Modifications for a Thales TV transmitter drawer

For 222 MHz

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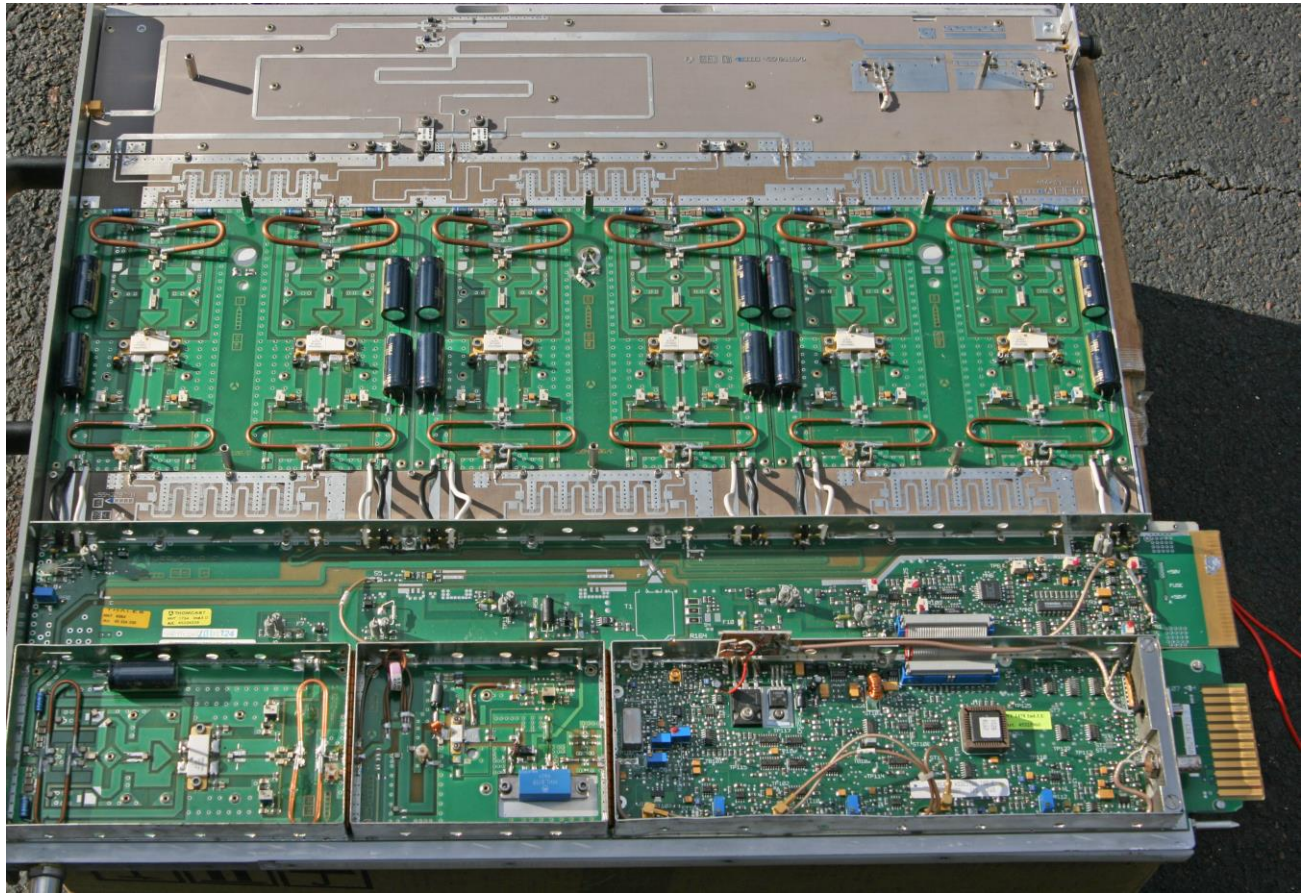
(Contact Jeff, WN3A for units available)

Thales High Band Transmitter

- Here are some instructions to convert a Thales/Thomcast TV transmitter drawer for amateur use at 222 MHz.



Well designed TV surplus amplifier with many conversion options for use on 222 MHz.

The Good

1) Very little RF conversion necessary for use on 222 MHz.
2) 50V supply
3) Several options available for various drive levels.
4) 6- BLF278 Push-Pull MOS FET devices.

The Not so Good

1) These by design are water cooled
2) Large footprint, approx., 24 x 22”

But we can deal with these issues……

Minimum steps necessary for conversion to 222 MHz amateur use.

1) Change input and output connector to a standard coaxial connectors.
2) Modify bias regulators for TR switching.
3) Install coax to driver stage for input drive level desired.
4) Add LPF, W6PQL boards will work, kit is low cost. Be sure to specify 222 MHz.

That’s about it!

