DEMI Part Number L50-28CK and K

Transverter Specifications

Power Out Maximum:	Nominal 25 W linear
Noise Figure and Gain:	>1.0 dB maximum @ 17 dB conversion gain minimum
DC Power Requirement:	11.5 - 15.5 VDC @ 6 Amp Max.
IF Drive Level Maximum:	Range Selectable between -20dBm and 25 watts
Keying Option with/ without Sequencer:	PTT-L (to ground) or PTT – H (Positive Voltage)
User Installed Options:	IF Drive Sense , Negative Voltage Gen., Cooling Fan, and Sequencer

Configuration Overview: The DEMI VHF/UHF transverter line is designed to interface and operate with most High Frequency transceivers that are available on the market today. Since you choose to purchase a kit version, you may configure it to your specifications and interface it with your desired transceiver. This configuration may be changed or altered at any time if you desire to utilize a different transceiver or change you system's configuration.

DEMI Part Number Verification: All DEMI VHF/UHF transverters contain the operating frequency within the part number, i.e. L50-28CK or K is equated to 50 MHz being converted to 28 MHz. Understand that the conversion is simple math. If you desire to operate on 51.500 MHz. with your L50-28, it will require you to adjust you transceiver to 29.500 MHz.

Power Out Maximum: The maximum ***linear*** output power indicated on this kit is 25W. This level should not be exceeded if linear operation is expected. The transverter may be capable of producing higher output power but is not recommended because of excessive heating that will interfere with its frequency stability while producing excessive "on the air" distortion products

Noise Figure and Gain: The noise figure and gain listed are nominal minimum requirements and all transverters will exceed these specifications if assembled and adjusted correctly. In utilizing the latest PHEMPT technology, we have designed the complete receive section of the transverter with extra filtering, diplexing, and gain management in mind complete with a RXIF gain control.

DC Power Requirement: The DC power requirement is listed and should be used as a guideline. Please include some "Buffer" in your power supply to eliminate voltage drop delivered to the transverter. Basically, do not utilize a 6-amp power supply for a 6-amp requirement transverter.

RF Option: The 50 Mhz. RF section may be configured with either a single port (Common RF) for both TX and RX or two separate ports, (Split RF) one RX and one TX. There is a PC board relay doing the Common RF switching. Once configured, the unit may be changed from Common to Split RF if the user desires. It will be covered in the manual.

IF Option: The IF (28 Mhz.) configuration options may be set up as Split IF (separate TXIF and RXIF in/out lines) or can be configured as a Common IF. There is a relay that will switch the RX and TX in the correct direction and is controlled by the PTT circuit.

IF Drive Level Maximum: After configuration, the transverter will operate at its maximum output power with any drive level between -20dBm and 25 watts. The overall drive level range is determined by different attenuators and/or gain stages if required. The TXIF gain control with 15-20 dB of dynamic range will allow the user to tailor a specific output power less than maximum.

Keying Option: The keying options are either PTT-L or PTT-H. PTT-L requires a connection to Ground to transmit. This is the most common keying option. PTT-H requires a voltage between 1.7 and 17VDC to transmit. This option can also be placed on the IF coax if desired. If you desire the sequencer to be utilized, the PTT connection will go directly to the sequencer to key it. In turn, it will key the transverter on the last step of the sequence. Now doing so creates other caveats if you choose to use a High IF drive level (above 1/2W). This is covered in the next section.

User installed Options: The **IF Drive Sense** option should be installed for any Common IF drive level above 100 mW. This circuit is a protection circuit that will prevent excessive IF drive levels from damaging the RXIF circuitry and the Mixer. When utilizing a high- level IF drive transceiver, the IF drive from your transceiver may be applied to the transverter at the same time as the PTT is energized. If the transverters sequencer is utilized, the transverter will be keyed last in the sequence. This would result in the high level IF drive being applied to the transverter's RXIF section which would cause the damage. With the IF drive sense circuit installed, it detects the high-level drive and enables the TXIF attenuator. This protects the transverter's RXIF section and Mixer. It then holds and waits for the Transverter to "Catch up" in the sequence. This circuit will allow a user to key the sequencer circuit with the standard PTT circuit of a transceiver without having an issue or requiring external wiring and modifications to the transceivers PTT circuit. This circuit will also protect the transverter in case the PTT circuit fails between the transverter and the transceiver. If the transverter is keyed directly with the PTT (sequencer is disabled) it will function normally. **CAUTION:** The IF drive sense circuit should not be used to key the sequencer because it will produce long delays between transmit and receive or chop off the beginning of a transmission. The transverter's IF drive sense was designed for protection only.

The **Negative Voltage** option may be utilized by **transceivers without transverter ports** but with ALC inputs to adjust the output power of the transceiver. If the transceiver has an ALC input, this connection can be made through the AUX connecter and will be indicated.

The **Cooling Fan** should be installed and used with the temperature sense circuit because it is crucial for frequency stability in digital modes. As the temperature increases the fan speed will increase to provide the additional cooling and frequency stability.

The **Sequencer** is a 4 step circuit that may be used to key any external devices and the transverter itself. It may be configured in any fashion and set up to switch external voltages such as a 24 VDC relay. The voltage may be run into the transverter through the AUX connector and switched through the sequencer.

The transverter has a provision for an **External Local Oscillator** connection. This will be discussed in the text and explained how to either configure a future Synthesized LO or use an external one of your own design.

The KIT Details: This assembly manual calls out a reference to one or two picture numbers for most assembly procedures. The pictures can be found on our website in the "Product Manuals" section. It is a full copy of this manual with all numbered pictures at the end of the document in .PDF format. You may down load a complete copy of this document or just reference the pictures. You will find that the details offered in the pictures will aid any assemble instruction.

The following component list contains both pre-assembled components and components to be assembled by the kit builder in **Bold Print**. Verify that all components in **Bold print** are supplied in the kit. The component containers will have extra components of some values. There may also be component values included in the kit not found on the list. These will be used in the testing section of the document. ALSO, because this is a board used for all transverters from 50 thru 432 MHz, there are some components installed on the circuit board that will need to be removed, changed, or not required in the circuit (labeled NR) because they will have no function in your ***frequency specific*** version. It is suggested to ***Highlight*** the components on the component placement document that ***are to be installed*** as you inventory the values.

DEM 50-28 COMPONENT LIST

Resistors (R) values are in Ohms and are chips unless otherwise specified. Some values are NR

R1 1K	R23 470	R39 220	R53 470	R67 10K
R2 – R8 **NR**	R26 24	R40 220	R54 10K	R68 1M
R9 5.6K	R27 5.6	R41 10K	R55 10K	R69 10K
R10 10K	R28 51	R42 10K	R56 10K	R70 10K
R11 220	R29 51	R43 470	R57 10K	R71 10K
R12 330	R30 51	R44 10K	R58 1M	R72 1M
R13 330	R31 12	R45 220K	R59 10K	R73 10K
R14 330	R32 51	R46 1M	R60 220	R75 100
R15 120	R33 1K	R47 10K	R61 10K	R76 51
R16 - R18 **NR**	R34 330	R48 10K	R62 10K	R77 1K
R19 470	R35 220	R49 1K	R63 1M	R78 220
R20 330	**R36 1K POT**	R50 5.6K	R64 10K	R81 5.6K
R21 150 ½ LEAD	R37 220	R51 5.6K	R65 220	R82 5.6K
R22 51	**R38 1K POT**	R52 22K	R66 10K	R84 5.6K

All inductors (L) are in ηH and are 1008 chip unless otherwise specified. "HW"=hand-wound and utilize enamel wire. Some values are NR

L1-L4 NR	**L13 9Turns #24 T37-12 Green/white HW**	**L22 330**
L5 1.0 µH	**L14 10Turns #24 T37-12 Green/white HW**	**L23 150**
L6 1.0 µH	**L15 10Turns #24 T37-12 Green/white HW**	**L24 220**
L7 330	**L16 9 Turns #24 T37-12 Green/white HW**	**L25 150**
L8 680	**L17 14Turns #28 T25-10 Black/gray HW**	**L26 330**
L9 680	**L18 330**	**L27 330**
L10 330	**L19 330**	**L29 220**
L11 – L12 NR	**L20 68**	**L30 1.0 µH**
	L21 1.0 µH	**1.0 µH molded choke**

All capacitors (C) are in ρF and are chip unless otherwise specified. “E” = Leaded Electrolytic, “T” = chip Tantalum, Band is positive. Some values are NR

