for 2320 MHz amateur band



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This manual concerns retuning of the UMTS power amplifier module based on a double LDMOS transistor type BLC8G22LS-450AV to the 2320 MHz amateur band. It should be treated as a starting point for possible more precise tuning.

Warning: Be especially careful not to expose your eyes to RF power - working amplifier must have the cover screwed on.

Start the modification of the module by removing the RF sockets and soldering the coaxial cables in their place (Figure 1). Any type of 50R cable with an SMA connector can be used at the input. However, the output cable must withstand a power of at least 150 W at 2320 MHz. Teflon cables such as RG142 / RG400 can be used here. The connector on this cable must be stronger than the SMA, therefore the N connector is recommended.

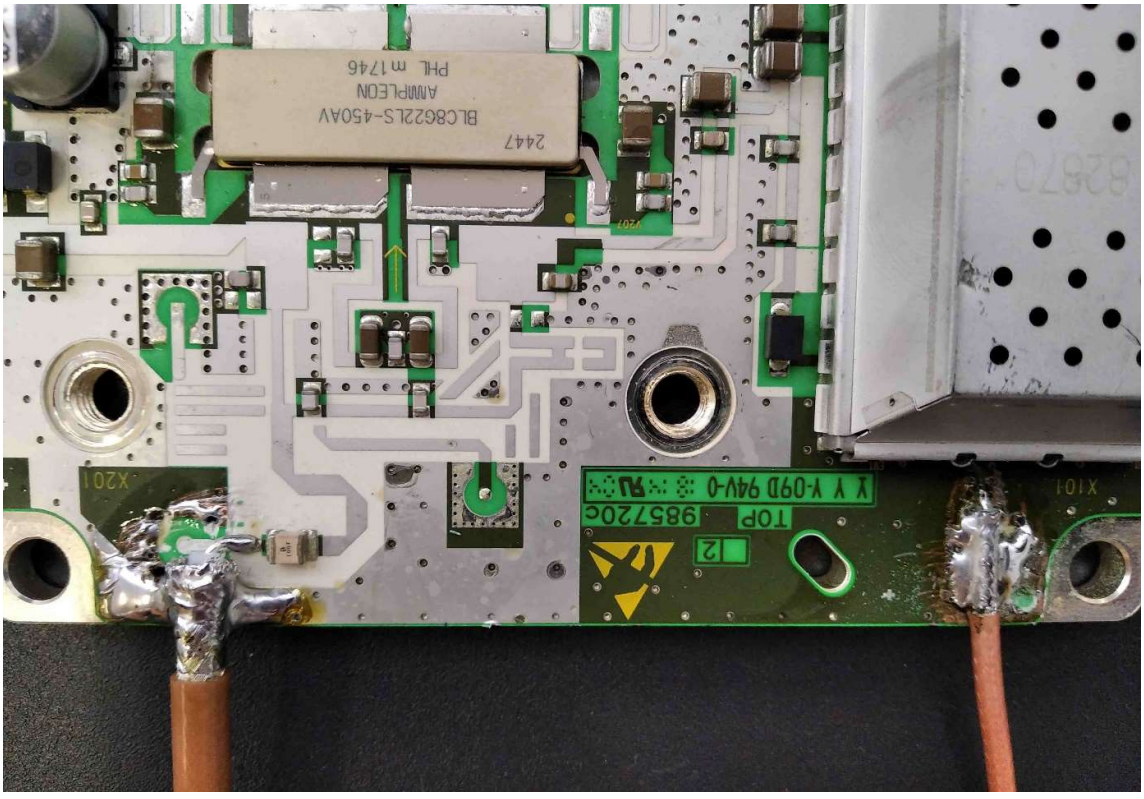

Figure 1. Cables soldered in place of sockets

The efficiency of the retuned amplifier is about 35%, so a sufficiently large heat sink should used.