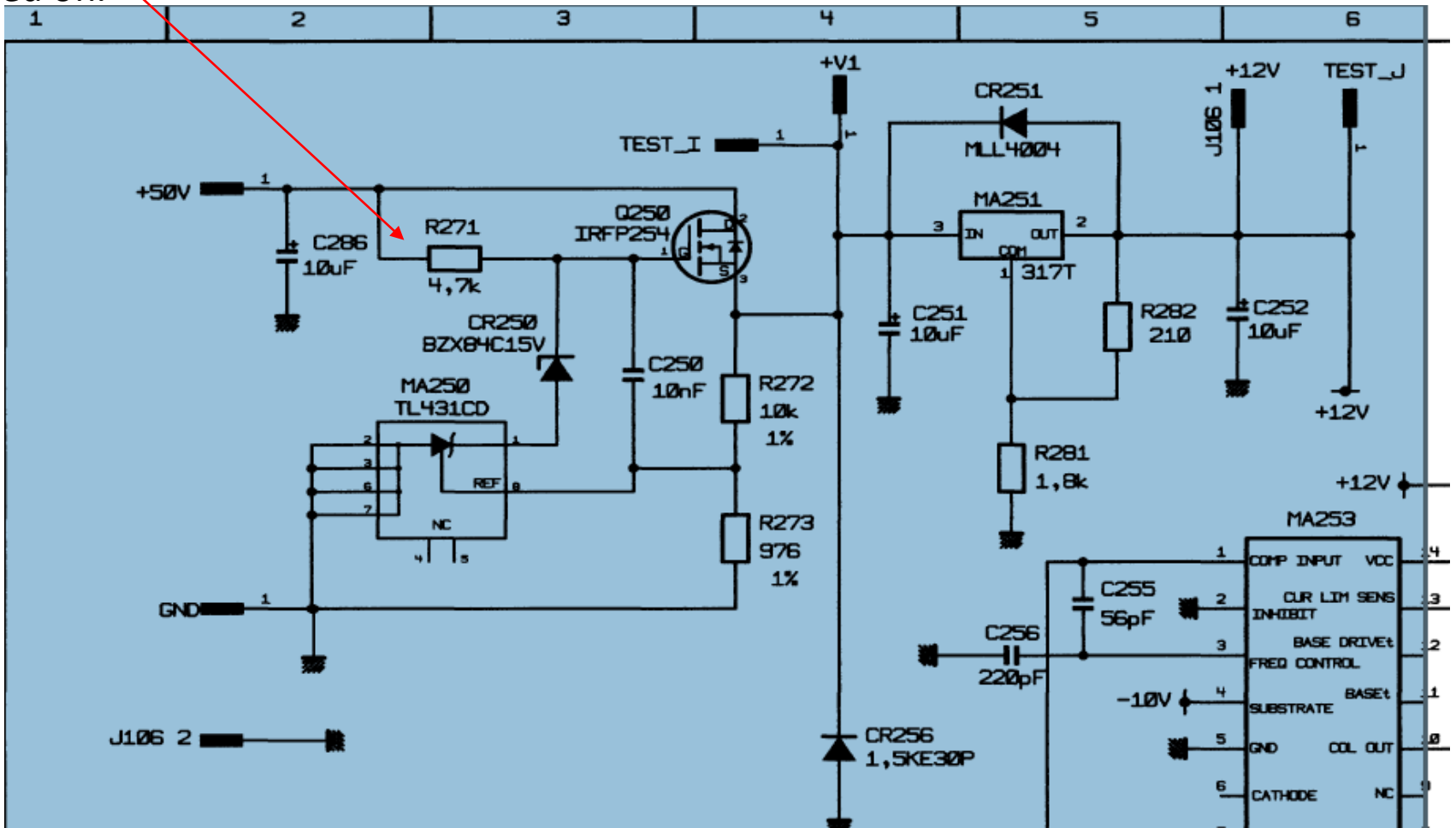
Bias T/R switching modification

Looking at the schematic provided, the bias for all the stages in the amplifier is derived from a series FET, Q250. The gate of Q250 is set from a voltage reference MA250, a TI voltage reference IC, TL431C.

To key the bias of the amplifier off and on, we can simply remove R271 from 50V and add a low power series FET to key it off and on. Schematic of original circuit shown below.

Original Bias regulator circuit.
Note +V1 is source for bias, and regulated +12V source for low power stages.

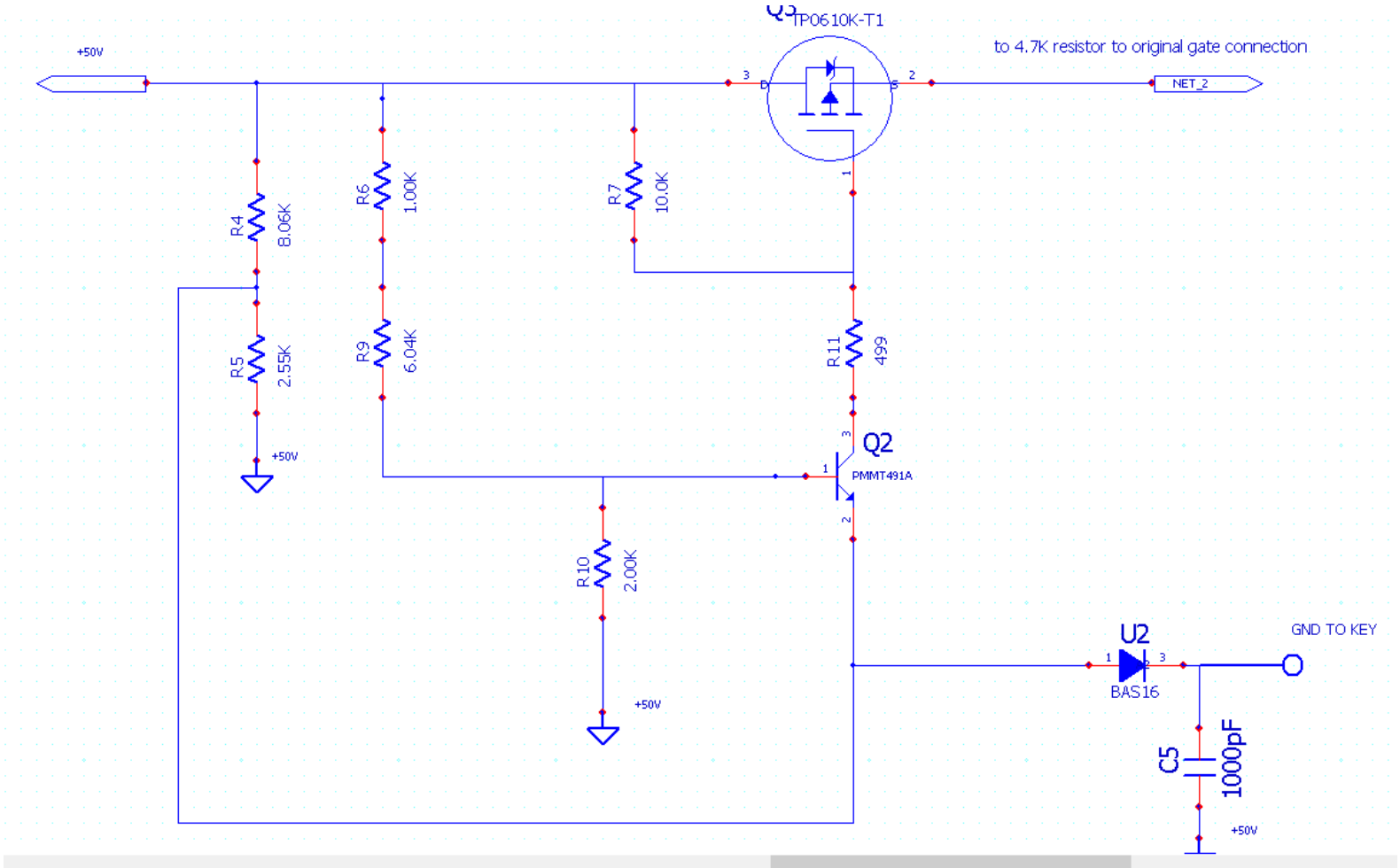
Remove +50V from R271 then bias and +12V is turned off.

