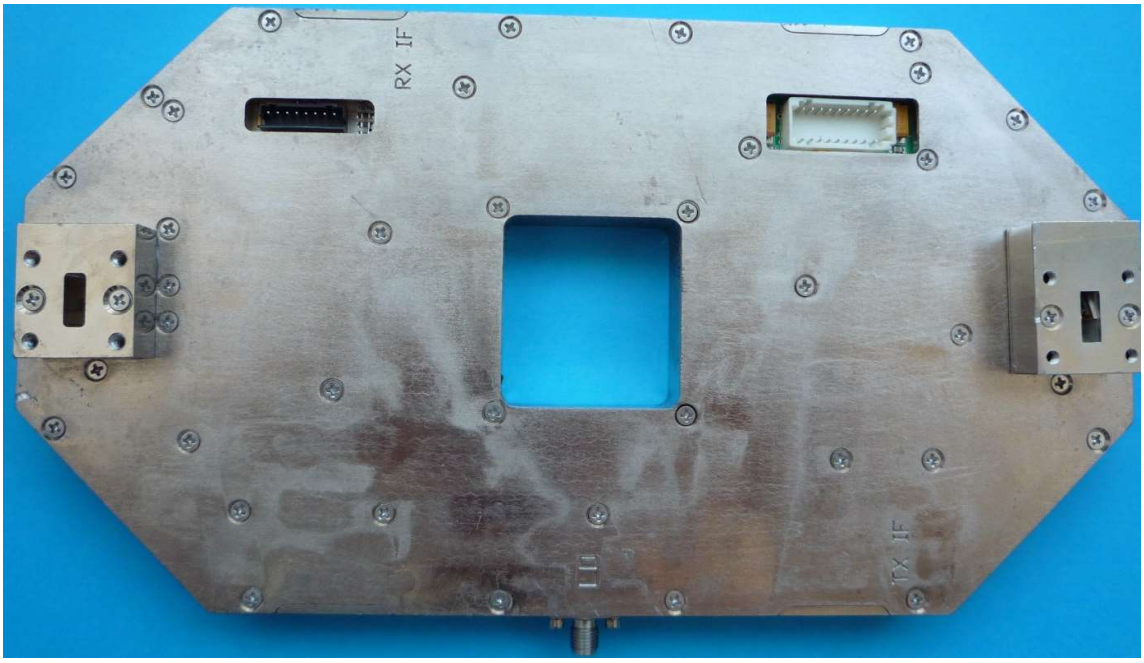
# Modification of modules from 23 GHz radio link to 24 GHz transverter





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*The manual concerns the modification of modules from a 22-23 GHz radio link to a 2320/24048 MHz transverter. After modification, 500-700 mW of output power at 24048 MHz was obtained, and the gain of the receiving path was 20-25 dB.*

In the considered radio link, the modules are of two types, differing in the frequencies of the transmitter and receiver. This is illustrated in the table below.

| Module type | TX RF filter | TX LO filter | RX RF filter | Input LO filter |
|---|---|---|---|---|
| TX high/RX low | 22.4 - 23.6 GHz | 20.19 - 21.59 GHz | 21.2 - 22.6 GHz | 6731 - 7195 MHz |
| TX low/RX high | 21.2 - 22.6 GHz | 23.4 - 24.61 GHz | 22.4 - 23.6 GHz | 7802 - 8202 MHz |

You will need both types of modules to make a transverter. The TX high module will be the base module. The frequencies of the filters in the LO path allow the use of an intermediate frequency of 2320 MHz. It is then required to feed the 7242.666 MHz signal to the LO input, which when tripled gives 21.728 GHz. The LO filter (20.19-21.59 GHz) in the TX submodule passes this frequency with little attenuation.

In turn, the frequency of 24048 MHz being a product of mixing in the transmission path will be passed through the RF filter (22.4-23.6 GHz) in the TX submodule also with a small attenuation. Figure 1 shows a TX high submodule, containing LO and RF filters.