C1 1000	C43 1000	**C66 0.1 µF 1210**	**C91 10 or 1000**
C2 –C12 NR	C44 1000	**C67 0.1 µF 1210**	C92 1000
C13 27	C45 1000	C68 1000	C93 1000
C14 Test Option	C46 1000	**C69 0.1 µF 1210**	**C94 10**
C15 56	C47 0.1 µF	**C70 100**	C95 –C97 1000
C16 Test Option	C48 0.1 µF	**C71 33**	C98 0.1 µF
C17 0.1 µF	C49 1000	C72 1000	**C99 10 µF T (1210)**
C18 2-6ρF Trimmer	C50 1000	**C75 1.0 µF T**	C100 1000
C19 1000	C51 0.1 µF	C76 0.1 µF	C102 1000
C20 56	C52 100	C77 0.1 µF	**C103 22 µF T (2312)**
C21 0.1 µF	**C53 100 µF E**	C78 1000	**C104 10 µF T (1210)**
C22 1000	**C54 120**	C79 1000	**C105 10 µF T (opt)**
C23 1000	**C55 120**	C80 1000	**C106 10 µF T (opt)**
C24 Remove	**C56 120**	C81 56	**C107 10 µF T (opt)**
C25 220	C57 1000	C82 150	C108 1000
C26 270	C58 100	C83 150	**C110 220**
C27 220	C59 0.1 µF	C85 150	**C111 3**
C28 1000	**C60 1.0 µF T**	C86 56	**C112 100 µF E**
C29 - C38 NR	C61 0.1 µF	C87 1000	**C113 68**
C39 1.0 µF T	C62 1000	C88 1000	**C114 68**
C40 0.1 µF	**C63 2-10ρF Trimmer**	C89 0.1 µF	**C115 10 µF T (2312)**
C41,C42 NR	**C64 2-6ρF Trimmer**	C90 1000	**C158 100**

Solid State, Relays and Filter Components. NR= Not required

CR1 1N4000 type	IC1 ,IC2 NR	Q7 PMBT3904
CR2 NR	**IC3 MAR3**	**Q8 MJD31**
CR3 MPN3404	**IC4 MAV11**	Q9 PMBT3904
CR4 MPN3404	**IC5 RA30H0608M**	**Q10 MJD32**
CR5 1N914 or 4148	**IC6 PHA-1**	Q11 PMBT3904
CR6 1N914 or 4148	**IC7 MAR6 (option)**	Q12 PMBT3904
CR7 HP2800 SMD	IC8 LM393	Q13 PMBT3904
CR8 HP2800 SMD	IC9 LM324	**Q14 MJD31**
CR9 MMBD914	**IC10 7660 (option)**	Q15 PMBT3904
CR10 1N4000 type	**K1 G5V or D2N**	Q24 PMBT3904
CR11 HP2800 SMD	**K2 G6Y**	Q26 PMBT3904
CR12 MMBD914	**K3 G6Y**	**VR3 78L05**
CR13 MMBD914	**M1 SYM18H**	**VR4 78M05**
CR14 1N4000 type	Q1,Q2 NR	**VR5 78S09**
CR21 MMBD914	Q3 PMBT3904	Y1 NR
F2 50M-3 pole	Q4 PMBT3904	**Y2 22.000 Standard**
F3 50M-2 pole	Q5 PMBT3904	**PTC-50 Thermistor**
F4 50M-2 pole	**Q6 FPD750**	**Xtal Shield**

Verify all of the listed hardware is in the Hardware Kit.

HARDWARE

(1) Heatsink	(1) #6 flat washer
(1) Back Panel of enclosure	(1) #6 ground lug
(1) U-channel enclosure	(1) #4 Ground lug
(1) Bottom panel	(1) 50 Ohm load
(7) Black 4-40 screws	(1) Switch
(16) 4-40 x ¼" screws	(1) Green LED
(12) Aluminum Shoulder Bushings	(1) Red LED
(10) 4-40 x 7/16" screws	(2) BNC connectors and Hardware
(3) 4-40 x ¼" threaded standoffs	(2) Type "N" connectors and hardware
(3) 4-40 nuts	(1) RCA connector
(1) 4-40 x3/8" screw	(1) 8 pin connector *set*
(1) Brass shield for Power module	(1) NL2 connector
(2) 6-32 x 5/16" screws	(1) NL2FC connector
(2) 3/8" hole plug	(2) Spade Terminal
(1) ¾" hole plug	(1) 1000pf disc cap
#16 wire, 2" black, 3" color	Coax, 20"
Power meter kit	#24 gauge wire, 6 feet (Green)
(1) Fan	(1) NTC Thermistor
(1) Fan guard	(4) 6-32 x 1-3/4" screws
Sleeving, 5"	(4) Tie Wraps
Tube of thermal compound	(4) Rubber feet
Bundle of precut #26 colored wire	5' of Zip cord

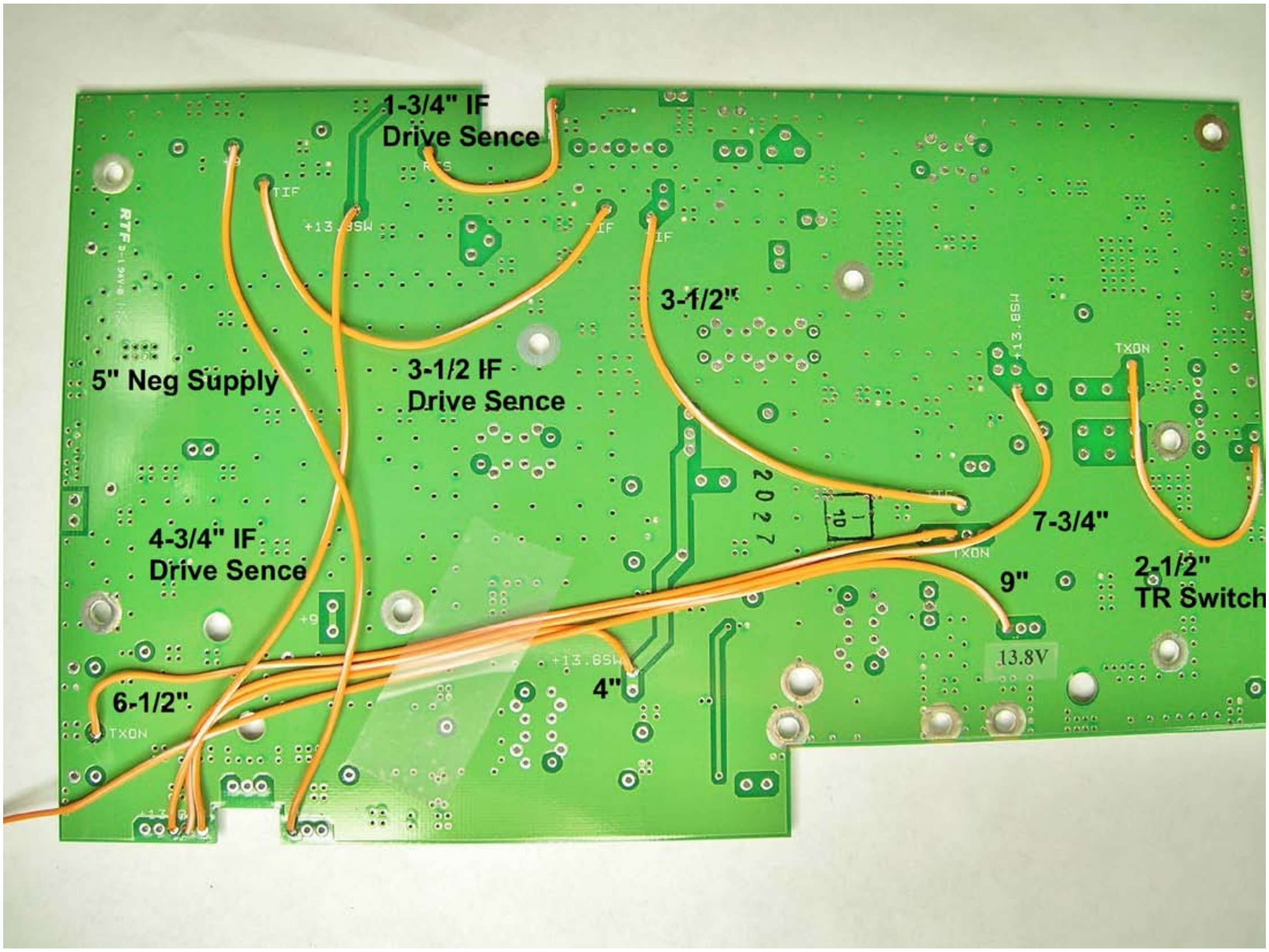
Circuit Board Assembly:

Refer to the component placement diagram and install all topside components that require soldering on the bottom side of the board. Install VR3, F2, F3, F4, K1, K2, K3, R36, R38, CR1, CR3- CR6, CR10 and CR14. Even though K2 (RF relay) and K3 (IF relay) are to make the common RF and IF connections, (combined TX and RX), separate TX and RX connections to both RF and IF ports can still be made after relay installation. BUT—you may leave both relays un-installed if you only desire separate RX and TX ports for the IF and RF connections. Be sure to heat the ground connections well before flowing solder on the filters and relays. Cut the excess from all leads flush with the board. **See Picture 1 and 2**

Now examine the Bottom Side Board Assembly picture on the next page. It is suggested to complete all of the wiring on the bottom side. Some wires are for features that you may never utilize in your configuration but will provide ease of a configuration change at a later date if you decide to change transceivers. If you do not see the need for certain features, some of the wiring may be omitted. The signals are marked on the picture. The negative voltage generator, (+9 connection) the IF drive sense (three wires), and the wiring for the RF TR relay may be left out if those circuits will not be utilized. They could be added to the top side if required in the future. All other wire connections are required for full transverter function. Each marked wire shows its approximate length.

