Nacton 4m transverter Upgrade modifications

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Please read before commencing the modifications.

As with most electronic designs experience gained with early units often lead to performance improvements in later versions. The following notes show how early units of the Nacton 4m transverter can be improved. It is not necessary to make these changes, but undoubtedly they do improve performance. Please read these notes in conjunction with the PCB errata sheet. The correct component designations are used in the following:

Improving sensitivity

There are several modifications that can be done to improve sensitivity on 4m.
The first of these involves a change of values in the receiver section input filter consisting of C45, 46, 47 and 48, together with inductor L20
The changes of values are to the capacitors **only** and are listed in Table 1 below

Note that in all of the following modifications 0805 size components are used.

Component	New value
C45	47pF
C46	12pF
C47	12pF
C48	47pF

Table 1 4m input filter

L20 will be found to peak in the middle of its adjustment range and there will be a broad increase in antenna noise.

Reducing noise

The second improvement comes from changes in the PIN diode switching. The original arrangement was found to add a small amount of noise into the IF signal path. This noise comes from Zener diode D2, amplified by TR5.
The changes involve some cut and strap modifications.
Once you have started this modification, do not power the transverter until it is completed!

1. Carefully unsolder R17 (430R) and place on one side
2. Carefully unsolder L5 and move it to the pads previously occupied by R17
3. Now solder R17 between the original signal track pad occupied by L5 and the large adjacent +5v regulator output pad next to C41.

This simple modification will improve receiver sensitivity by several dB. The changes are shown in Photo 1 circled in yellow, and include the next few changes as well.

Restoring the transmit path

It is now necessary to do the following modification to restore transmit operation and as a by-product, further improve receiver sensitivity.

Unsolder L4 and placed on one side.
Solder a 430R resistor to the vacant L4 pad that connectors to D4. Do **not** solder the other end to the other pad. Instead you should solder the end of a short length of insulated wire to the free end of the resistor (called R35) and the other end should be soldered to the +5v output pin pad of IC3.

This modification ensures D4 is turned off completely on receive. If it is not then adjusting the transmit gain pot, R27, affects the receiver gain due to signal leakage through D4 and the pot to ground.

A very slight improvement in sensitivity can also be made by swapping the switching diode arrangement in the RF path side (Diodes D5 and D6). For this you will need a spare 430R resistor.
Carefully unsolder R28 and place on one side.
Unsolder L17 and then solder it in place of R28, just removed.
Unsolder L18 and replace with a 430R 0805 size resistor. Store L18 for a rainy day!

Noise suppression

Noise suppression can be improved by including an 0805 size 100nF capacitor from the base to emitter of TR5. This is simply done by soldering an SMD 100nF across the outer pins of TR5, taking care not to come into contact with the centre (collector) pin of this transistor.

The reverse bias on the PIN switching diodes is not well defined. Adding 1K resistors (R37 and R38) across the transmit and receive +5V supplies is an easy solution to this problem.

For convenience R37 is connected across C671 (near the centre of the board) and R38 is connected across C42 (near IC4) as shown in photo 1, circled in red.

Supply voltage recommendation

To reduce unwanted heat dissipation on the PCB it is highly recommended that the transverter module is operated from no more than 10-12V. An external 7810 voltage regulator can be used to bring a 13.5v supply down to 10V. There is (just) sufficient voltage headroom to operate the 78M08 (IC2) local oscillator voltage regulator.

