## Additional notes about the 2400 MHz power amplifier (v 4.0)



This publication describes the problems encountered during assembly, together with suggestions for solutions.

The main problem encountered by the users of the amplifier is the deterioration of parameters in relation to those obtained during tuning. The reason for this is primarily bad ground contact.

In extreme cases, this leads the amplifier to getting oscillated. This manifests itself in high current consumption (in the absence of an input signal), significantly exceeding the nominal value of the quiescent current (0.8 A).

LDMOS transistors have a source on the flange, which must be connected to the bottom layer of the board (board ground) the shortest way. The heat sink, in addition to dissipating heat, provides this connection. The problem is that the flanges of the transistors are not in the same plane as the PCB - they protrude by 0.7mm. Originally, the amplifier board was placed on a heat sink that had milled areas so that the transistors would enter these places. In amateur conditions, it is not always possible to make milled areas, so often the board is placed on a flat heat sink. In this case, there is a significant reduction in gain and output power and oscillations occur. The reason is the formation of gaps between the bottom layer of PCB and the heat sink near the gates and drains. The ground of the board in these places is no longer in contact with the heat sink, which causes the formation of parasitic inductances and detuning of the matching circuits.

In other words, the transistors and the board must be mechanically perfectly fitted to the heat sink.

This can be easily done by resoldering transistors and is described in the following procedure:

1. Completely desolder both LDMOS transistors. Before this, mark them (not to swap them later).

2. Tight screw the board and transistors to the previously prepared heat sink (preparation consists of drilling and tapping holes: 20 for PCB, 4 for transistors and 4 for output isolator, if not removed). Additionally, it is necessary to prepare holes (5 or 8)for screwing the cover.

3. Now solder the terminals of the transistors one by one, as much as possible bending them (pressing) to the board (Fig. 3). This should be done carefully so as not to mechanically damage the transistors.



Figure 1. Board and heat sink ready to place LDMOS



Figure 2. Screwed LDMOS ready for soldering

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Figure 3. Soldering and bending terminals of LDMOS

Measurements of the amplifier converted this way showed a slight parameters deterioration due to a detuning of the matching circuits of the transistors. If terminals transistors will be bent too mild (Fig. 4), degradation of parameters may be greater. Using a power meter, the amplifier may be additionally tuned, which will improve the performance.

It is important to screw tight the board and transistors to the heat sink, using all holes in the board (20 + 4).



Figure 4. Good and bad way of soldering transistors

Copyright by Andrzej SP8XXN and Tom SP5XMU March 2021 The output isolator, if it has not previously been replaced by a 50 ohm semi rigid cable, can be screwed to flat heat sink without any modifications. It should be paid attention, whether the isolator terminals are not in contact with its housing (ground). See Figure 5.



Figure 5. Output isolator on a flat surface



Figure 6. PA module on flat (not original) heat sink with output isolator replaced by piece of 50 ohm coax cable

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