The module is powered from 28V through a dedicated PCB. The positive pole of the power supply and GND are attached to the thick tracks. One of the thin tracks is supplied with a voltage of 12 to 28 V (Figure 2). It is not a typical PTT - without supplying voltage there, a current of about 500 mA flows through the module, while after applying about 1.4 A.

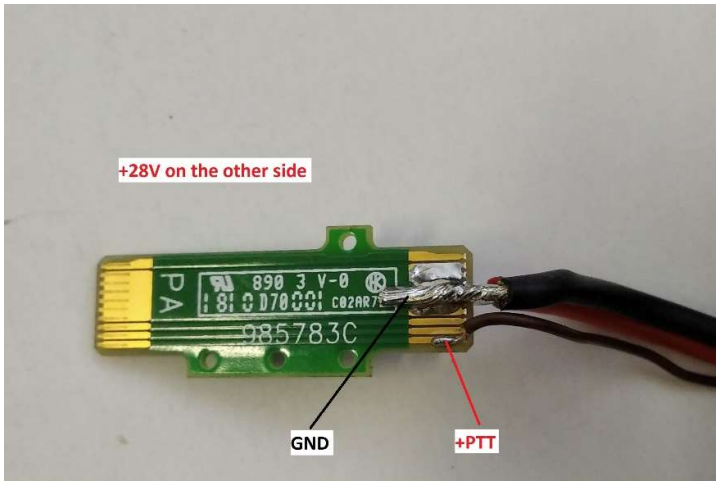

Figure 2. Board for connecting the module power supply

Start the module retuning by removing 2 capacitors from the driver circuit (Figure 3). This procedure increases the gain at 2320 MHz.

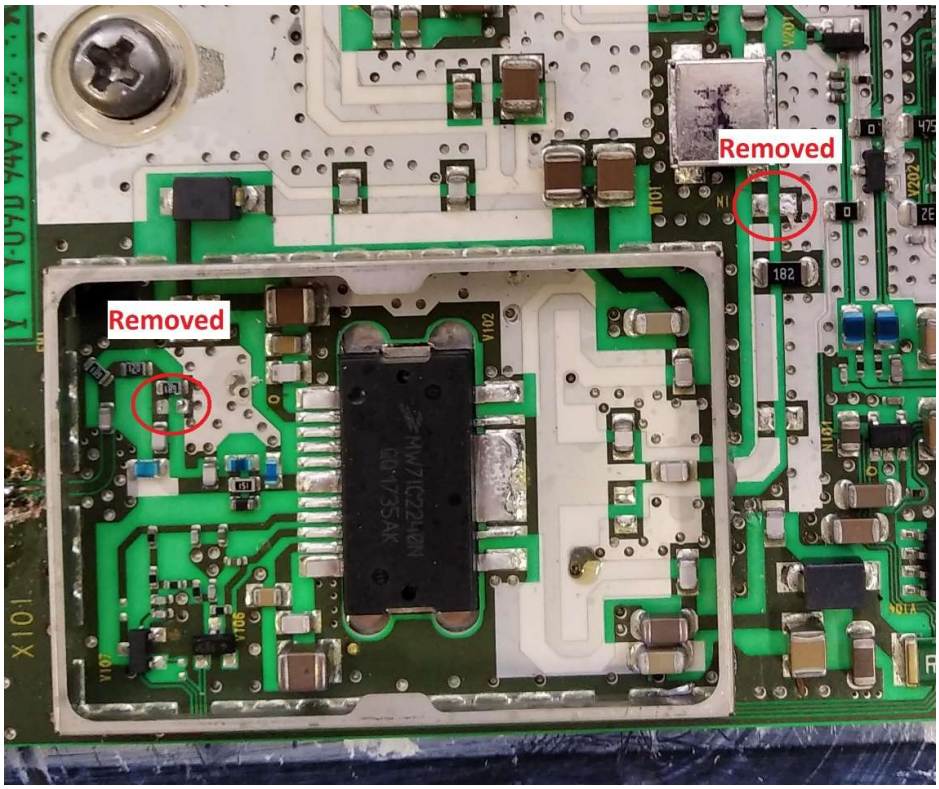

Figure 3. Capacitors from the driver to be removed

The final stage includes a transistor dedicated to the Doherty amplifiers (BLC8G22LS-450AV), which actually contains two LDMOS transistors in its structure: main and peak (Figure 4).