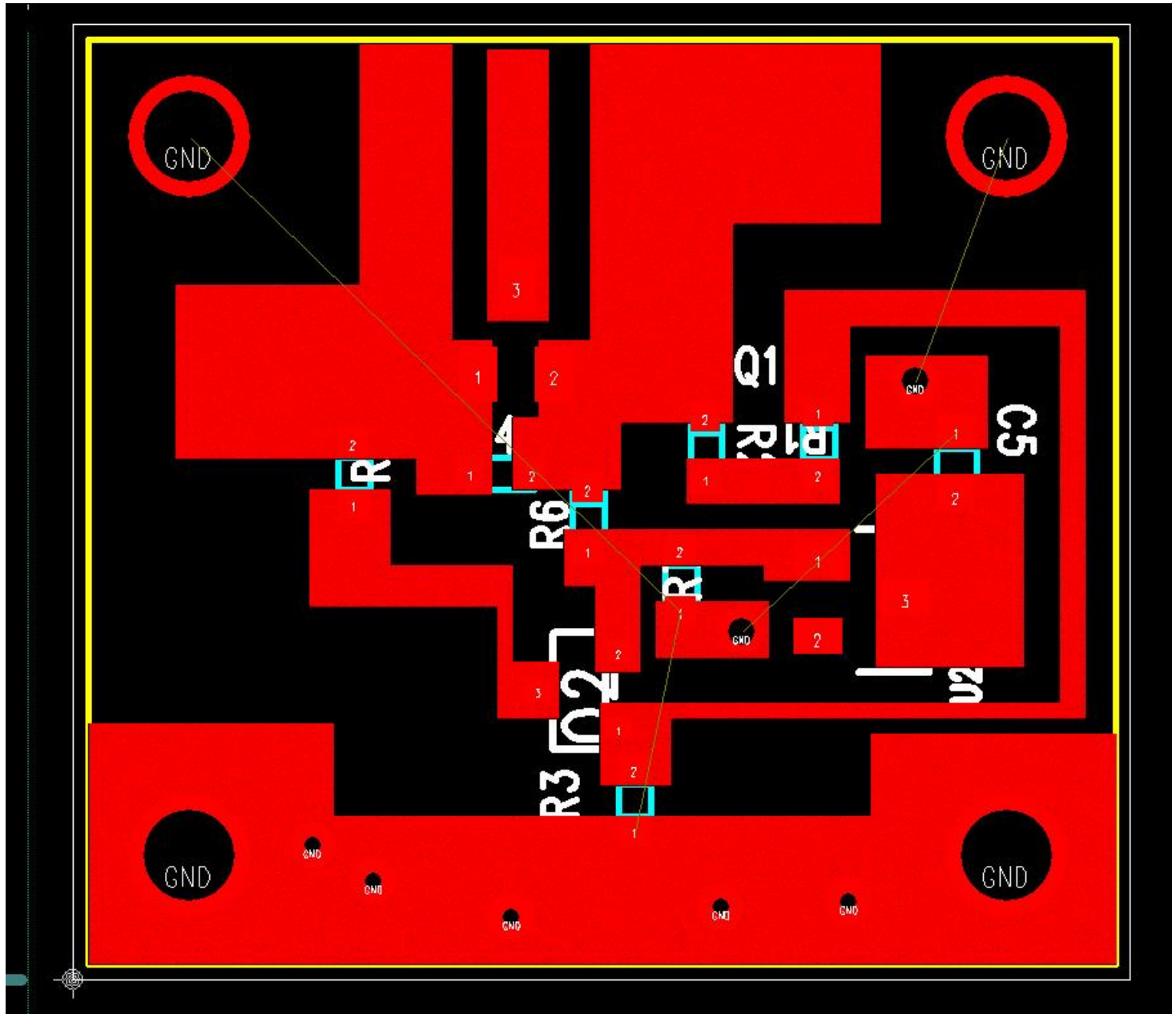


Additional Bias control circuit added.

