ORION 220 MHZ CONVERSION
BY
Mike May
WB8VLC/7

This modification was written up so that any version of the VHF high split Orion can be converted to 220 MHz. My radio was a regular non dual bandwidth 150 to 174 Mhz Orion with a blown up high power output and as a result it was decided to simply replace the existing VHF power module/driver with a comparable 220 MHz power module instead of repairing and then converting a dead VHF amplifier stage.

PERFORM all hardware modifications prior to programming and tuning of the receiver and transmitter.
http://www.repeater-builder.com/ge/lbi-library/lbi-39003.pdf wide bandwidth radio
http://www.repeater-builder.com/ge/lbi-library/lbi-38993.pdf receiver service section
http://www.repeater-builder.com/ge/lbi-library/lbi-39003c.pdf Power amplifier LBI
http://www.repeater-builder.com/ge/lbi-library/lbi-39002a.pdf PA maintenance

TOOLS REQUIRED:

1. DC voltmeter
2. RF signal generator
3. 50 watt or more 50 ohm RF power meter or a dummy load and a RF power meter or a suitable comm. Test set etc.
4. #20 TORX bit
5. #10 TORX bit
6. solder iron
7. tweezers
8. Insulated tuning tool for spreading the transmitter and receiver inductors.
9. desolder wick.
10. Anti Static mat or anti static bag and anti static grounding strap.
11. 220 MHz plus 4 SC file 70MHz + sc4 .
12. Capacitors as required, DigiKey 0805 series any NPO series chip caps are suitable.
13. #28 to #32 gage magnet wire for modified L436 and L437

C244 = 12 PF any 50 volt 0805 series NPO chip capacitor
C241 = 7.5PF any 50 volt 0805 series NPO chip capacitor
C243 = 3.9 PF any 50 volt 0805 series NPO chip capacitor
C288 = 12 PF any 50 volt 0805 series NPO chip capacitor
C285 = 8.2 PF any 50 volt 0805 series NPO chip capacitor

See the figure below.
Opening the radio up: Using a #20 TORX bit and a #10 TORX bit.
Turn the radio upside down and using the #20 torque bit remove the radios bottom cover #20 TORX screws.

See the figure below. Remove the metallic sub shields over the Power amplifier board, and the receiver boards paying attention to the side of the transmitter that needs to be lifted away first as marked on the shield.

Receive VCO mods: SEE the appropriate orion LBI for the following capacitor locations.

Using the #10 TORX bit remove all screws and set the solid synthesizer cover aside.
Remove the Receiver Synthesizer board from the chassis.

See LBI39173 and LBI39003
Remove C244 and CHANGE TO a 12PF
Remove C241 and CHANGE TO a 7.5PF
Remove C243 and CHANGE TO a 3.9 PF
REMOVE C242, do not place a capacitor in this position.

Remove L242, USE A SOLDER IRON AND MELT THE PLASTIC COVER OFF AND BREAK AWAY. Resolder the bare inductor back in the board.
Short across 1/3 of the turn going to ground and spread this inductor wide. Later on you will adjust RX VCO tuning capacitor CV240 for receive VCO lock after all mods are made. See FIGURE 1.