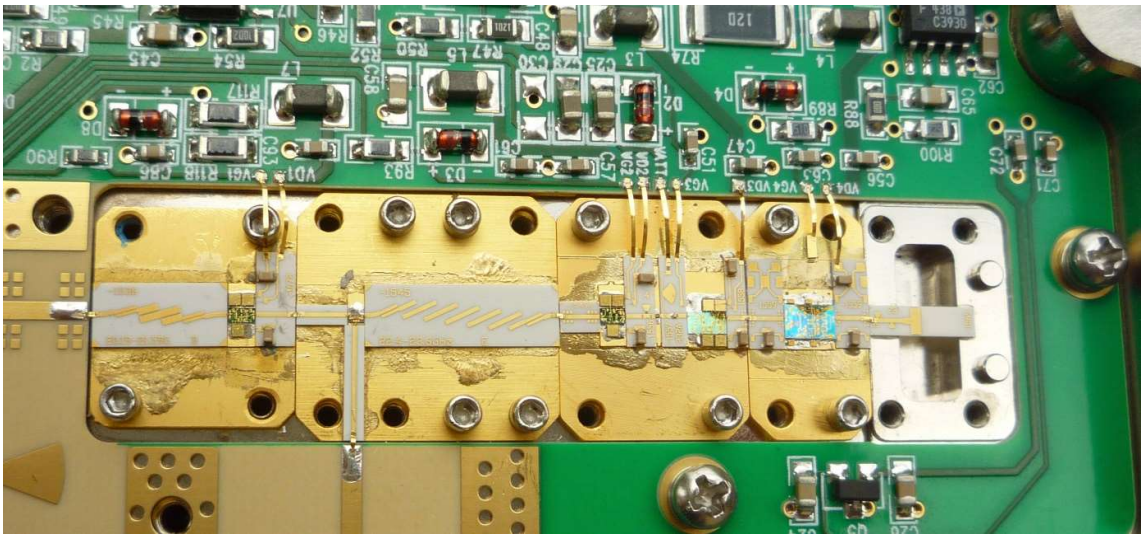

Figure 1. Transmitter submodule with LO and RF filters

The main task will be to remove the RX high submodule from the TX low module and mount it to the TX high module.

Start the modification by removing the covers of both RX submodules (Figure 2) and cutting off the wires connecting to the PCBs and waveguide probes. Then remove the RX submodule from the TX low/RX high module (Figure 3) and mount it to the base module (TX high/RX low). Next, recreate the connections by soldering the previously cut wires (Figure 4). Finally, screw the RX submodule cover. Now it is the desired TX high/RX high configuration.