A small board can be provided to solder on the side wall so the original sheet metal covers can be put back on. About 10 parts required to have solid state TR switching. This circuit is the W6PQL FET switch with a small SOT-23 FET in use.

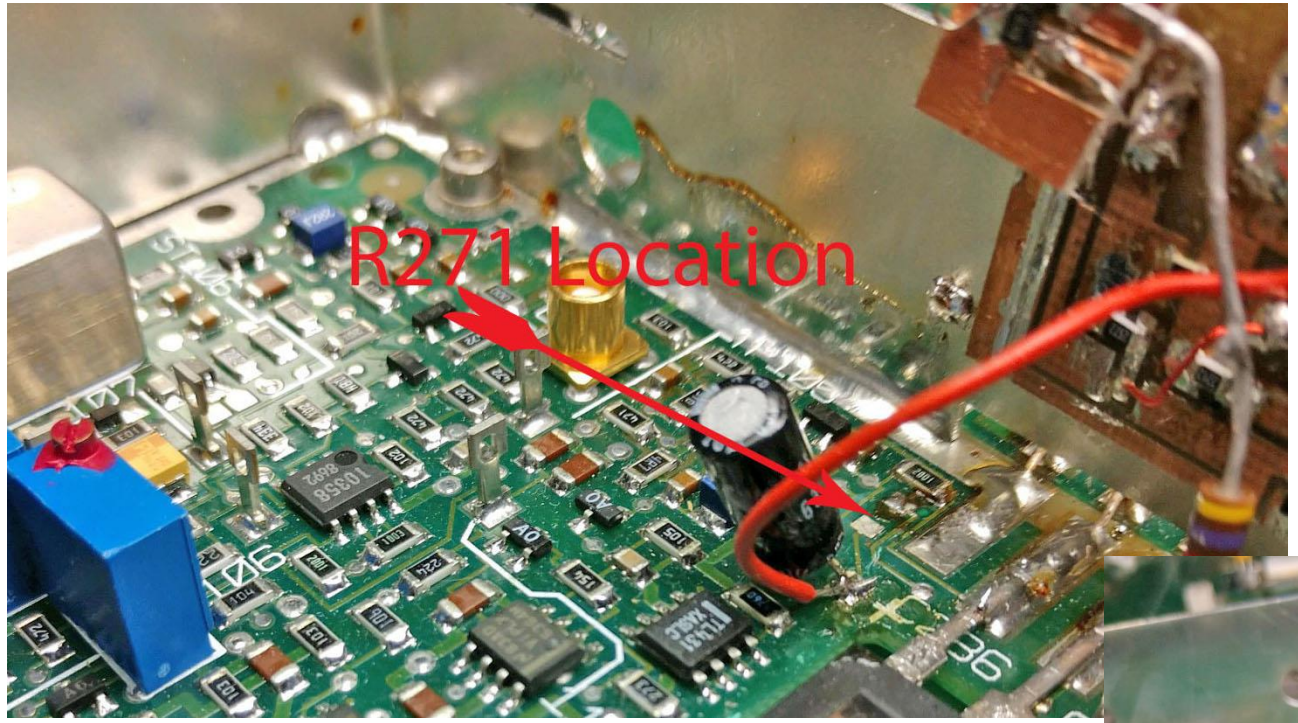
A Dip relay can also be used, this circuit saves having to connect a voltage to power the relay. This circuit also has a low voltage to key to gnd.



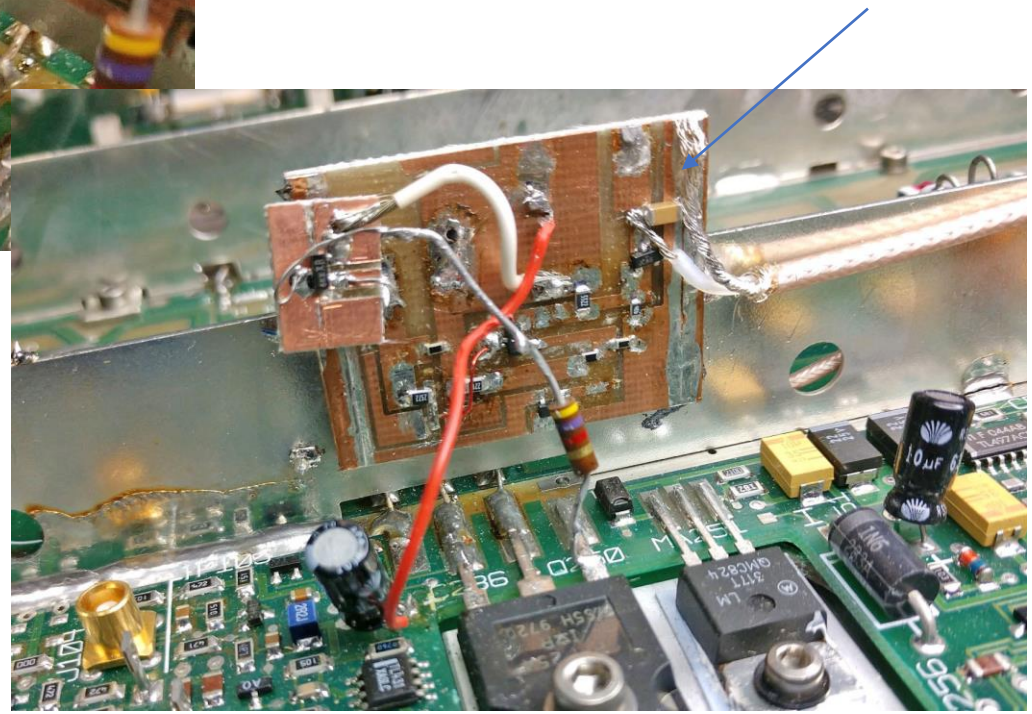


Key Board artwork,
As of this writing,
boards are on
order.