Find the 6 foot wind of #26 Green hook up wire, then cut, trim, tin, and install. It is best to cut the wire a bit long (1/4") and trail fit after soldering one end in place. If you are close with the measurements, the wires will fall into place as shown. If the wire is too long they may get pinched during the assembly of the board. One wire, the 9" 13.8V, is only attached at one end for now. Save the extra wire out of the 6' bundle for topside wiring. **See picture 3** for correct technique of wire soldering.

After all wires that you wish to install are installed, (10 max) be sure none of the wires cross any of the bottom side solder connections of the filters, pots, and RF relays. This is to prevent any RF signals from coupling to the DC connections. The exception is the 2-1/2" TXON wire for the TR switch. It crosses under K1 which is a non-RF circuit relay. Also be sure that the wires do not cross any mounting holes. Then with a small piece of tape, (any type) attach the wires as shown in the next picture being sure that the wires are laying flat on the circuit board. If you desire to attach other wires or configure the transverter differently, or desire to use any type of adhesive to hold wire in place, please do so. Just be sure to clear all mounting holes and exposed RF circuits and do not allow and excessive amount of adhesive to prevent the circuit board from attaching flat to the mounting hardware on the heatsink. A 1/8" clearance is required between the board and heatsink.



Bottom Side Board Wiring

Surface mounting assembly of components:

The rest of this document assumes that you have the complete kit version. If you have the basic PC board kit, follow along in the instruction manual but skip the instructions that do not pertain to your final assembly.

First, examine the board. It is a basic rectangle with two small notches and one large notch on one corner. If you hold the board so you can read the majority of the screened text left to right, you will find the large notch on the lower left hand side of the board. This is the orientation that the top side component placement document will refer to. In brief, the TX chain and power amplifier is in the lower left, the RX LNA in the upper left, the Local oscillator on the lower and center right. The IF Drive sense and Negative voltage generator are on the upper right. The upper center of the board is the IF section and the lower center is the sequencer as shown in **Picture 4.**

What is convenient for assembly is that the circuit board may be mounted to the heatsink before any surface mount work is done. But, if you have a PC board vice that you utilize for board projects, you may want to use it. It is your choice. Since there is no further work to be done on the bottom side of the board, we recommend attaching the board to the heatsink to save a step.

Find the 11 shoulder bushings in the hardware kit and install them in the holes in the heatsink. These act as spacers for the board. Some may fit snug and it is alright to gently "tap" them in. Be sure that they are completely seated. Next locate the position for the NTC as shown on the component placement. It is the largest recessed hole in the heatsink. It requires to be filled about ¾ of the way with thermal compound before the NTC is installed and is easier to do before the board is attached to the heatsink. Find the tube of thermal compound, use, than save the rest for the Power module mounting later in the kit instructions. **See picture 5.**

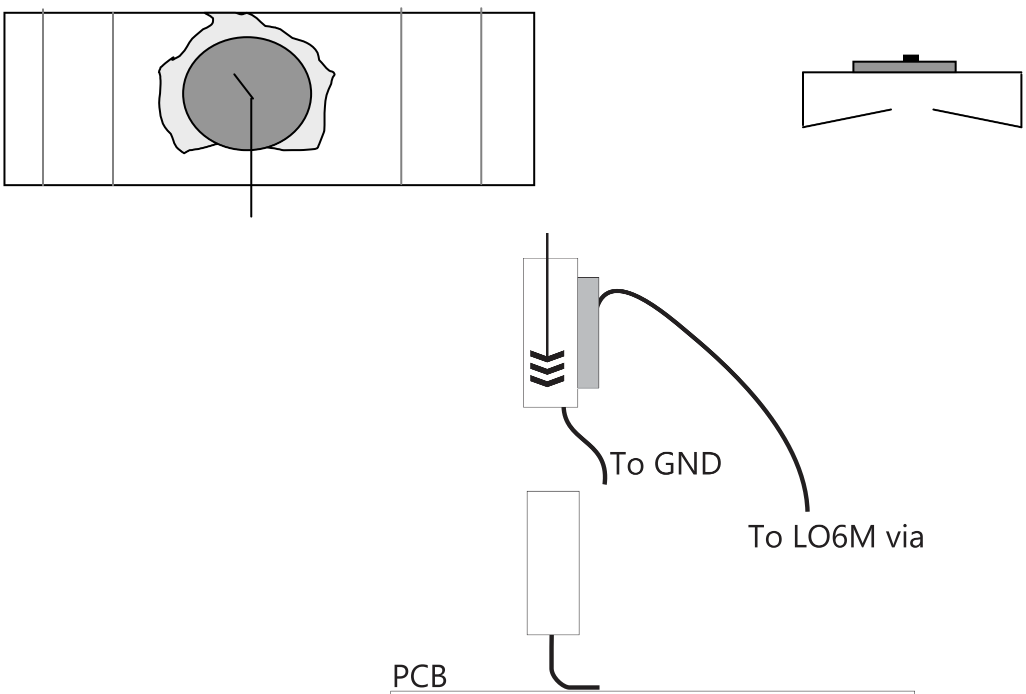
Now find VR5, the 9 VDC regulator. Its leads are mounted through the bottom side of the board. Insert VR5's leads through the board from the bottom side as far as it will go. Then bend it over in the direction as shown in the placement diagram. Do not solder! Align and place the circuit board on the bushings along with VR5 in place. Be sure the one end of the 9" +13 8V wire is out from under the board on the lower right hand side. This wire is connected to the switch during final wiring. Then verify that the board sits flat on the bushings (no wires being pinched) and attach the board with eleven 4-40 x 7/16", 4-40 x ¼" screw for VR5. Start all screws first, then tighten. Some screws will be removed to ease assembly later during the process and will be specified, but for now, you have a solid mounted circuit board ready for assembly. Solder VR5's leads in place after all screws are seated. **See Pictures 6 and 7**

Next step in the board assembly is to remove the components that will inhibit the operation of your transverter. For the L50-28CK, there is only one component, C24. Wick all connections clean if you can. All other components that are marked NR in the components list are not connected if the board is assembled correctly and will not affect the performance of the transverters. **See Picture 8** for the location of C24.

It is now recommended to follow the assembly steps listed below but if you are an experienced builder, you may start on the board anywhere you want placing all of the components listed on the component lists. The assembly steps will cover some options and place importance on some order of assembly but again, nothing is critical and does not need to be assembled in any particular order. If you decide to go about this on your own path, the only precaution is if you desire to test the local oscillator for the correct output level, do not install the Mixer, M1. Leaving the mixer un-installed allows testing of the RF, LO and IF stages independently.