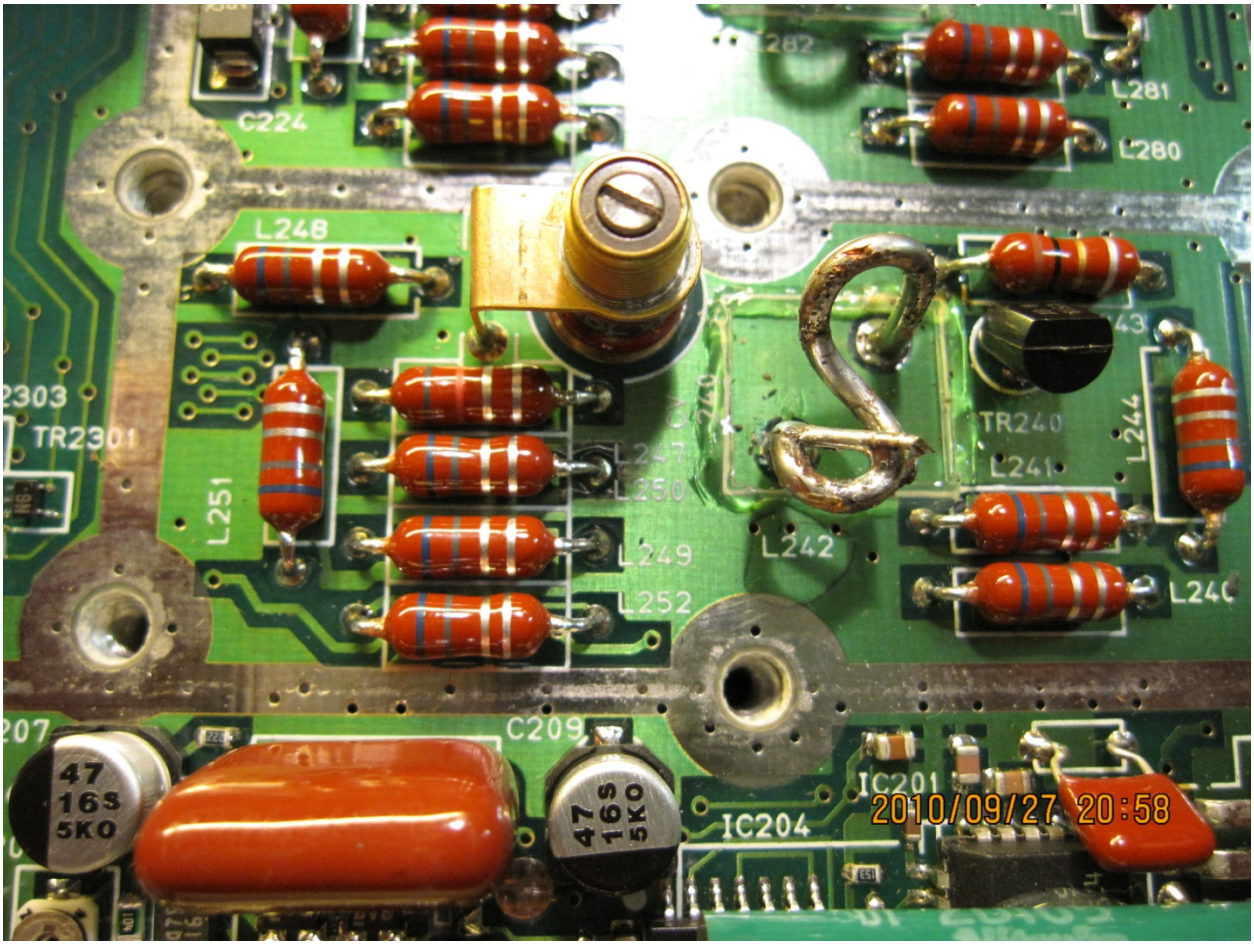