Figure 4. Double LDMOS used in final stage

The method of modifying the input (gates) circuits was obtained by measuring with a VNA matching at the main and peak inputs and empirically - striving to obtain the maximum gain of the module. It is a coarse method and it is probably possible to obtain even better parameters. It turned out that it was only necessary to modify the input circuit of the main transistor (Figure 5).

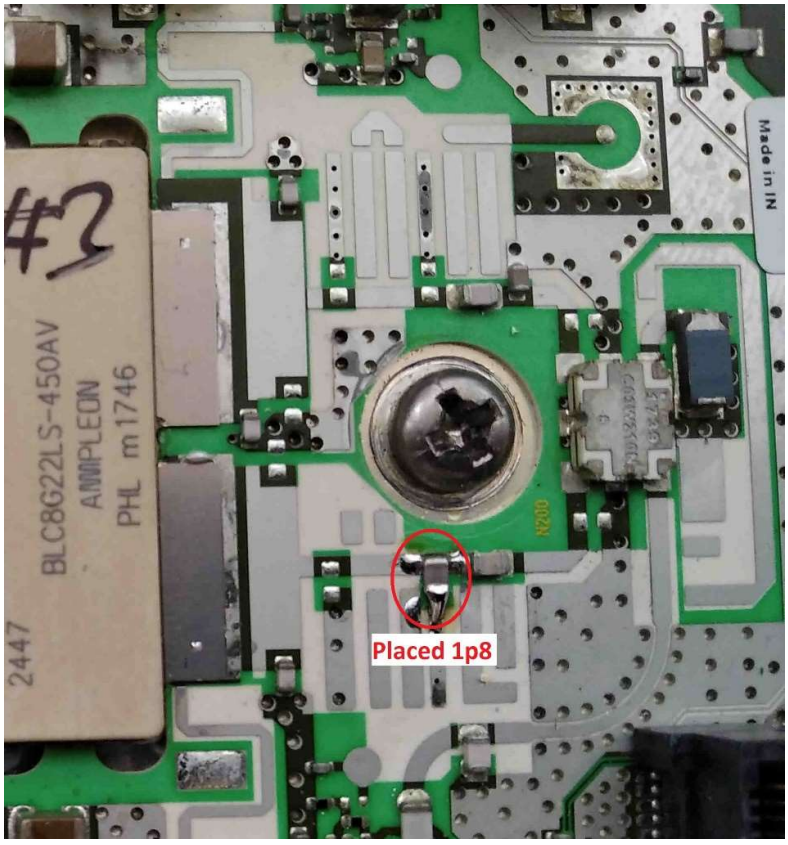

Figure 5. Tuning of the input

In turn, in the output circuit of the main transistor, the marked capacitors are removed and the farthest capacitor is resoldered so that it is next to the closer one. This is shown at Figure 6. As in the case of the peak transistor input circuit, the satisfactory results were obtained without changing anything in the output circuit of this transistor.