1. Comparing your board to **Picture 9 and 10,** you will see that only a couple of components need to be assembled in the LO. Install C13, C20, L5, L6 and C18. C18 is now a smaller surface mount trimmer and will not match the picture. There are open positions at C16 and C14. These are to be left open and will be discussed in the test procedure.
2. Prep the leads of the Y2 Crystal as shown in the next group of pictorials. Solder it to the circuit board with the leads pointed at C17 and R10. Prep the PTC Thermistor and Xtal shield as shown. With a solder iron, remove one lead from the Thermistor then solder the

Thermistor to the shield. When cooled, bend to shape and place the PTC and shield assembly over the Xtal. Attach the previously removed wire to the side of the shield and connect to ground in a via hole that is in the ground plane between C13 and Y2 with the shortest connection possible. Cut and fit a piece of the sleeving to fit the "Hot" lead then connect the "Hot" PTC wire to the via-hole near the LO6M designator on the board. **See picture 10.**



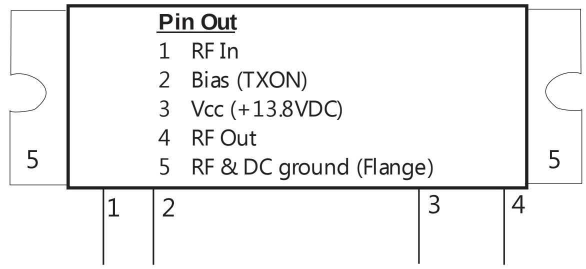
3. Install C39 near VR5 then install L7- L10, C23 and C25 - C27. This is the local oscillator low pass filter and completes the oscillator. **See Picture 11** and be sure C24 is remove not like the picture shows! If you wish to test the oscillator level and have an mW power meter, skip assembly Step 4. Leaving the mixer un-installed allows you to test the individual sections of the transverter if you desire. BUT— if you do not have gain measuring capability and accuracy to at least a dB, Complete Step 4 next.
4. If you do not wish to test the Oscillator level, install the mixer M1.Line it up on the pads and solder. It is best to tin one pad and hold the mixer in place while heating the tinned pad. Solder the other two by flowing solder and then do the ground pads (3) .It will require some heat to flow the ground connections! **See Picture 12.**
5. Next assemble the IF section of the transverter. Install L22- L27,L29 and C110. **Picture 13**
6. All of the following components listed in Step 6 except for IC7 can now be installed but their utilization is dependent on the IF configuration you require. An explanation of what certain components do follows along with advice if you chose not to install. For further explanation

of the IF section, Refer to the "***<u>TXIF Drive Level Range"</u>*** section found in the "***<u>Options Setup</u>***" section on page 25.

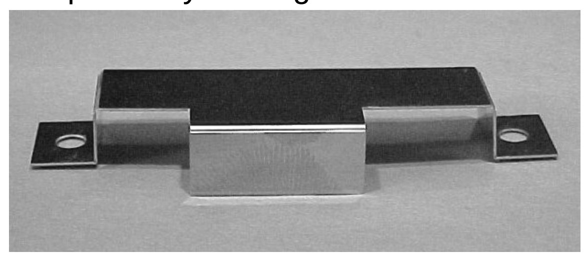
a. CR5 and CR6 are only required for drive levels higher than 1/2W but not required at all if you use separate TX and RX ports. BUT-Having them installed does not inhibit any configuration.
b. CR7, CR8, C94 and C99 (near IC8) are part of the RF sense protection circuit. The circuit is only required for a common IF greater than 1/2W drive configurations but will not inhibit any configuration. Check polarity of C99
c. The 50 Ohm load is required with any drive level above 200 mw regardless of any IF configuration. It will provide attenuation at all drive levels so do not install for lower drive levels. Attach one lead to a #4 ground lug mounted to the load with a 4-40 x3/8" **See Picture 14**
d. C91should be a 1000pf if the drive level is below 1/2W and 10 pF for all drive levels above ½ watt.
e. IC7 is the TXIF gain stage and is only installed if the IF drive level is 1 mw (0dBm) or less. If your drive level is close to 1mw, install it after the TXRF testing is complete. Depending on test results, it may or may not be required to compensate for lower or higher TX gains in the transverter.

7. If you require the negative voltage generator circuit, Install IC10, C105- C107. These components need to be ordered separately. This circuit provides a negative voltage that is supplied to transceivers that do not have a transverter port or a way of limiting the output power, and of course, have an ALC input. When voltage is supplied to ALC input of a transceiver, it will limit the power delivered to a transverter. After assembly, it's operation will be discussed further in the set up and operation section of this manual. **See Picture 15** and the component placement document for correct assembly. C106 is marked backwards on the circuit board screen printing.
8. Complete the assembly of the sequencer by installing Q8, Q10, C103 and C104. Do not mix up Q8 and Q10 and check polarity of C103 and 104! **See picture 16.**
9. Install TXRF gain stage components IC3, IC4, R21, and C60. Surface one lead of R21 (the connection to IC4). Form the lead of IC3 and IC4 before soldering if required. Then install C53 and C112 by surface mounting the leads**. Picture 17 and 22.**
10. Install the TX low pass filter. Place and solder C54-C56, C113, C111 and C114 first. Then wind the T37-12 torroids using the #24 enamel wire described in the components parts list as shown in **Picture 18**. Be sure to solder tin the ends before installation. Then install as shown in **Picture 19.**
11. Install CR11 (lower left hand corner) the power detector diode. Then install Q14 and C115, the fan speed control circuit. **Picture 19.**
12. Begin to install the RX section by installing Q6. Then install C63, C64, L17, C67, R27, C158, C66, C69, L18 and L30. Be sure that C63 and 64 adjust after soldering. **See picture 20.** C63 and C64 are smaller surface mount versions not shown in the picture.
13. Complete the diplexer circuit by installing L19, L20, C70 and C71. **See Picture 21.**
14. Finish the RX section by installing IC6, L21, VR4 and C75**. See picture 21.**

Power Module Installation:



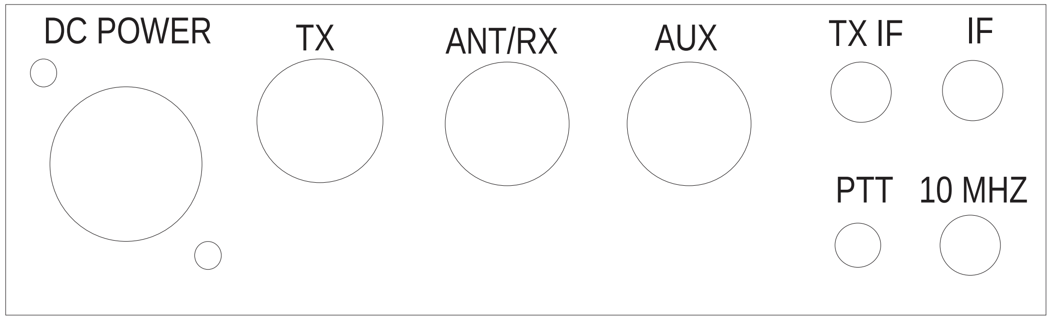
Place the power module (IC5) on the heatsink in its mounting location. Trim the leads so they do not extend past the solder pads. They should be approximately 3/8"-1/2" long once trimmed. Remove the Module and wipe the mounting surfaces of the heatsink and flange of IC5, verify the surfaces are free of any foreign matter. Apply a thin even coating of the supplied thermal compound to the mounting flange and the heatsink and the bottom of the power module. Place IC5 on the heatsink and "Lap" the thermal compound by moving the module side to side while exerting slight down ward pressure. You will feel the resistance build up when lapped. Line up the leads with the traces of the circuit board. Find the brass shield and form to fit as shown. Using one 6-32 screw and flat washer, install it through the shield and the mounting flange, into the heatsink hole nearest the Q11, 3 and PH3 marking on the PC board. Then install the other 6-32 screw with a #6 Lug in the other hole. Tighten evenly into the heat sink. **NOTE:** Make sure IC5 is mechanically sound to the heat sink because improper seating of the hybrid could result in poor grounding and heat transfer causing damage to the power module. Also be sure that the shield does not shift of contact any of the module leads. The shield front should fit between the module and the part of PC board with the bare metal and two board mounting screws. Form the module leads flat to the traces, and then solder all leads of IC5 to the circuit board. Now observe where the shield contacts the bare metal of the PCB. Tack solder along that edge. It will require a lot of heat so take your time. It helps if you loosen the board mounting screws or remove completely. Just don't fill the holes with solder. Re-tighten when complete. **See picture 22.**



Finally, install the NTC in the hole through the board and in the thermal compound in the heatsink. Attach the leads as shown on the components placement after installing sleeving on the leads. The PCB is complete. **See picture 17.**

Final Wiring and Assembly

The final wiring and assembly starts with installing the connectors in the rear panel. You may install all of them or only the connectors you will use. All connectors require all supplied hardware. Install all connectors through the labeled side of the panel. All but the PTT and the DC power connector are self aligning. The 8 pin AUX connector may have two flat sides so chose the fit that allows Pins 1 and 7 to be closest to the top side of the panel. Install all with the lock rings on the panel surface and then the ground lugs (if applicable) between the Nut and the Lock ring. The DC power connector (flanged black plastic) is positioned so that 1+ Pin is closest to the top of the panel in relationship to the labeling. **See picture 23** for the correct placement of the solder lugs before wire assembly.



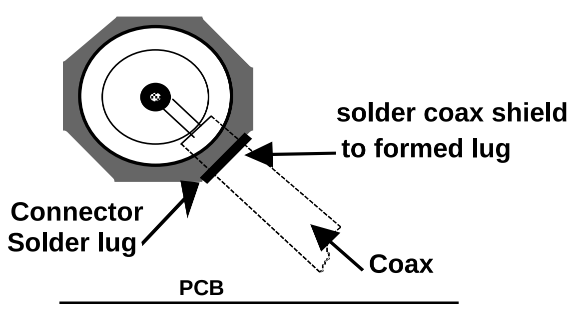
Rear Panel view

Depending on your requirements, Cut, strip, and tin both ends of the coaxes as shown in the next pictorial. Different configurations are explained in the **Options Setup** section at the end of the manual. The lengths of coax are shown below and depend on you specific configuration.