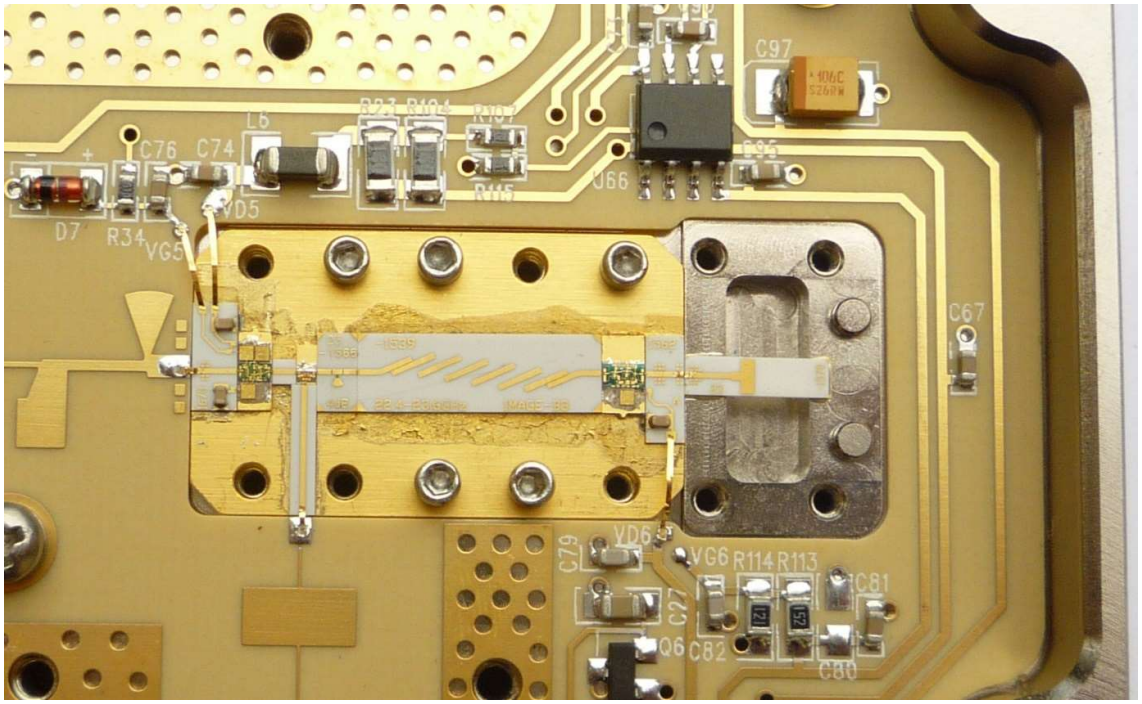


Figure 2. RX submodule before removal

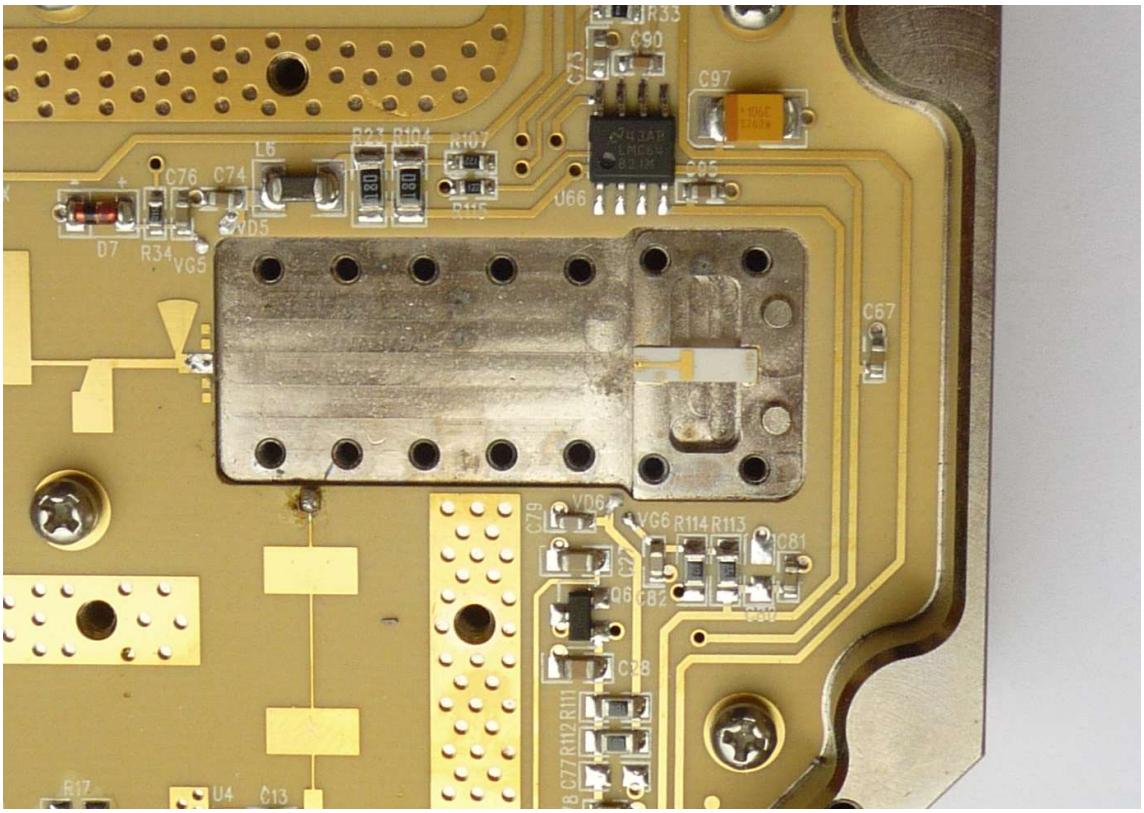


Figure 3. Module with the RX submodule removed

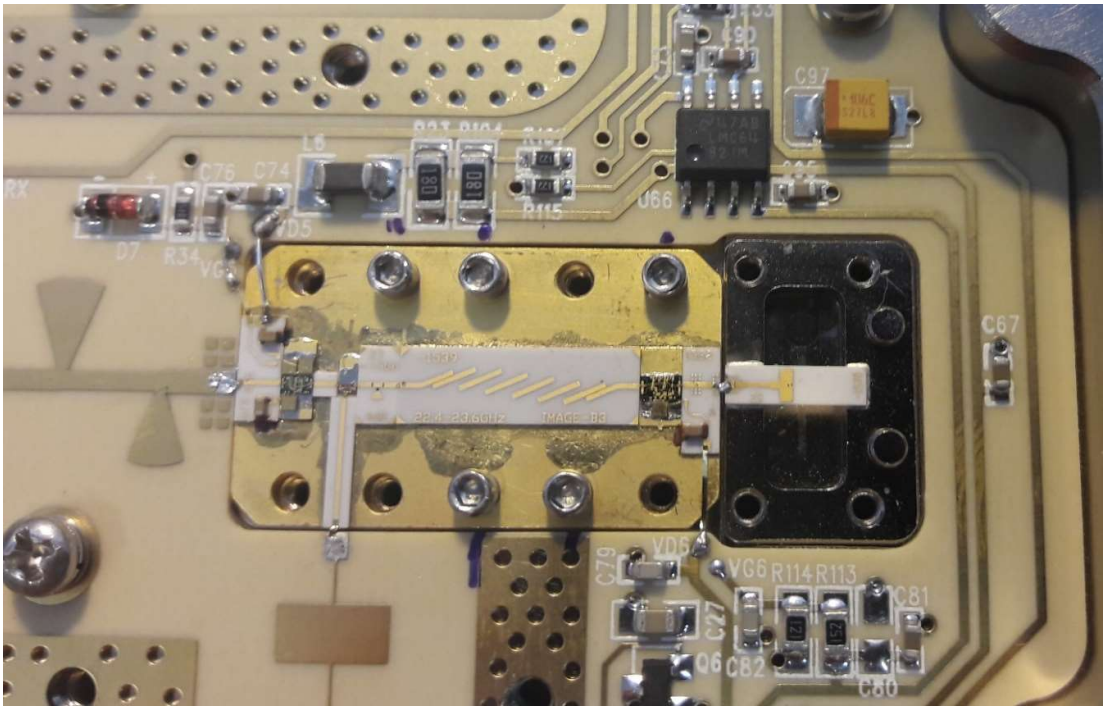


Figure 4. RX high submodule installed instead of RX low one

The second task is to modify the IF amplifier. It contains two MMIC MGA82563. To increase the gain, remove the attenuators between the MMICs (Figure 5). This procedure increases the gain of the IF amplifier from 11 dB to 20 dB.