R271 removed, wire to new bias board.



New breadboard prototype bias board, solder or mount on the sidewall.



This TR switching method has been in use for bench testing and on the air.

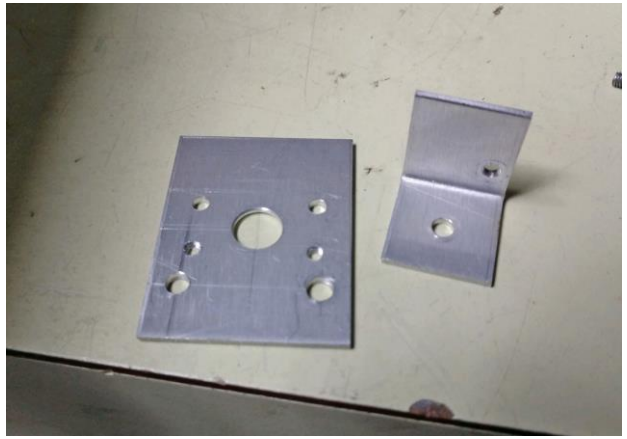
Output N connector Modification

- As in most solid state TV surplus, the RF connectors are a blind mate and manufacture specific. These drawers were made for hot swap. These connectors will have to be removed and replaced with N and BNC or other connectors of your choice.

Note: In a attempt to preserve the water jacket in the cold plate base of the amplifier no additional holes were drilled, here is a N connector mount suggestion.

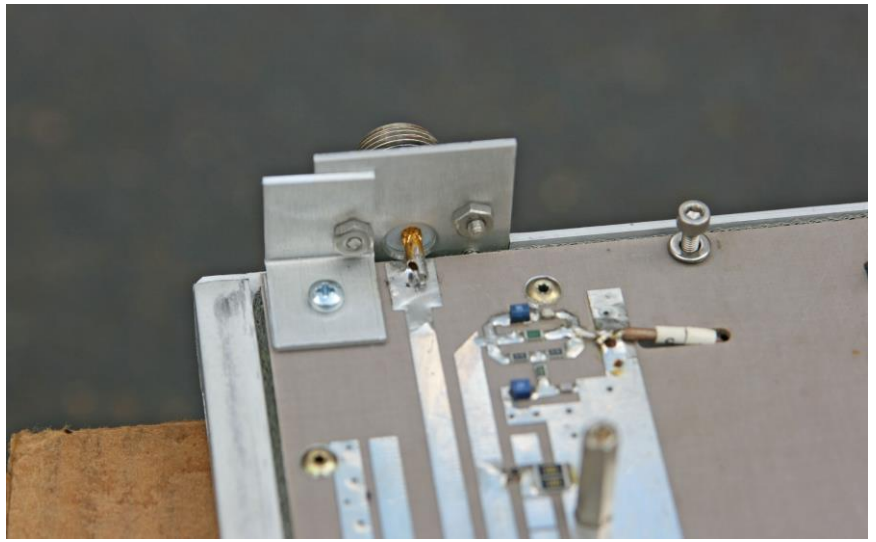
Removed connector, ready for N install

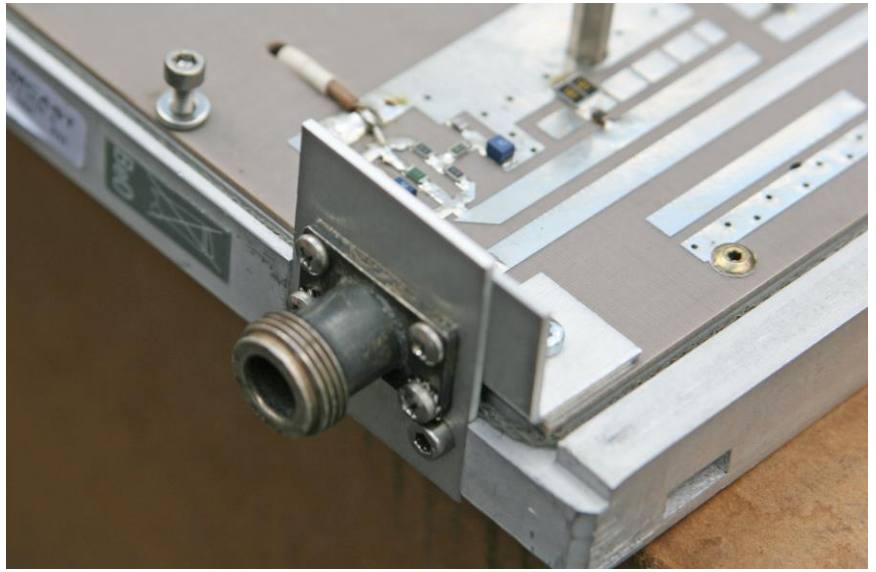
Sheet metal for N conn mount. This mount was made for a N connector with a flat surface on the rear of the mount, this connector happens to be from a Comark TV surplus drawer. With a thicker plate other connectors can be used, Flathead screws would have to be used from the rear to mount the N connector if the screws interfere with the original mounting holes in the cold plate.