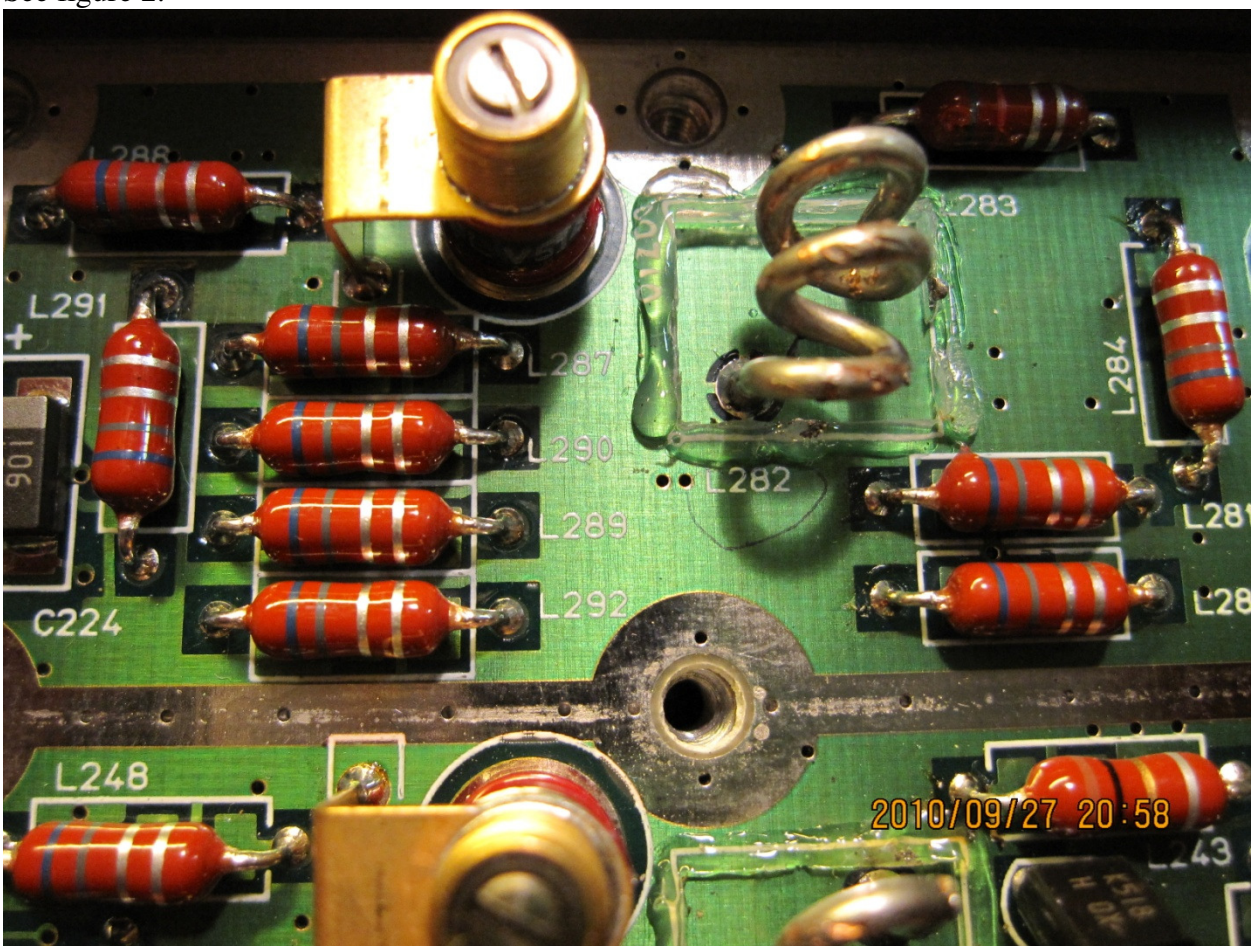