Common IF (the IF BNC Connector)	**5-1/2"**
RFIF (the IF BNC Connector)	**5-1/2"**
TXIF (the TXIF BNC connector)	**6 ½"**
Common RF (the ANT/RX "N" connector)	**3"**
RXRF (the ANT/RX "N" connector)	**3"**
TXRF (the TX "N" connector)	**3"**

Also see Picture 25.

Attach the longer stripped end of the coax to the connector as shown in the next pictorial. Push the end through the hole in the ground lug, solder the center conductor to the center pin, then solder the shield to the ground lug. **See picture 24.**



With the pre-cut bundle of colored wire, make wire connections to the AUX and PTT connectors. Follow the wire chart. Strip and tin one end of the wires to 3/16". Tin the connector pins before soldering. All wires are required for sequencer operation and PTT control. **Picture 24.**

AUX Pin 1	**11"Orange wire**
AUX Pin 2	**11" Yellow wire**
AUX Pin 3	**9" Blue wire**
AUX Pin 6, 7, and 8	**1-1/2" Black wires (cut from 6" wire)**
PTT connector	**12" White wire--- Also install 1000pF disc to ground**

The DC power connector should now be wired. Crimp a terminal to the 1 ½" #18 Black wire and one to the 2 ½' # 18 Orange wire. Then strip and tin each wire to 3/8" on the other. Connect the terminals to the DC power connector**. See Picture 26.**

Place one Ty-Wrap on the bundle of wires less the black ground wires and including the PTT wire as close to the AUX connector as possible. Then attach the rear connector panel to the heat sink using two 4-40 x ¼" screws. Run the bundled AUX and PTT wires between the panel and the circuit board towards the DC power connector bending them around the corner and behind the Power Module. Strip and tin one end of the 15" purple wire and connect it to the PWR via near CR11 on the lower left corner of the board where the AUX wires wrap around the Power Module. Install a second Ty-Wrap at that point. Now, connect the black wire from the Power connector to the ground lug on IC5 flange. Attach the +DC wire form the power connector to the bare metal marked 13.8V on pin 3 of the power Module. Then Ty-Wrap the bundle to the DC ground wire connection on the side of the power module. **See picture 27 and 28.**

Finish the panel wiring by connecting the short Black wires from the AUX connector (Pins 6, 7, 8) to ground. Insert the three wires into any of the via-holes in the circuit board below the connector. The via-holes are plated through so use a lot of heat to flow the solder. Then begin to connect all of the coaxes to the circuit boards as you have planned for your configuration. If you are unsure of their connections, you may refer to the "***Common or Split IF Option"*** and the ***"Common or Split RF connections"*** section found in the ***"Options Setup"*** section on page 24 of this manual. There should be a Minimum of two and a maximum of four coaxes. Be sure that the shields are soldered to the board well. It is Teflon coax so do not be afraid to heat the connection! **See picture 29.** Then connect the other AUX connector wires to the sequencer section. Pin 1 to Via 1 on the board, then Pin 2 to 2, Pin 3 to 3. This will provide Pin 1 with voltage on RX, Pin 2 with Voltage on TX and Pin 3 will be a connection to Ground on TX. Trim, strip and tin the wires before connecting. If you desire anything other sequenced signal, consult the Sequencer schematic and its matrix for alternative connections. **See Picture 19.**

The PTT wire may be connected to the PTT – H or L in the sequencer if you plan to use the sequencer or connected directly to the transverter's PTT –H or L near the K1 relay. This will depend on your configuration plans. If you are using the sequencer, install the 6" White/Org wire from the “4” via in the sequencer to the PTT-L via near CR9. With the left over green wire, strip and tin two 1”green wires and connect them from the +DC to the DC1 and DC2 vias in the sequencer. **See Picture 16**. Connect a 3” wire between the +9 (near VR5) and the +LO6M via. Strip and tin a 3” wire and install one end in the +13.8SW via near VR5. If you require the negative voltage option, connect an 8” green wire from the ALC via and pin 4 on the AUX connector. **See Picture 29**

Begin to Pre-wire the U-channel front panel by assembling the enclosed RFPM kit. See page 26 for the assembly document. This is the bar graph power meter. When completed, install a 2” black wire (GND Connection) and a 6” green wire (+V). Strip and Tin both ends of both wires. You may test the RFPM separately before installing. It requires 12VDC (+ and -) on the two wires and a variable voltage from 0 to 5 VDC on the DET connection. You should be able to vary the voltage and move the Bar Graph display up and down. The Pot will adjust its sensitivity. When complete, find two ¼” threaded hex stand-offs and two 4-40 nuts. Pass the threaded end of the stand-offs through the two mounting holes on the RFPM board so that the threads are on the component side of the board not the display side. Then hand-tighten the nuts. Install the RFPM in the front panel with two 4-40 Black screws. Center the display and tighten the nuts and the screws. **See picture 30.** Then cut, strip and tin the wires on the two LEDs to 2”.Install the Green (ON) LED and the Red (XMIT). Install the switch in the front panel then install the front panel to the heatsink with four 4-40 X ¼” screws and four 4-40 black screws to the rear panel. Start all screws first, and then tighten. It may be necessary to loosen the rear panel a bit to get all screws started. Be sure not to trap any wires under the panel**.**

The front panel wiring starts by connecting the black wire of the power meter to the ground via hole in the circuit board below. **See Picture 30.** The +DC wire connects to the 13.8SW via near VR5. The 15” purple wire from the PWR via on the board connects to the DET via on the RFPM. Strip, tin and connect. The LED’s are connected next. The Red connects to the TX via and the Green to the ON LED via. There is associated ground vias near each connection. Strip, tin, and solder. Now, attach the wire coming out from under the board to the center pole of the switch. Strip, tin and solder. Then connect the wire from the +13.8SW connection to the top lug on the switch. **See picture 29.**

Installation of the Fan Option is recommended for the best possible frequency stability for digital operation. Turn the transverter over so the Heat sink is up. Notice that all of the holes are not filled. There are four 6-32 tapped holes and a large thru- hole. The thru-hole is for the wire of the fan. Feed the wire through the hole and place the fan on the heatsink, label down so that it blow air into the fins. Be sure that the wire is not trapped between the fan and a rib of the heat sink, You may need to cut a notch in the fan’s wire channel so the wires pass through. Place the fan grill on it and bolt down the assembly with four 6-32 x 1-3/4” bolts. Make them snug but do not over tighten. **See picture 31.** Turn the assembly back over and dress the wires by Ty-Wrapping them to the sequencer wires near the step “3” connection. Then follow the PTT and DC power wire across the Module. Cut, trim and tin the Red fan wire and attach it to the +13.8V pad with the DC power wire. Continue to route the Black fan wire to the –F pad. Cut, trim and solder. Install a Fifth Ty-wrap to bundle the PTT, +DC and fan wires if desired. **See picture 17.**

Last step before testing is to assemble the DC power cable. They are a little complex but just a great locking connector when complete. First find the NL2FC mate to the flange connector mounted on the transverter. Notice it is 4 parts. The main body, with the Gray lock ring, (2 parts) “semi-installed.” Do not push the gray ring down covering the contact screws or you will spend some time figuring out how to unlock the cover!! Prep the Red/Black -#14 zip cable by striping and tinning ¼' on one end. Tin solder both end. Be sure to control the heat (it's not Teflon!) Now, the positive voltage connection is clearly marked on the black body and the gray ring as “**1+**” the negative or ground connection of the connector is not so clear. Look on the lock tab of the black body. It says “**1-**“. Insert the tined end of the wires in to the clamping holes and tighten the screws. Then it is best to review **Picture 32** for the correct alignment of the rest of the connector parts because words just can't do it! The tricky part is aligning the three sided wire clamp. It only fits one way and requires some manipulation. After its inserted, screw down the blue lock nut and then slide down the Gray sleeve. Check out how it mates and disconnects.

NOW—consider an inline fuse or limited power supply for testing. The Basic assembly is complete and the transverter is now ready for test.

Transverter Testing: Before applying DC power to the complete transverter, verify main DC wiring and have a proper fuse installed in the DC power cable or supply. Install some sort of 50 Ohm load on the ANT, TXRF, or RXRF ports. Verify that the PTT port is not shorted. If all looks good, apply DC power and switch on. The Green LED should light and the TX LED (RED) will remain off.