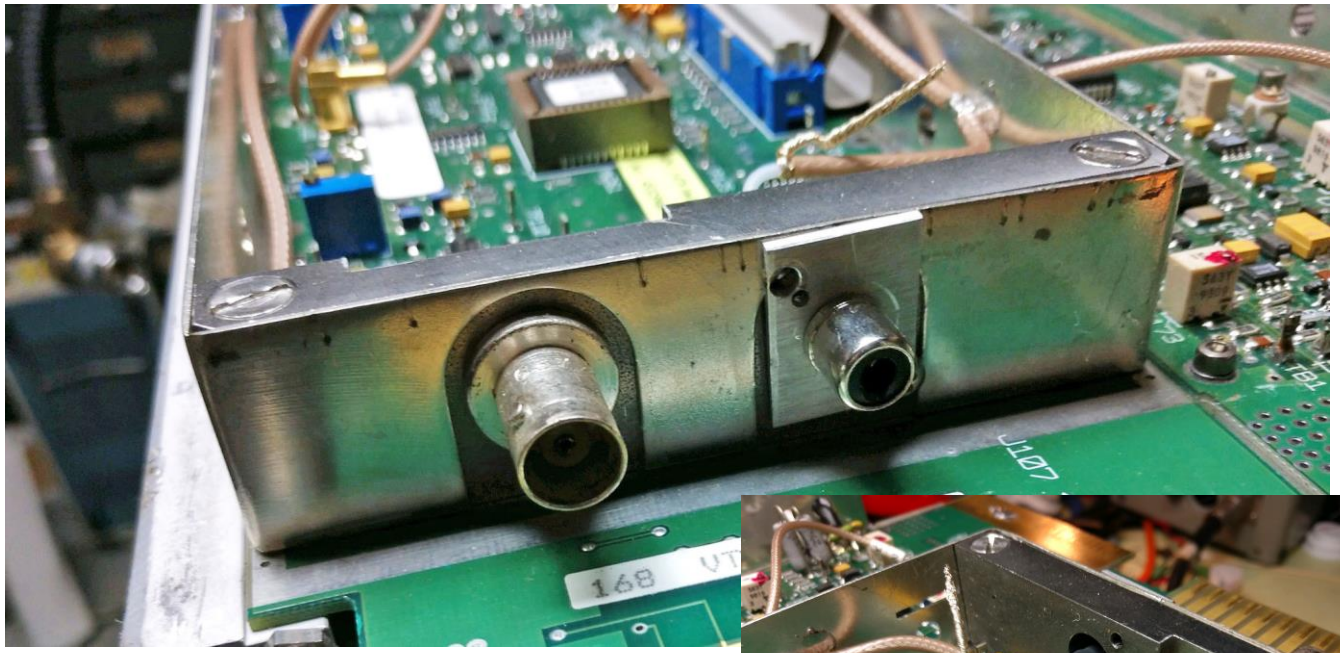
N connector mount on baseplate

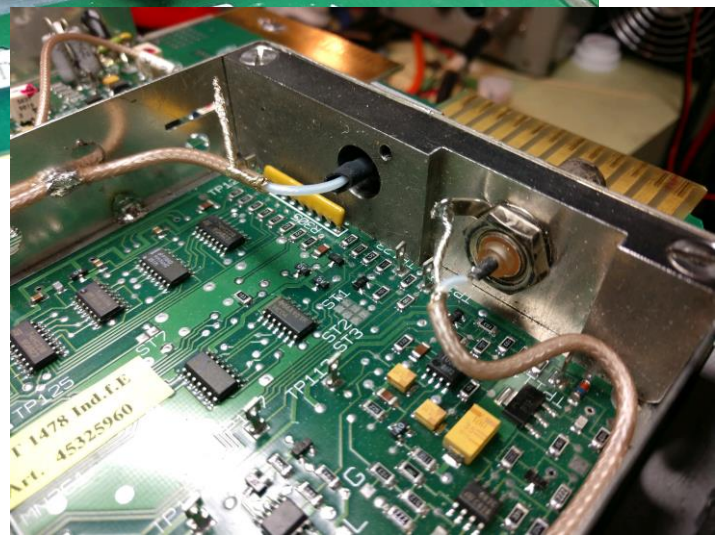
New N connector mounted on baseplate. Note angle bracket provides additional ground connection and mechanical stability.





Input BNC and Phono connector mounted on existing block. The original block is steel, hard to machine, but it fits. A bracket could be made from aluminum, or solder cables to vertical shield.