FIGURE 1. receive, spread VCO inductor L242 while adjusting RX VCO tuning capacitor, CV240 for receive VCO lock.

Transmit VCO mods: See LBI39173 and LBI39003

Remove C288 and change to 12pf
Remove C285 and change to 8.2 pf
Remove C286, do not place a capacitor in this position.
L282, USE A SOLDER IRON AND MELT THE PLASTIC COVER OFF AND BREAK AWAY.
Resolder the bare inductor back in the board.
 Later you will Spread this modified inductor wide while adjusting tuning capacitor CV280 for transmit VCO lock.
See figure 2.



FIGUERE 2. L282 Spread TX VCO coil and adjust TX tuning capacitor CV280 for transmit VCO lock.

RECEIVE BANDPASS FILTER:

Computer modeling of the original receiver pre-amps output side tracking band pass filter showed that there was minimal risk to image rejection or out of band interference if it was removed and bypassed, this made the modification much easier than having to try and make the original pre-selector accurately track across the modified 220 range.

Lift R411, 412 and 413. See figure 3A.

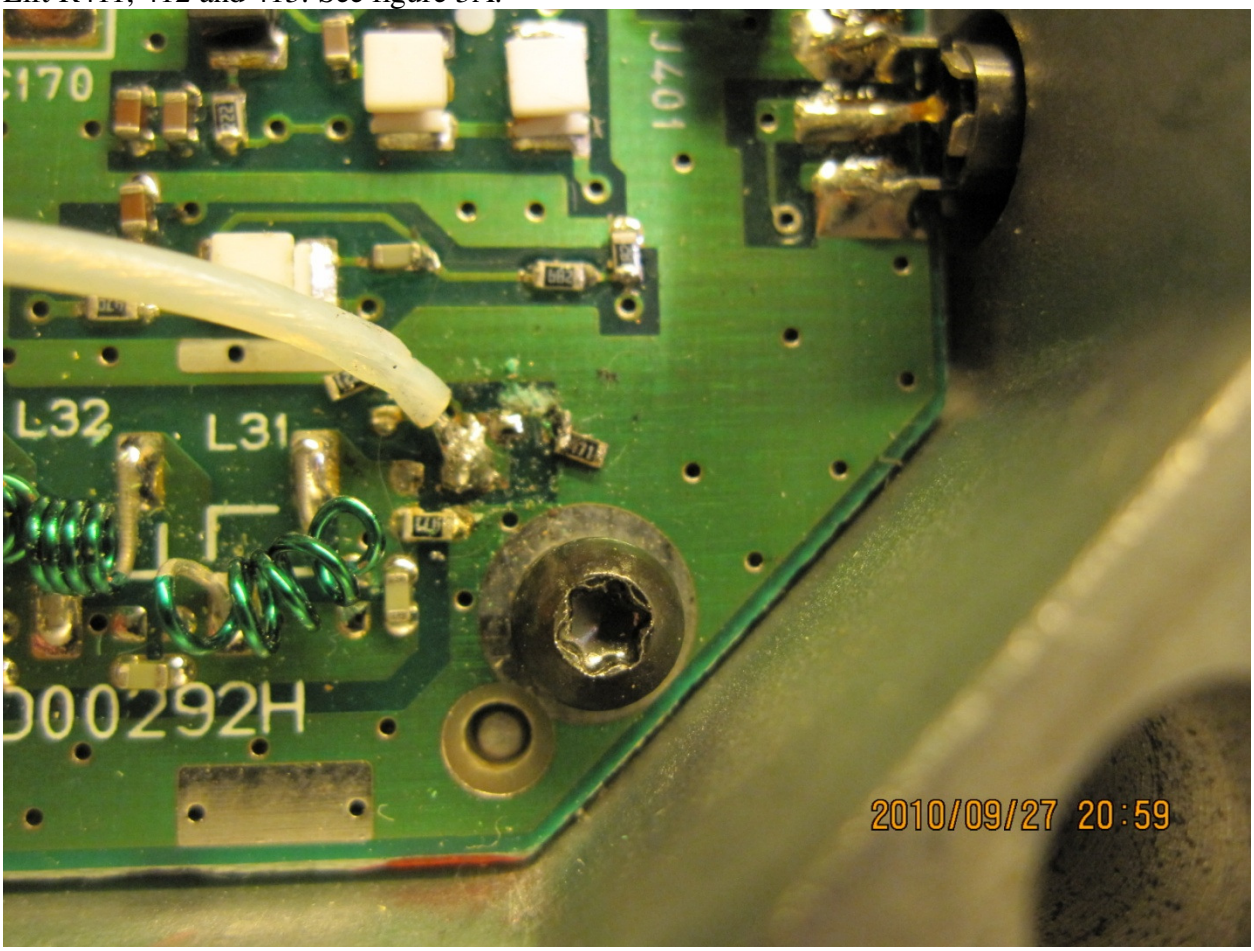


FIGURE 3A, Tracking band pass filter input side is isolated by lifting R411 to R413 to remove the tracking filter from the circuit.

Lift L435 (L35) at the tracking band pass filters output side see figure 3B.