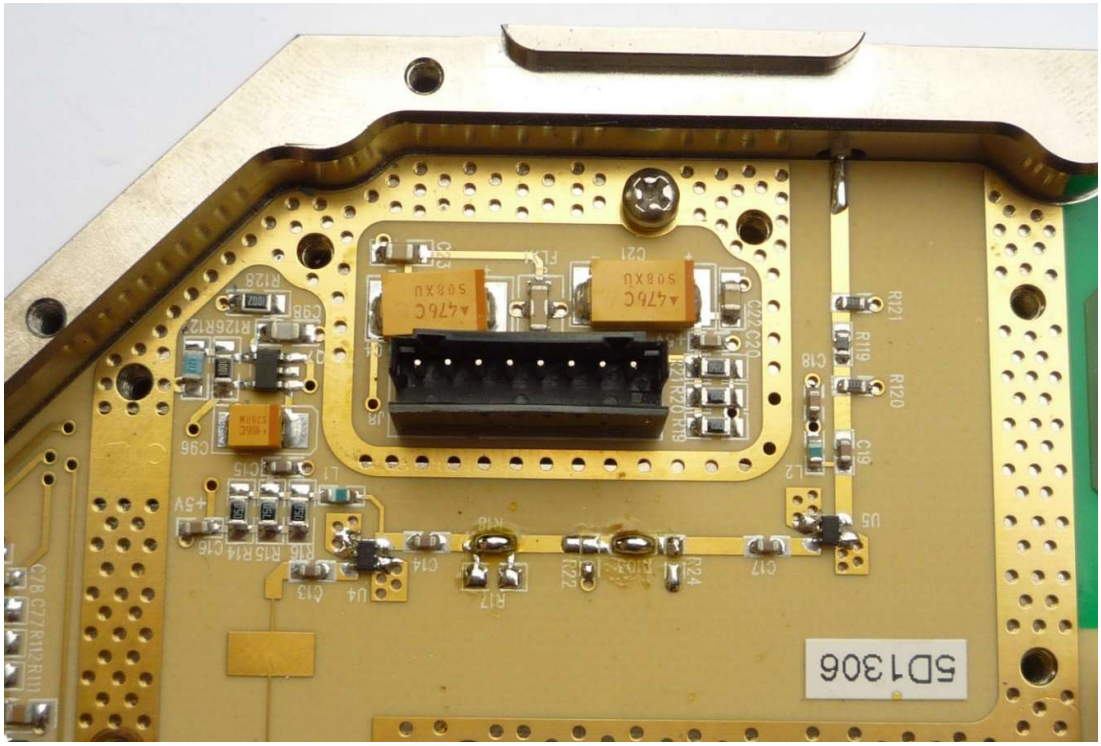


Figure 5. IF amplifier with removed attenuators

The module has two separate TX and RX ports in the WR42 waveguide standard. For operation can be used two antennas or a RF relay and one antenna. During the tests, the first solution was used.

Several modules have been modified as described above. The following results were obtained:

Output power at 24048 MHz: 550 to 720 mW

Input powet at 2320 MHz: +6 to +13 dBm

RX path amplification: 18 to 25 dB

LO input level (7242.666 MHz): +6 dBm

LO leakage at TX RF output (21728 MHz): -17 to -10 dBm

Supply:

+13 V, pin 3 (connector J1), pin 2 (connector J8)

+5 V, pin 12 (connector J1), pin 3 (connector J8)

-5 V, pins 4 (connectors J1 and J8)

+3.3 V, pins 13 and 14 (connector J1)

+9 V TX, pins 2 and 11 (connector J1)

GND, pins 1, 5, 18 (connector J1) and 1, 5, 8 (connector J8)

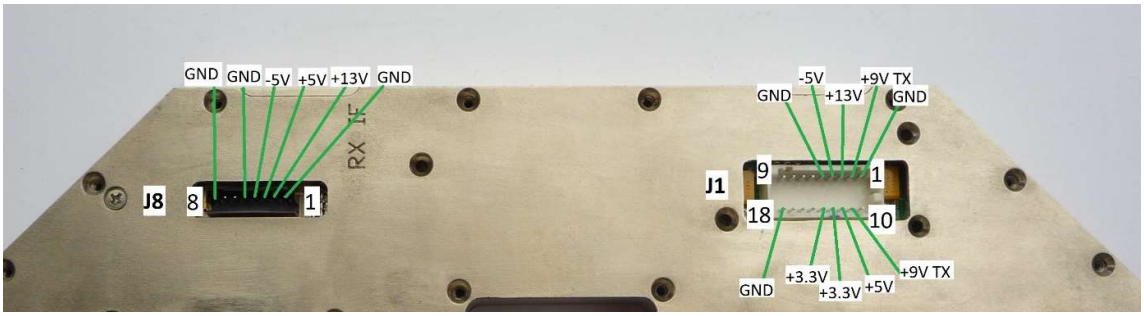


Figure 6. Power supply pins

RF elements in the module:

FMM5807X - final power amplifier, 21 to 27 GHz, Pout = 30 dBm, G = 14 dB

FMM5804X - driver, 17.5 to 31.5 GHz, Pout = 23 dBm, G = 18 dB

CHA2090-99F - LNA, 17 to 24 GHz, G = 23 dB, F = 2 dB

3x NBB-310 - LO amplifiers, DC to 12 GHz MMIC amplifier

2x MGA82563 - IF amplifier, 0.1 to 6 GHz MMIC amplifier