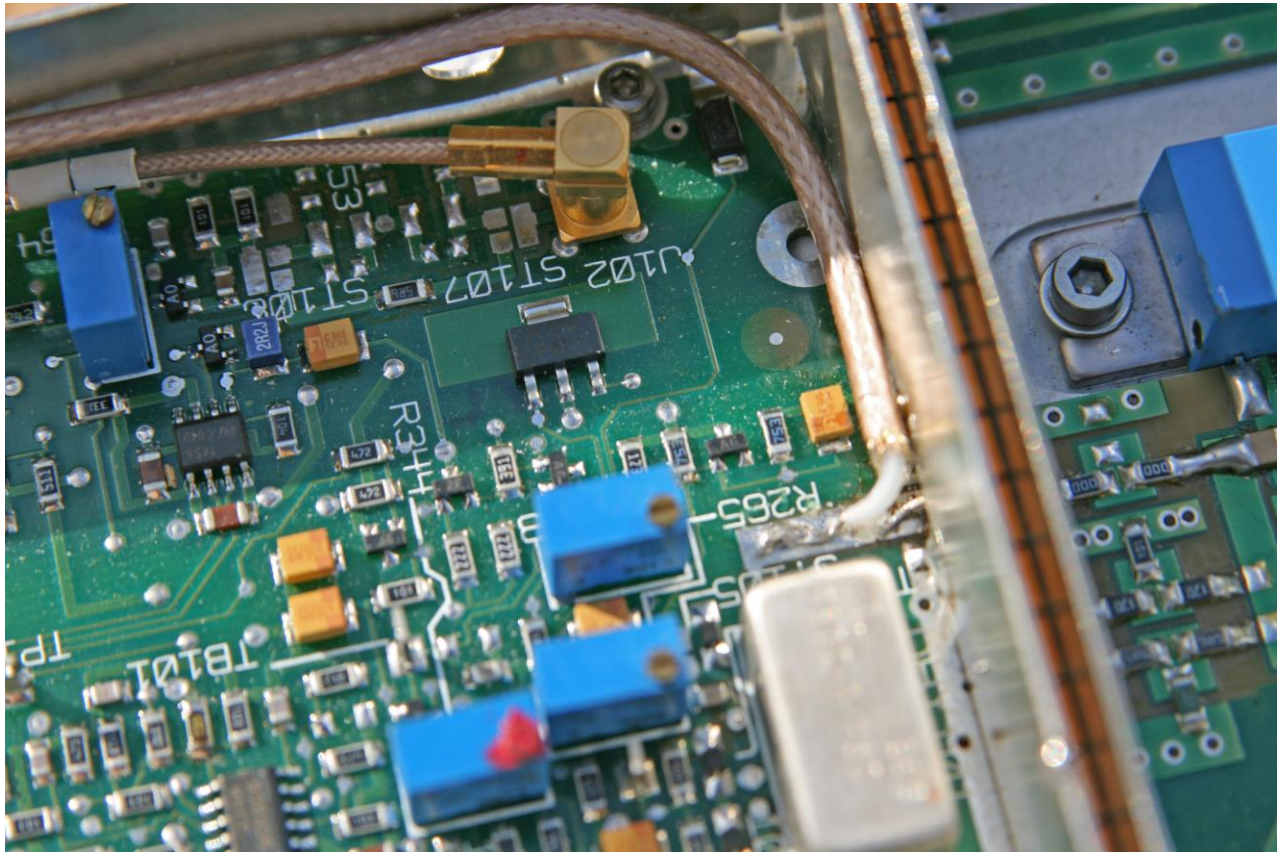




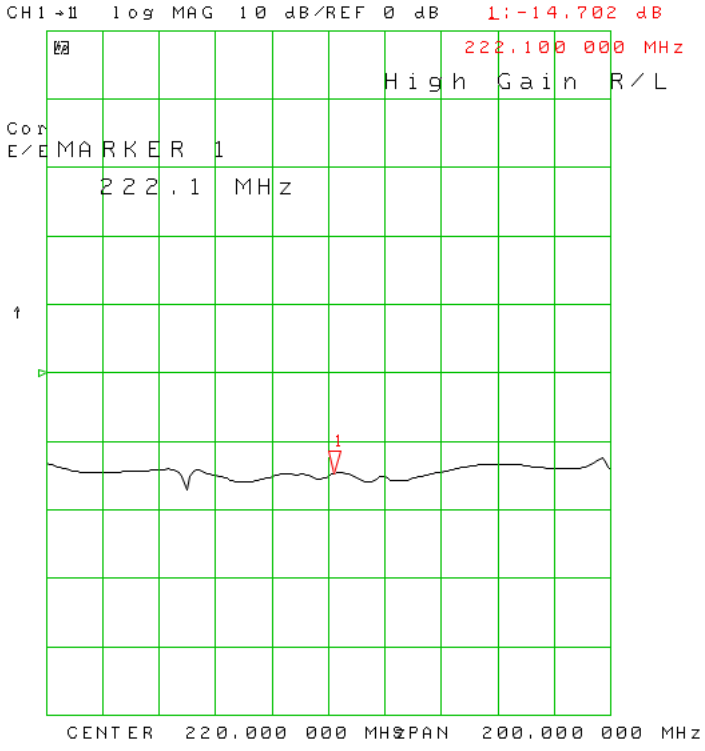
RF input connection

This amplifier has several driver stages before the power splitter to the 6 output Fets. The manufacture provided small wires from stage to stage, (bless them), which makes it easy to solder a RG 316 or other small coax at the point drive is applied. Also, the sheet metal is tin plated, so ground can be soldered just about anywhere.

The input was 1st wired to the 1st stage to measure and test at the highest gain available. This worked well. The input was from the 222 mixer filter stage in the transverter. This was used on the air for a sprint contest and net check in.
At this point, about -2 dBm provided 900w out! This is fun! Input coax connection for high gain shown below.
The on the air testing at 900 to 1000W out was with a common 50V server blade supply.