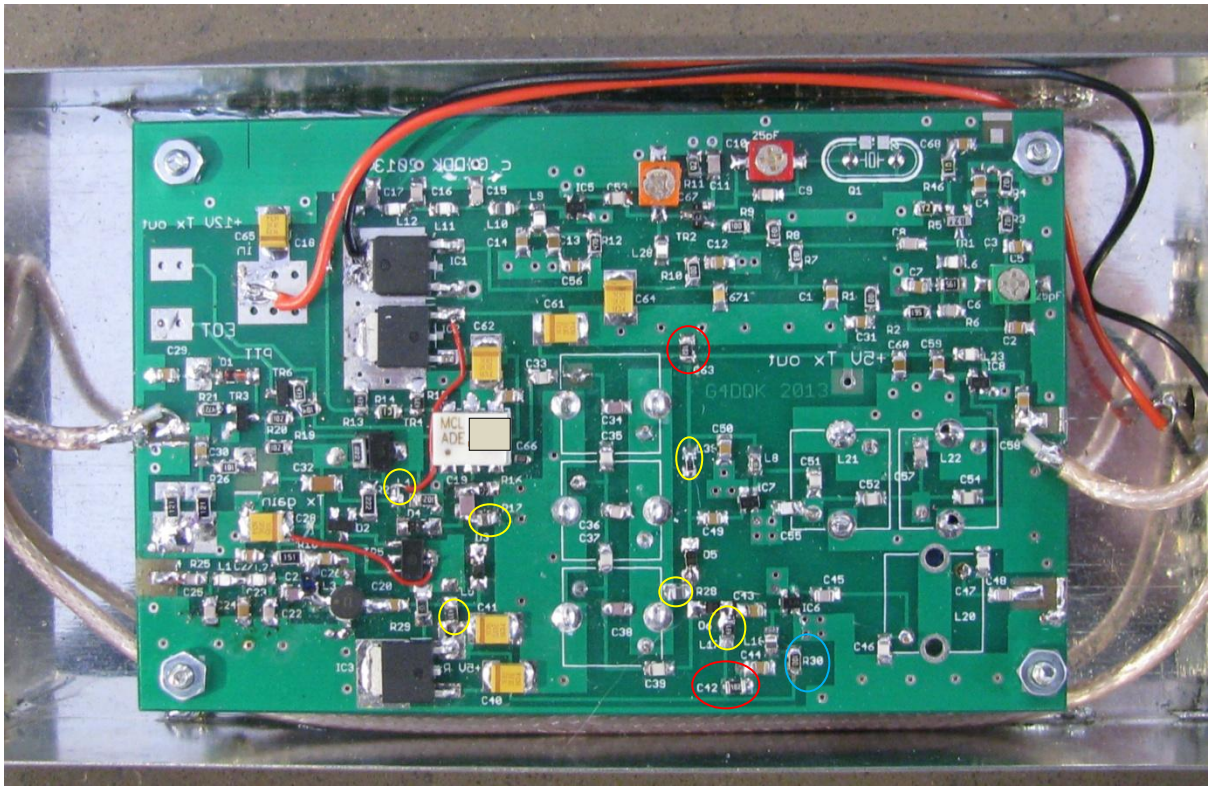

Photo 1. Modified Nacton 4m transverter mounted in the screened tinplate box used for testing. Resistors R37 and R38 are shown circled in red. The PIN diode changes are shown circled in yellow. The thin red wires are the Post mixer amplifier and the R35 modifications.

Improving intermodulation performance

It is recommended that the ZHCS400 switching diodes D3,4,5 and 6 are replaced by better PIN diodes. The recommended ones are BAP64-03. These are in the same SOD323 package as the diodes originally supplied with the kit.

Post mixer amplifier

In the previous modification sheet I described how to improve the stability of the receive post mixer amplifier by taking its supply from the switched (input) side of IC2. This information is repeated in this sheet for completeness.

Cut the short track between C26 and TR5. Solder a short, insulated, wire between the positive end of C26 and the collector tab of TR5, as shown in Fig 2, below.

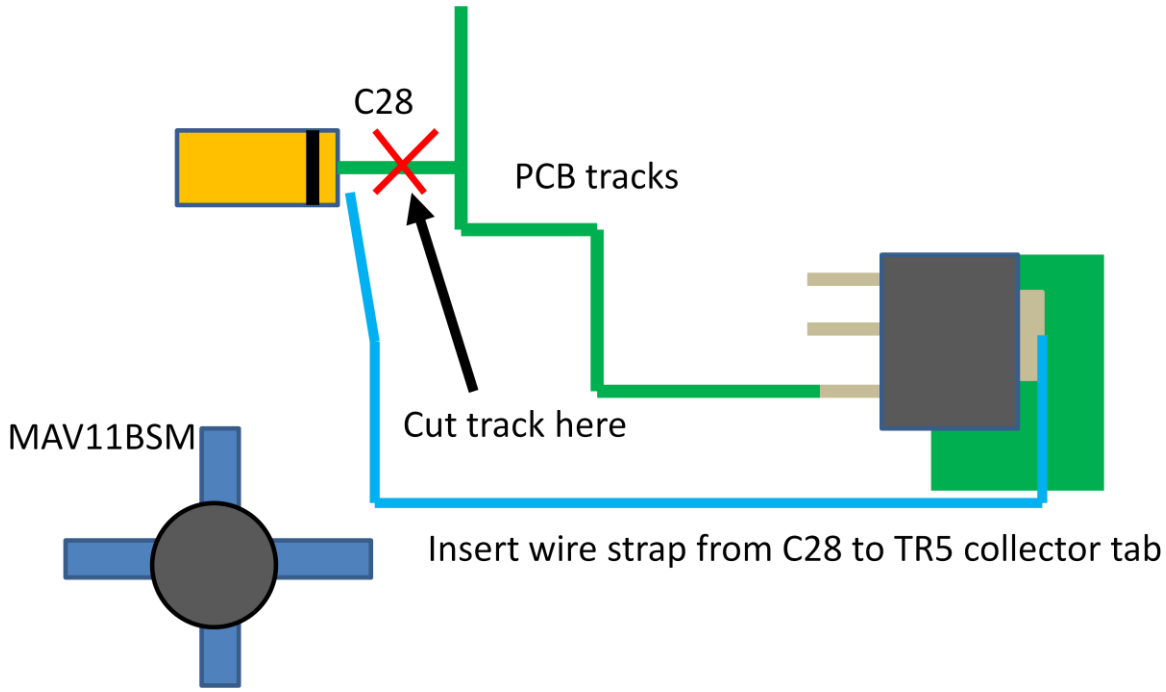

Fig 2. Switching the post mixer amplifier on transmit.

Improved 29MHz IF filter

The 29MHz output bandpass filter can be improved by changing a few of the capacitor values. These are shown in table 2, below. The input and output match are improved as is rejection of feed-through of unwanted products from the mixer.

Component	New value
C21	68pF
C22	82pF
C23	560pF
C24	82pF
C25	68pF

Table 2 IF output filter values

Improving transmitter stability

There is a lot of gain in the transmit amplifier chain. By including a 10R resistor (R39) across L23, as shown in the circuit diagram, stability is improved at the expense of requiring slightly more IF drive. Typically the maximum drive requirement goes up from +6 to +10dBm at the 28MHz IF input. R39 should be soldered directly across the top of L23. The position of R39 is shown circled in blue in photo 1.

Test voltages

These are shown circled on the schematic circuit diagram, for both transmit (T) and receive (R).

For transmit the PTT line was earthed and the IF input driven at 28.2MHz with +6dBm with the transmit pot set to minimum attenuation. For receive the input and output should be terminated in 50Ω

New Nacton 4m schematic circuit diagram incorporating test voltages