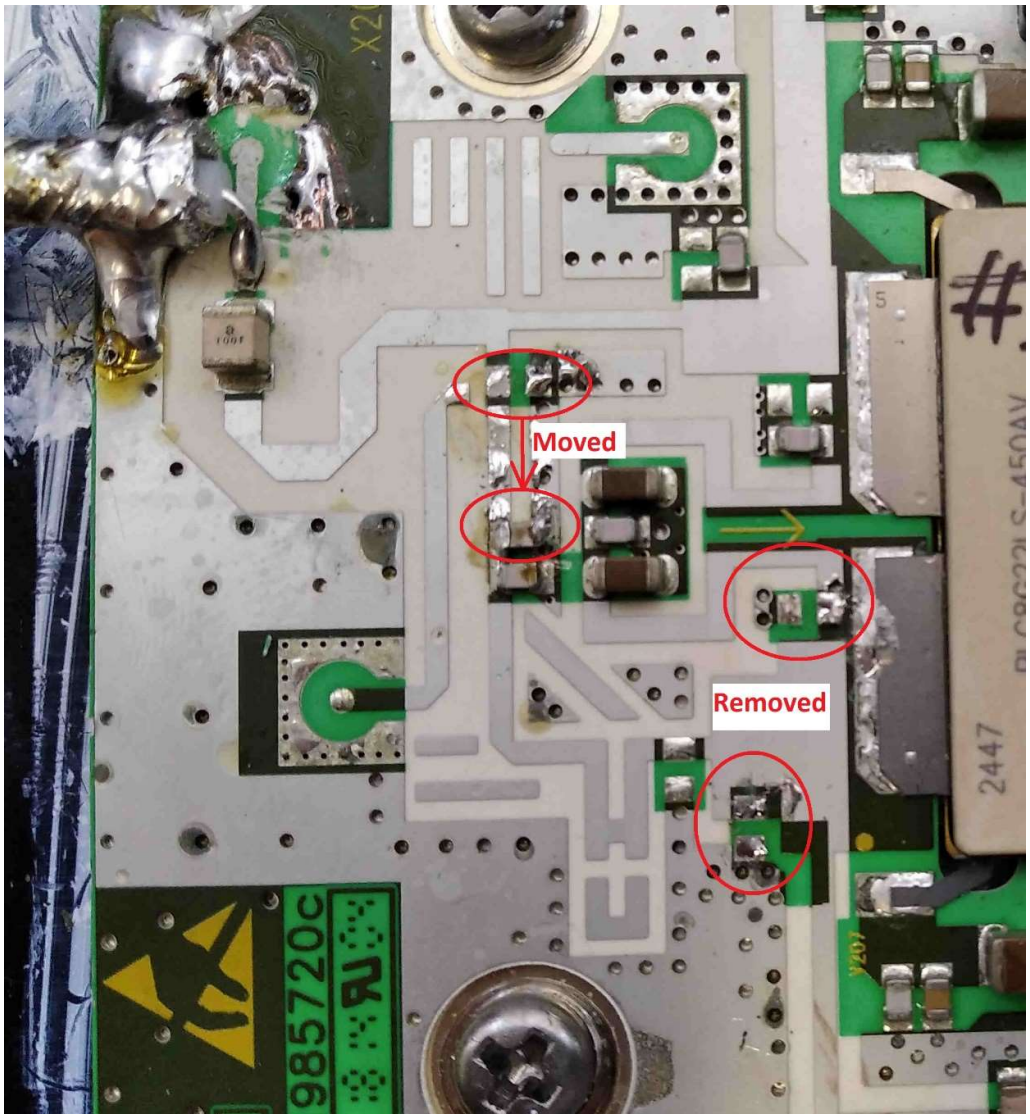

Figure 6. Tuning of the output

The modification described above makes it possible to obtain a power of about 140-160W at 2320 MHz (in my case, the limitation was the power supply). It is possible that with a 28V power supply with a maximum output current greater than 16A, more output power can be get. Also, with even finer tuning of the module it is possible to get more power output.

According to the procedure described above, 2 modules were retuned. The following results were obtained:

Module 1. Pin = +13 dBm, Pout = 160 W, ID = 15.5 A, efficiency 37 %

Module 2. Pin = +13 dBm, Pout = 150 W, ID = 16.0 A, efficiency 33 %

The retuned modules were also measured at 2400 MHz, but the results were not satisfactory. With the input power of +15 dBm, the maximum output power was 40 W, with ID = 10 A (efficiency 14%).