Start by verifying voltages on the board. All voltages should coincide with the DC input voltage from the power supply unless it is on the output of a regulator. There is a voltage matrix at the end of the test section that may be used for checking and troubleshooting. You could verify every point or in general, check VR4 (5 VDC) and VR5 (9 VDC). Verify the +13.8SW voltages and the +DC in the sequencer. Check Pin one in the sequencer for +12VDC or greater. The drain of Q6 (junction of L18 and C69) should be around 3.8 VDC. Verify –F to be somewhere between 6 and 13 VDC depending if the fan is running or not. If voltages do not fall in line, check wiring or assembly. When complete, shut power switch off.

Oscillator testing *<u>without</u>* mixer installed: If you encounter a problem with the Oscillator, refer to the voltage matrix and verify Q3 and Q4's function. Start by connecting a test coax to the LO input pad of the mixer M1 and ground. This will allow the measurement of the level injected into the mixer. You may also measure the frequency of the oscillator with this connection. Connect the coax to a power meter set to measure 100 mW. Switch the DC power on. The oscillator should just start up but an adjustment of C18 may be required. Verify its level on the power meter. It should be between +15 and +19 dBm. If low, check for missing or unsoldered components in the LO Low Pass Filter. Also refer to the voltage check sheet at the end of the test document if needed. If the level is OK and you have a spectrum analyzer, you may verify the 2nd harmonic content. It should be a minimum of -40 dBC (40 dB below the fundamental. If not verify the Low pass filter (the components between C23 and C28). Now, if all tests are ok, you may install the mixer or not and proceed to the General Oscillator testing section. Leaving the mixer un-installed will allow complete testing of the transverter if you have the test equipment. Proceed to the General Oscillator testing.

Oscillator testing *with* mixer installed: If you encounter a problem with the Oscillator, refer to the voltage matrix and verify Q3 and Q4's function. With the mixer installed, you can only test and adjust the frequency of the oscillator by probing the input of the mixer. Proceed to the General Oscillator testing section for this.

General Oscillator testing: The frequency may be checked now but the circuit should be allowed to warm up about 15 minutes for its first time. Verify that the Xtal heater is warm and allow it to soak. The frequency may be probed at the LO input to the mixer or on the coax if the mixer is not installed. You should be able to adjust to the frequency of the oscillator with C18. **See Picture 9 and 10.** It will be a small amount of adjustment but if you can achieve anything within 50 Hz of the final frequency, skip the Frequency Net modification step. If you do not have enough adjustment to achieve this, it will require one or two additional chip capacitors to be added to the circuit.

Frequency Net Modification: The goal here is to get the frequency within 50 Hz of 22 MHz. and allow a 24 hr burn in before the final "Netting" of the frequency occurs. If the frequency is low (less than 22.000 MHz) start by replacing C20 with one of the spare 27ρF chips. If the frequency then goes to high, place another 27ρF on the C20A position to bring it back down.

If the frequency is high, (most common) it will matter how high. Verify the amount. If it is more than 3 kHz, place a 27ρF in the C16 position. If it is less than 3 kHz, place a 27ρF in the C14 position. Just get it close and allow it to burn in for a minimum of 24 hrs. You can complete the rest of the transverter testing and then do the burn in. ALSO—the mixer should be installed now after a final level check. After the burn in, net the frequency. If it becomes out of adjustment, review the steps and the procedure of what you did. There are some smaller value (10 ρF) chip caps that can be use to replace the 27ρF or added to the 27's you have placed. Makes no difference how you get it to net.

Receiver Testing: Depending on your configuration, the RXRF input port and RXIF output ports will vary. It is assumed that the voltage checks were made and determined to be in spec before the Receive RF test is made. Use whatever means to generate a signal into the RF port (on air signal, signal generator -30dBm or less, or a Noise figure meter) and use whatever 28 MHz receiving device you desire to peak C63 and C64 for maximum gain**. See picture 20.** If you use a noise figure meter, you may find that the best noise figure is not the maximum gain but if you only have gain measurement capabilities, the noise figure will close enough if optimized for gain. Also, with a Noise figure meter, depending on the LO leakage level, (22 MHz), it may interfere with the meters measurement. There is a 22 MHz trap built into the transverter (C110 and L29) that should allow the measurement to be made but if not, check its construction. You may also use and external high pass or band pass filter for the Meter if required. The level of leakage is not an issue because the 28 MHz. band pass filtering in any transceiver will eliminate the problem if it does exist. Be sure to rotate R39 (RXIF Gain adjustment) to verify function. There should not be a need for adjusting the filters. If 17dB of conversion gain (15 minimum) cannot be achieved, start by verifying voltages on Q6 and IC6 then check kit installed components. Use whatever means to signal trace from input to output to find the problem. Be sure of the RXRF and RXIF configuration and check for shorts on the coaxes and solder shorts on the boards. If all is OK, proceed with testing.

Now, as mentioned or that you may have surmised, F4 is shared by both RX and TX. The filters are factory adjusted but not exactly optimized for our expected performance. The Issue with F4 is that it is wide enough to allow the 2nd harmonic of the 22 MHz LO (44 MHz.) to pass with very little attenuation. Depending on the tolerance of the mixer and the level of the LO, it may or may not be a problem. BUT- as a precaution, a solution is to adjust the performance of F4 to eliminate reduce the 44 MHz level. What we found out and is quite simple is to remove two tuning slugs from F4. This narrows the performance of the filter and since the "50 ohm matching" of the RF side of the filter is compromised by IC6 and IC3, it's a non issue. It is important to do this during the RX test to be sure it does not reduce the RX performance. Remove the two slugs that are closest to IC3 and IC6. **See picture 33.** Retest the RX and if none or slight degradation occurs, (1-2 dB) it's good. **See Picture 34** and place the Aluminum foil tape on the filter to keep the holes covered.

Transmit Testing: If you plan on using the Negative voltage generator to reduce the output power of your transceiver for transverter configuration, proceed to the "**Negative Voltage Option**" test section first (page 20). Then come back to this section for the complete Transmit testing.

Depending on your configuration, be sure to have some sort of 50 Ohm load and or RF power meter connected to the designated TX port of the transverter. Preliminary TX testing is done without IF drive being applied. Start by manually enabling the PTT signal (High or Low depending on your configuration). This in turn will enable the TX section and disable the RX section of the transverter through the sequencer or directly depending on your configuration. All relays installed will actuate and the Hybrid power module will draw quiescent current of up to 4-5 amps. The other TX driver stages and the TXIF amp if utilized will also be biased. When the transverter is first keyed, (without IF Drive) verify that there is no relay chatter and the total transverter current drain is less than 6 amps. In this state, verify the TX voltages on the matrix. You may notice the fan speed increasing as the transverters TX time is extended. When finished checking all of the TX voltages, un-key the transverter. If there is a problem, find it by checking the wiring first then the kit assembled components. Also verify that there is "Zero" RF output power on the RF meter.

If RF output power is measured, it can only be two causes. Oscillations cause by mistakes in construction or LO leakage. Oscillations can be cause by bad grounding of the hybrid and shield, poor construction/missing components and incorrect wiring or damaged components. Check all work! LO leakage caused by the second harmonic of 22 MHz, 44 MHz, could be an issue if the M1 mixer is not soldered correctly on ground or is defective. It can be detected with a frequency counter anywhere in the TX chain. If the 2nd harmonic is found to be the problem after verification of assembly, please consult DEMI by phone or via the Technical e-mail address found on the website. If all is good, proceed with the testing.

<u>IMPORTANT NOTE:</u> In the following step, do not assume that if the output power of the transverter is low, it is because you do not have enough **<u>IF drive</u>**. Please consult DEMI if you have problems obtaining full output power with your specified drive level during the test procedure after you have exhausted all possibilities discussed in the procedure.

Rotate R36 fully counter-clockwise (maximum attenuation) and then connect the TXIF drive source. Manually enable the PTT and apply the minimum amount of drive that your transceiver can produce. Verify any output on the power meter. Then, slowly increase the drive level of the transceiver to your maximum desired drive level (maximum of 10 watts) you have configured the transverter for while observing the power meter. Then adjust the TXIF gain control (R36) to obtain 20-25 watts of output power.

If you cannot achieve any output power, verify opens or shorts starting with the TX output connector then back through the TX section. Look for opens in the Low pass filter L13-L16. **Picture 19.** If the TR relay is in your configuration, verify its function. You may disable the bias to the RF power module by removing R22. The relay and Low pas filter can then be checked with an Ohm meter. Recheck the TX voltages in the TX chain. Then proceed through the IF section looking for opens or shorts and the function of the TX IF relay if in use. Retest with low drive power first after finding problem.

If the correct amount of power cannot be achieved, (low power) the problem can only be a few things. First check the output low pass filter, L13-L16, C54-56, C113 and C114. Verify the windings (re-count the turns) and you may try to spread or compress the turns for an additional output power. The filter is there to eliminate the 2nd harmonic so—no matter how you adjust the "L's" it will not affect the 2nd harmonic but may increase or decrease the insertion loss at the operating frequency. Also verify that the filter components are not heating. Touch them with RF off. The cores should not heat at 25 watts output. If so, something is installed incorrectly.