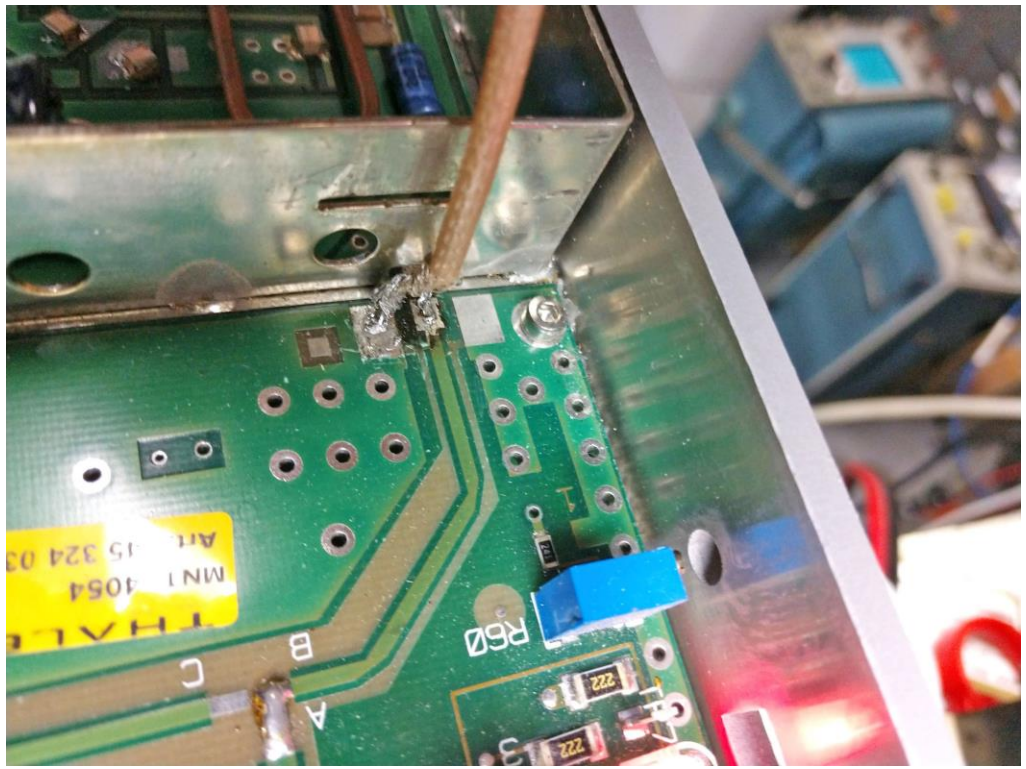


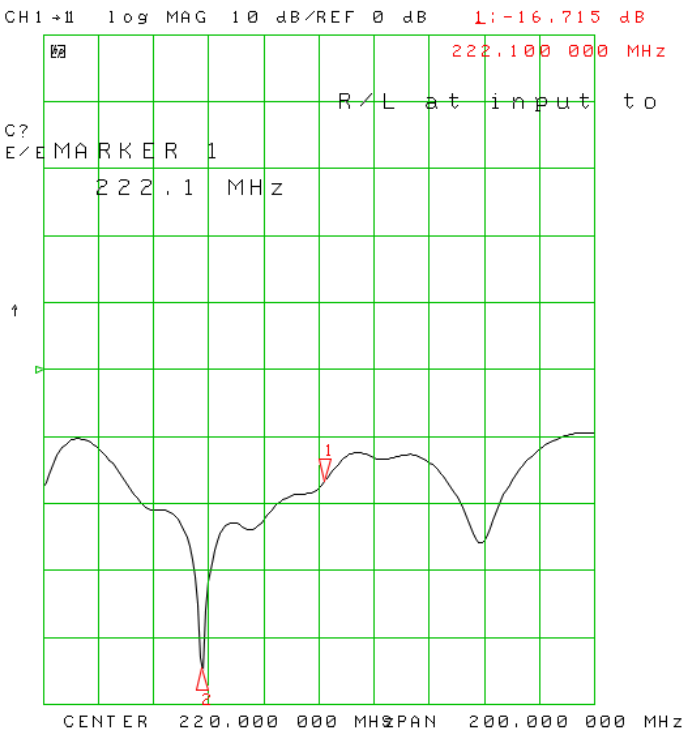
R/L at the input connection shown.



RF input for higher drive

Although the drivers on the amplifier provide high gain, most stations or amateur use will be with higher power transverters.
The input stages can be bypassed to drive directly into the power splitter to the 6 output stages. This was tested at 10W drive as of this writing. The wire from the previous stage was removed through the wall, picture and R/L plot below. 10W of drive is about 400 W out, more testing will be done at 20W drive. This R/L shows the splitters are optimized lower in frequency, around 180 MHz. No significant reflected power measured from a 10W driver at the time of this writing.
Data testing at higher power levels
23 Watts drive at the point shown below, equals close to 1000 Watts out.
At 950 Watts out, 50V supply, Current is about 50 A. Amplifier still appears to be linear. No more current available on bench supply at this level.





Some additional Details

- There is a RF sample port on the front panel
    - SMB connector
    - 48.2 dB measured, 50 dB was probably design goal.
- Measured bias on one unit is 3.2-3.3 V measured from gate to ground on each of the 6 devices. (2x), 12 measurements total. This is a good way on power up to verify you have a good unit. Bias voltages may vary slightly.
    - Although no instability was observed, always make sure the output is loaded in 50 ohms, with power on, especially with bias on.
- Resting current on the entire chassis is about 6 A, at 50V.
- Spare devices are available on the internet, be careful- significant cost to replace.

Summary as of Feb 2020

As of this writing, testing was done on the air during a sprint contest and local net check in at 900 W out. With intermittent sideband operation, the baseplate was warm to the touch using a small fan blowing across the baseplate. For contest and digital operation this unit will require water cooling or the attachment of heatsinks with possible additional fans.
The mating cooling connectors are available if you chose water cooling and not cut the hoses supplied. They are available from Staublu, P/N CBI 06.7252/IA. These can be hose clamped to plastic tubing. The contact is on the last page from this document. Small water pumps, heat exchangers, etc. are available at low cost if you really want to go for high power.

Mounting,- these amplifiers have a large footprint, but low profile. One way I mounted the amp in the shack was hanging it on the side of the rack.

Several opportunities exist for additional conversion and efficiency at 222 MHz.

The 6 output stages may be able to be optimized for 222 MHz. Testing was stopped at 1000W out as built with no RF modification because of relay, load, and power supply limitations. These amplifiers should be able to deliver in excess of 1400 W with appropriate power supplies and coax hardware.

It is possible each output stage can be tuned for 144 MHz, and the power splitters bypassed with lengths of coax (if necessary) for conversion to 2 meters. If the surplus quantities exist, conversion for 2 meters can be attempted. As of now, a small quantity of these are available for use at 222MHz.

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