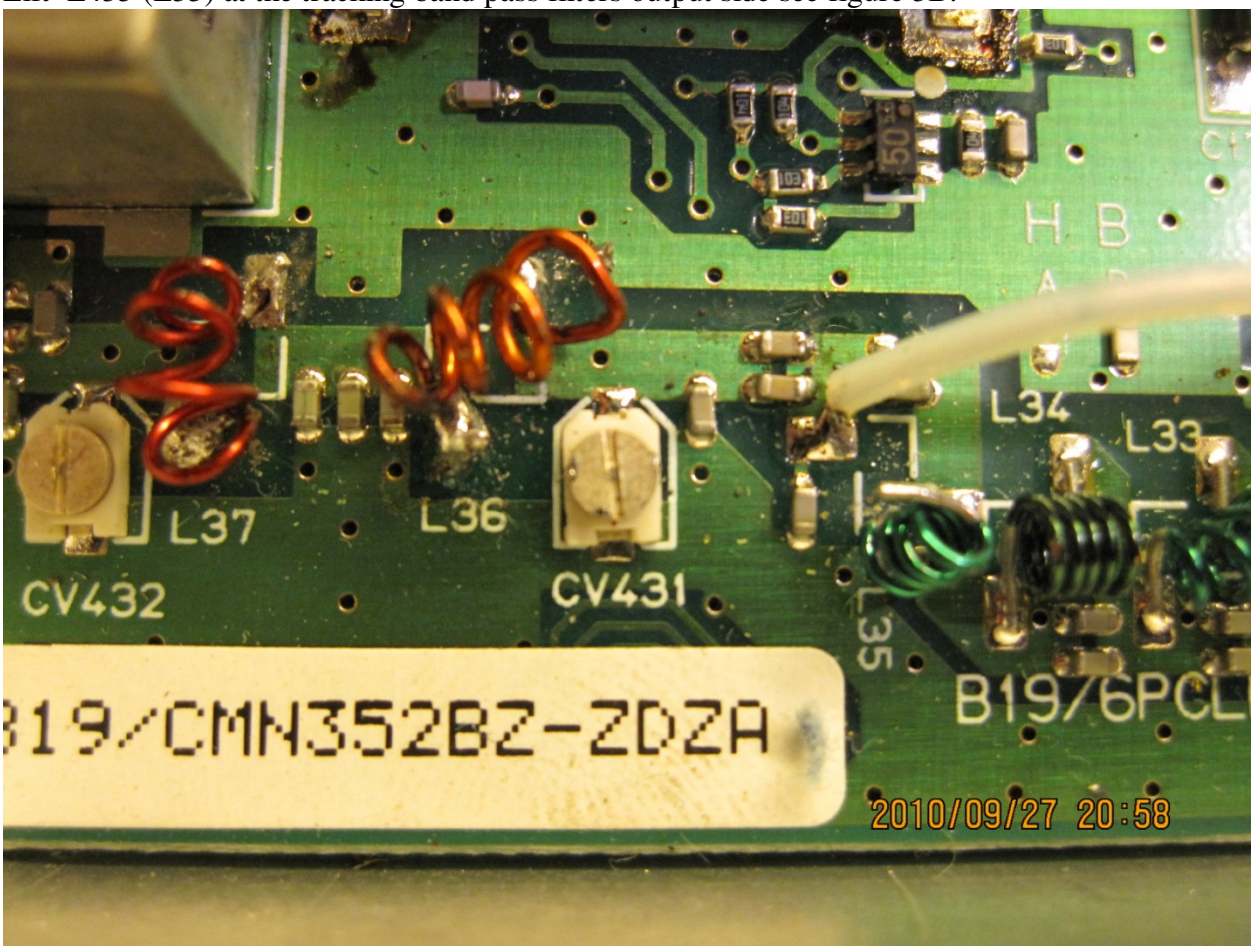


FIGURE 3B. L35 lifted on tracking filter output end.

Solder one end of a piece of jumper wire to the pads where R411 to R413 were connected to. Solder the other end to C443 where L35 was previously connected. This bypasses the tracking pre-selector filter consisting of L431 (L31) through L434 (L34) which isn't needed for 220 MHz. See Figure 4.