Next suspect the TXIF components. Verify that the Pin diodes CR3 and CR4 are functioning. If the RX gain is OK, the filter diplexer should be OK but you can verify with an ohm meter anyway. Next understand that even if you have configured the transverter correctly, the operating range may be on the edge. Your drive level from your transceiver may not be what was specified. If you have measured and verified it, and depending on your configuration, you may vary the value of C91 if you are using the load. If you are using a low drive level (around 0 dBm) you may need to install the TXIF gain stage. Do not install it if you use more than 5 mW of drive.

If all is OK, the transverter should very easily exceed the rated output with your desired drive level in any mode. Finish the test by setting the TXIF to produce 25 watts of output power.

Bar Graph RF Power Meter: While the power meter is connected, the RF bar graph meter calibration can be done. During key down with a 25 watt output level, adjust VR1 on the bar graph to show 9 bars lit. Then vary the power or use SSB to generate RF and follow your speech pattern on the bar graph. Remember that the Bar Graph display is relative and its function may be affected by high VSWR. If maximum deflection cannot be obtained, verify that C111 is installed and that the RFPM is assembled and wired correctly. You may also check CR11 with a ohm meter in the diode function. Keep a load of some sort on the transverter's out for the following tests

IF Drive Sense Circuit: The IF drive sense circuit is a protection circuit only. It needs to be utilized with IF drive powers above 200 mW and is only used with a common IF configuration. It will operate at drive levels down to 10 mW. To preliminary test it, you can apply a low level voltage to e any RFS via (1-2 volts) and the TIF signal near Q26 should go high. This voltage energizes the K3 relay. The purpose of C94, CR7 and CR8 is to sample and convert the 28 MHz RF energy to DC voltage. To test, lower your IF drive down to the lowest level possible. Then key your transceiver and apply drive. The TIF signal should go high. If not verify the CR7 and CR8 diodes and the RFS signal with an ohm meter. When the PTT is enabled on transmit either through the sequencer or directly by your transceivers PTT, the K3 relay and the rest of the TXIF circuit will be energized by the transverters TXON voltage and over ride the protection through the CR21 isolation diode.

Fan Speed Controller: The fan speed controller should operate on its own speeding the fan up as the transverter heats. You can check the voltage at –F as the transverter is heating. This is the negative lead to the fan and as the transverter increases in temperature, this voltage will move closer to Zero or ground as the heat sink warms. If you find that the fan is running too early, you can lower the value of R77 from 1K to 910 ohms or even 820 ohms. This also means it will start later in the temp cycle which may affect the frequency stability but its adjustment may increase or decrease the delta in frequency change over temperature.

Sequencer: Testing of the sequencer is simple. Just verify the steps are what it is connected to in both TX and RX modes. If wired as recommended, 1 is positive voltage in RX, open in TX. 2 is open in RX, positive voltage in TX. 3 is open in RX and Ground in TX. 4 is what enables the transverter and is ground in TX. It is open in RX and Ground in TX. This is reflected on the matrix on the sequencer schematic. If you wire it differently, use that matrix to note your changes.

For mast mount LNA operation with the basic transverter or with an external high power amplifier, all switching tests should be done ***without RF applied.*** Verify that the switching is completed in your desired sequence and gradually add in your external components and verify their operation. All testing can be done without coaxial cables connected. Connect the transverters IF or TXIF cable last.

Step 1 +12VDC on RX for a preamp @ 500 mA maximum

Step 2 +12VDC on TX for a TR relay (around the preamp) @ 500 mA maximum

Step 3 Ground on TX to key a power amplifier. Sinks 100 mA maximum

Step 4 Ground on TX to key Transverter. Sinks 100 mA maximum

Optional Sequencer Connections:

Step 1 and 2. They can be connected to switch higher DC voltages. The DC voltage is applied to the DC1 and DC2 connections on the board (30VDC maximum).

Step 2 TL2 is a secondary connection to the second step. It is a “LOW” on transmit. It can be used to drive a relay or key an amplifier but an external isolation device should be utilized. It will sink 100 mA maximum

Step 3 and Step 4. They have secondary outputs that are both “High” on transmit. They are labeled PH3 and PH4. These should be isolated from devices that require high currents and are intended to drive low current devices or Pass transistors or FETs. They will source 5mA.

The transverter’s sequencer may be by-passed to eliminate switching time delays. The external PTT input of the transverter may be connected directly to the transverter’s PTT inputs (see component placement document) PTT-H is near C100 and PTT-L is near C102.

Negative Voltage Option: If you have installed the negative voltage generator option, an approximate -9VDC will be available on the AUX connector pin 4. To set this up with your transceiver, connect pin 4 and one of the ground pins to your transceiver’s ALC input. Connect your transceivers output to a power meter and load. With both the transverter and Transceiver powered on, measure the output power of the transceiver on somewhere in the 28 MHz band to verify that the ALC circuit within your transceiver is operating correctly. With the negative voltage applied, there should be minimum power output (less than 1 watt or as low as a few mW’s depending on what type of transceiver it is) With the power meter still connected, if the transverter is powered off, the transceivers output power should come back to normal. Be careful if you are using an mW power meter!! If it all checks out, continue with the transverter testing and installation Connect the RF drive to the transverter and with the transverter switch on, you may then adjust the TXIF drive level in the transverter for your desired output power level.

IMPORTANT NOTE: If you are using the ALC (negative voltage generator) circuit and you desire to use your transceiver for other than transverter use, operating it with the RF/IF cable connected without the ALC voltage running will damage the transverter. What is suggested is to place a coaxial relay (SPDT) between the transverter’s IF port and the Transceiver’s RF port. Wire the relay so that it directs the RF path to the Transverter when energized. Connect the +13.8SW buss and ground to the relay through the AUX connector.

When the Transverter is switch on, the relay will direct the RF path of the transceiver to the transverter and the transverter will apply the negative voltage to the transceivers ALC port. Power the transverter off will simply switch the transceiver back to normal.

With all circuitry now checked close up the transverter. The TXIF and RXIF adjustments are accessible through the bottom cover. The frequency adjustment is not and it is best not to drill an extra hole for it. This will be explained in the **General Operation, Oscillator** section.

Test Point Matrix

Device/mode	Input	Output	Emitter/Source	Base/Gate	Collector/Drain
Q3 RX	NA	NA	2.0-3.0VDC	2.5-3.5VDC	8.4-9.1VDC
Q4 RX	NA	NA	0.00 VDC	-0.70 to0.7VDC	8.4-9.1VDC
IC6 RX	0.95-1.7VDC	4.5-5.5VDC	NA	NA	NA
Q6 RX	NA	NA	0.35-0.65VDC	0VDC	3.4-3.9VDC
SEQ Pin1 RX	NA	13-14VDC	NA	NA	NA
IC5 Pin2 TX	4.2-4.8VDC	NA	NA	NA	NA
IC3 TX	2.2-2.8VDC	4.5-5.0VDC	NA	NA	NA
IC4 TX	1.5-2.0VDC	5.0-6.0VDC	NA	NA	NA
IC7 TX	2.2-2.8VDC	4.5-5.0VDC	NA	NA	NA
SEQ Pin2 TX	NA	13-14VDC	NA	NA	NA
TIF TX	NA	12-14VDC	NA	NA	NA
CR3-CR4 TX	NA	0.65-0.95	NA	NA	NA

Installation and Operation

Theory of Operation: The basic principle of a VHF/UHF transverter is to convert a chosen band of operation to the 28 MHz. band of a HF transceiver. Following the recommendations of the HF transceiver's operation manual for transverter use is the most important aspect of correct transverter operation. If configured correctly, the transverter will convert both transmit and receive signals to a new band of operation and seam "invisible" to your HF transceivers operation. In simple terms, the transverter will not improve the performance of your HF transceiver but will not cause any degradation of performance in any way.

Interfacing and Operation:

MOST IMPORTANT: When interfacing your transverter, it is recommended that all usable features of the transverter are tested and proven before integrating the transverter into your system. This means verify the transverter functions correctly with the transceiver before interfacing to High Power amplifiers, mast-mount LNA's, and external TR relays. During the initial setup of the transverter, test all switching functions before applying RF. Implement one accessory at a time confirming the switching function, then RF function. Start with low RF drive levels and gradually increase to the final desired level.

It is assumed that since you have assembled this transverter to your specifications, interfacing will be easy. But—we will offer some tips that may have been over looked. Start the interfacing with good quality 50 ohm cables for the IF (28 MHz.) connections. These connections may be low level or at the 25 watt level depending on your configuration and good quality BNC type connectors with adapters to your transceiver are fine! The shielding quality is important to prevent other 28 MHz signals from "Creeping" into your transceiver.