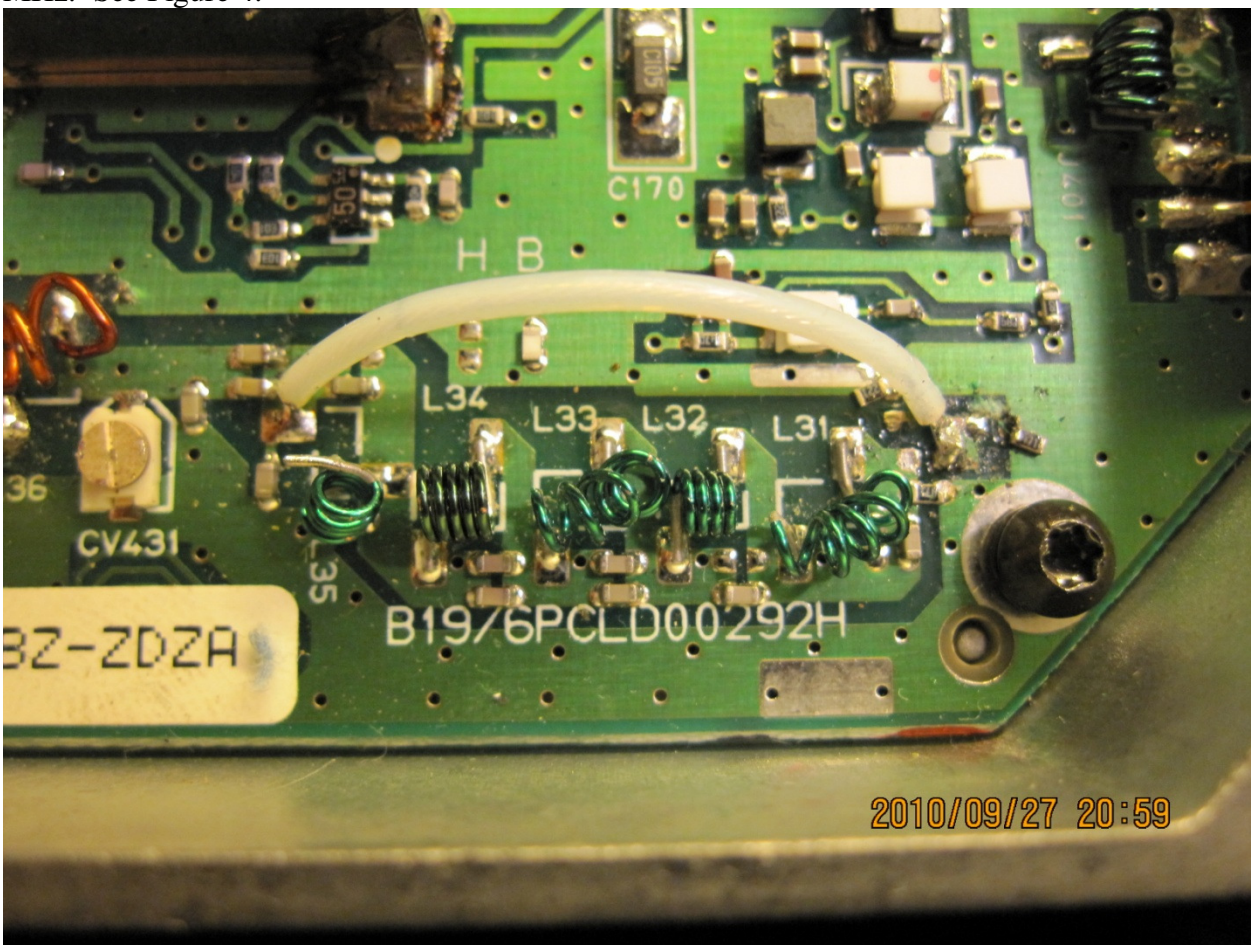


Figure 4, tracking rx band pass filter, L31 through L34 bypassed.

I could not obtain an acceptable band pass response using the original inductors, L436 and L437, as a result I made new ones using #28 magnet wire and spread them while adjusting CV432 and CV431 for flat sensitivity across 222 to 225 MHz.

Change L436(L36) and L437(L37) to 4 turns of #28 to #32 magnet wire, these are wound on a 1/16 dia, drill bit and later they will be spread wide for best sensitivity, see Figure 5.

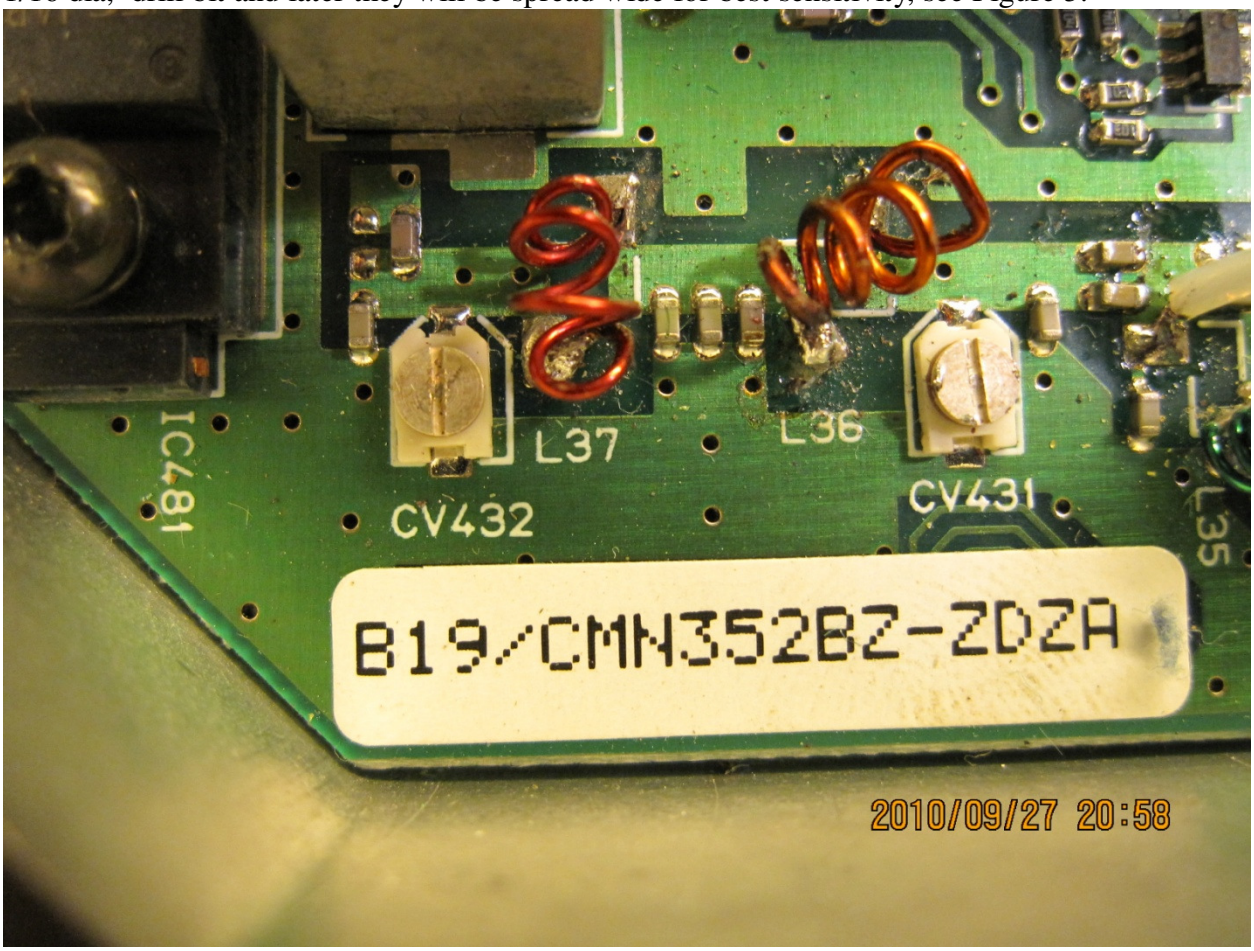


Figure 5. Receiver pre-selector inductors L436 and L437, home made and initially preset at 3 wire diameter spacing.

Preset inductor L01 (L401) at the receiver input by spacing the end turns at 1 wire diameter spacing, later on it will be further fine tuned for best sensitivity, see Figure 6.

FIGURE 6. RX input inductor, L01 (L401) preset.

Screw the receiver synthesizer board back into the chassis at this time but do not place the cover over the VCO section until the radio is tuned and aligned in later steps.

Also add in a few of the TORX screws in some of the holes where the solid synthesizer cover screws in over the VCO section, do this for good grounding. The solid VCO cover will be placed in at a later time after the radio is aligned.

RX input Pin switch ¼ wave line:

Initial adjustment of L24 and L25 prior to receiver sensitivity alignment. FIGURE 7.

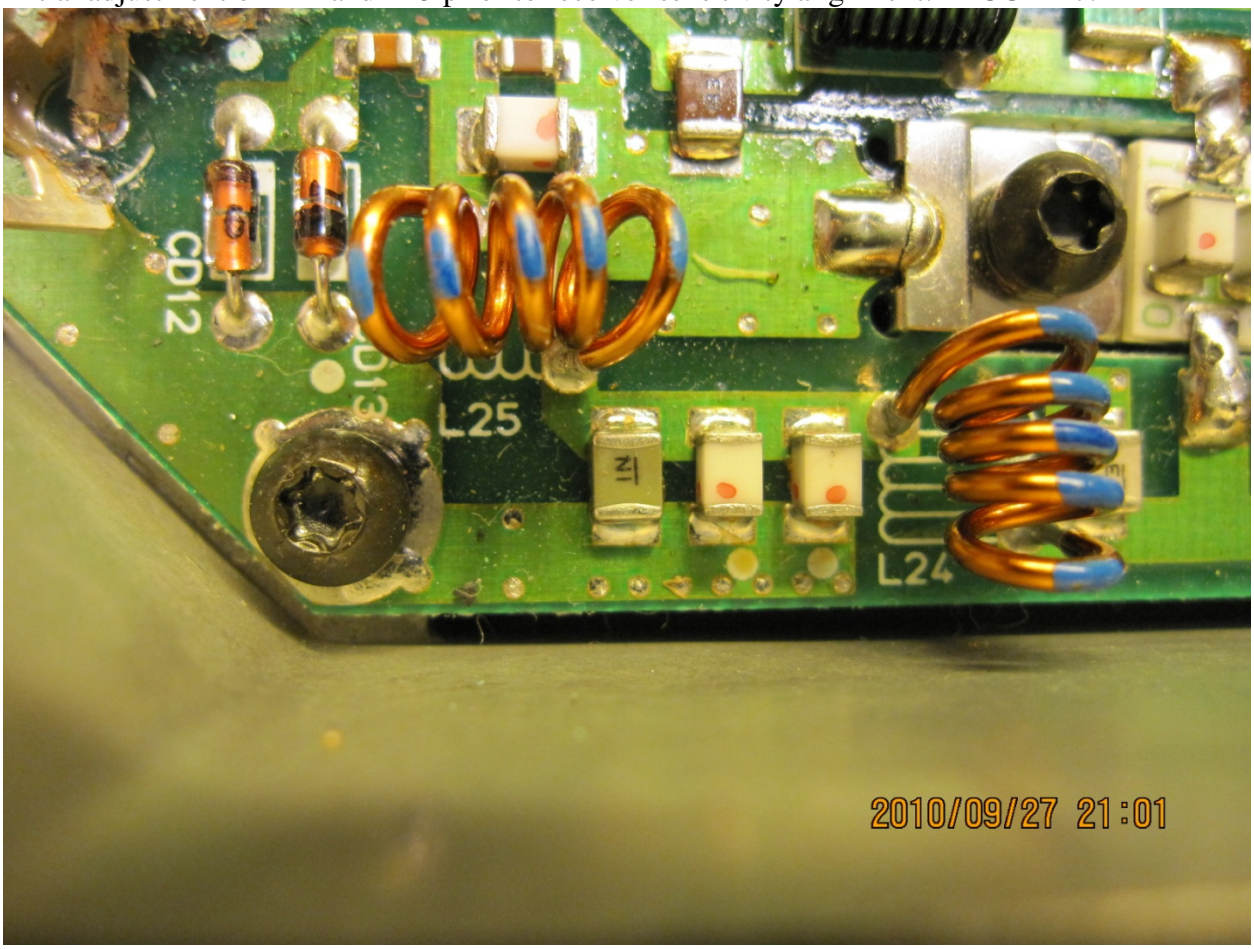


Figure 7. Receiver ¼ wave line. Presetting of L24 end turns at 1 wire spacing and the middle turns at ½ wire spacing. Set L25's end turns at 2 wire spacing and the middle turns at 1 wire spacing.