All transverters will require a PTT (to ground or positive voltage on TX) to enable the transmit mode of the transverter. The PTT input to the transverter is a RCA connector. This cable does not need to be shielded, but extra protection in a QRO station is a good idea! Most transceivers have RCA connectors for PTT outputs but others have various connections. Be sure to have whatever cable that is required ready to go.

The DC power cable should be connected to the desired power supply. If you require a longer DC power lead, consider moving up one gauge to eliminate a voltage drop problem. Plan on 6 amp current drain and please fuse the line.

The AUX connector will contain all sequencer connections and any other special requirements such as the negative voltage or any other inputs or outputs you desire. The matching connector to the AUX connecter is supplied and should be wired before final interfacing.

If using a mast mount LNA, the IP3 performance of the transverter will be limited by the LNA and total system IP3 performance will be degraded. The amount of degradation will depend on the performance characteristics of the LNA. Yes, the total system gain can be controlled by the RXIF gain control but the dynamic range of the transverter will be reduced by the amount of gain of the LNA at the minimum. Such a system should have the capability of switching the mast mount LNA out of the system. Use of an “In the Shack” LNA in front of the transverter is total nonsense! If you believe your system is lacking gain and the transverter is in spec, find the problem in your transceiver or—if you must, install an IF amplifier on 28 MHz so not to degrade the transverters “RF” performance.

Another suggestion is if you are to use a mast mount preamplifier, you may consider bypassing the transverters LNA. It requires removing R31 and R26 from the circuit. Then move the RXRF connector cable to the C68 pad. A ground pad is cleared for a coax shield nearby. This will utilize the diplexer and first filter in the receive chain and disable all DC power to the Q6 FET.

Unless you have ordered a special order Crystal, the national calling frequencies will be on 50.100 or 28.100 MHz on you IF transceiver. Use of the transverter outside of the Weak Signal portion of the band (above 52MHz) is possible but slightly degraded performance may be expected. The transverter is designed specifically for the weak signal portion of the band.

Setting your final output power of the transverter is recommended to be done in the CW mode. BUT—verify that if you change modes of your transceiver, the drive levels do not change or overdrive may occur in the SSB mode causing undesirable effects on the band!

The bar graph display is a relative power meter and is driven by the directional coupler and RF detector circuit found in the Low pass filter section of the board (CR11, R76, R75, C108, C111) RF is detected and converted to DC voltage and conducted to the Bar graph display on the front panel. If you find that you operate the transverter at any other level than what it is calibrated to, you may change it by adjusting VR1 on the display board. Also remember being that is a reference meter, if your VSWR should increase, it may or may not show an increase or decrease on the bar graph display.

General Operation: General operation of the transverter, if everything is adjusted correctly, should be transparent to the transceiver and the user. Except for the frequency read out, (if your transceiver doesn’t allow its display to be adjusted for transverter operation) it will be like operating on 10 Meters. All of the functions of the transceiver (filtering, DSP, split band operation, dual VFO) will be transposed to the frequency band of the transverter.

Some cautions should be taken when operating CW or VOX. Operating the transverter in a "Full Break-in" mode is not recommended. Because of the mechanical relays in the transverter, there will be too much delay to operate "Full Break-in" effectively. AND—the relays would be abused if "Full break-in "is enabled. It is best to operate in "semi break-in" and adjust the delay of the PTT on your transceiver to match your comfortable CW operating speed in a way that the delay will hold the PTT until your transmission is complete. If you have implemented the sequencer, its delay will need to be longer to allow all components within the system (Power amplifier, LNA, relays,) to complete their transition if utilized. If just the transverter is to be used alone, the transceiver PTT signal may be connected directly to the transverter's PTT input bypassing the sequencer. This will shorten up the delay but will still not allow "full break-in" without relay chatter.

General Operation, Oscillator: The transverter will experience frequency drift through aging. Even if you took time to "Net" the frequency of the transverter's local oscillator at its normal operating temperature after a long burn-in, frequency shift from ageing may still cause a need to be re-adjusted after prolonged operation. This is because of the physical nature of crystal ageing through temperature cycling. As the hours of operation time increase, this "Zero Offset" frequency will be less and less and eventually will not require adjustment.

As for frequency drift during operation, great care has been taken to minimize it in the design. The oscillator section of the transverter board is "Ovenized" and the speed of the cooling fan on the heat sink is controlled by the actual heat sink temperature. The problem still arises from the internal air temperature of the transverter and the heat conduction of the heat sink to the oscillator section of the transverter board. The frequency drift the transverter exhibits may not be noticed on SSB and CW operation. But, a carful understanding of how much "drift" the transverter exhibits and in what direction is moves is important for digital mode operation.

Our testing of this design was done with 30 second transmit and receive times at the transverter's full rated output power. After a 10-15 min warm up time, we have found that the most extreme drift will occur during the first few transmissions while the transverter reaches its stable internal operating temperature. If the room temperature is less than 75 degrees F (approximately 25 degrees C) the cooling fan may be running slow or not at all. The first or second transmission will cause the Fan to cycle and if the heat sink temp rises enough, it will remain running. The first cycle will cause the largest frequency shift. The next 3-4 transmissions will stabilize the frequency drift. At the 5th or 6th transmissions, the frequency drift will settle down to be 1-2 Hz or less if all conditions remain the same during 30-second cycles. Of course this may better or worse depending on the transmit power and duty cycle. An operation recommendation would be to start your digital Sked a few minutes early and you will achieve frequency stability at the actual start time of the Sked. Realistically expect 50 Hz total drift. Some factory production units have achieved less than 30 Hz

What is expected to keep the frequency drift to a minimum is to be sure all un-used connector holes in the rear panel either have connectors or holeplugs in them. The IF adjustment holes on the bottom cover plate may remain open but the addition of extra holes or enlarging the existing ones will affect the cooling.

Removal of the fan from the transverter will allow the transverter to drift as much as 500 Hz over a ½ hr. 30 second cycle schedule. This may be acceptable for SSB and CW operation but we have found the ambient fan noise of the transverter to be un-noticeable so if you desire to operate with a digital mode, install the fan. AND—the opposite goes for adding an extra fan. It will not help the “Balance” of heat and air and most like cause excessive drift. But, feel free to experiment if you desire.

Examine the fan control circuit schematic. Voltage from the NTC Thermistor drives the NPN transistor which in turn drives the Pass transistor on the negative lead of the Fan. R77 controls at what temperature the fan starts. The larger the resistance, the lower temp the fan starts at. BUT—if you find that in the TX mode, the heat generated causes excessive drift, the –F connection may be connected to the open contacts on K1 so that the fan operates at full speed during TX. Simply, make the relay’s common connection to ground and run a wire between the NO contact and the –F connection. The fan will now run at full speed during TX and its thermal speed on RX. Understand that there is a delay in heat transfer and that the heatsink still heats up after the transverter is in the RX mode.

You may find that if the frequency drift is excessive or just want to keep it to the very minimum, a thermal “Blanket” may be applied to the crystal and oven, The custom fitting of a piece of Styrofoam will insulate it all from the internal heat of the transverter.

Options Setup:

Common or Split IF Option: The IF configuration may be change at any time according to the type of transceiver you are utilizing. Refer to the Component placement or schematic for clarification. The component designators are also screened on the circuit board.

K3 is the common IF relay. To split the IF lines into separate RXIF and TXIF, remove the IF coax from its position on the board (junction of C93 and C94) and re-attach the center conductor between C95 and K3. The shield may be soldered where it was on the ground pad marked COM. The TXIF cable can be prepped and soldered to the pad between K3 and C92. The shield can be soldered to the ground pad labeled TXIF. Install a BNC connector in the rear panel (TXIF) and attach the TXIF coax. Reverse the procedure if you want to change to or back to Common IF.

Please note that if you have a separate IF configuration, the IF drive sense option will no longer function. It is not necessary with the split IF. It is to protect the RX circuit and Mixer from being damaged with the TXIF drive power.

TXIF Drive Level Range: The TXIF drive level range can be changed at anytime to conform to your transceiver type. Basically, there are three configurations. For high IF drive levels, (200 mW-25 watts) the 50 Ohm load will be installed with a low value capacitor in the C91 position (10 pF or less for 25 watts). Mid level drives between 1mW and 250 mW will not have the load installed and will have a 1000 ρF capacitor installed for C91. For the low drive levels (-20dBm to 0dBm or 1mW) IC7 will be installed. If you desire to change the drive level for whatever reason, just duplicate the info above. To install IC7, cut the ribs in the trace before installing. -10 to -6dBm inputs, use a

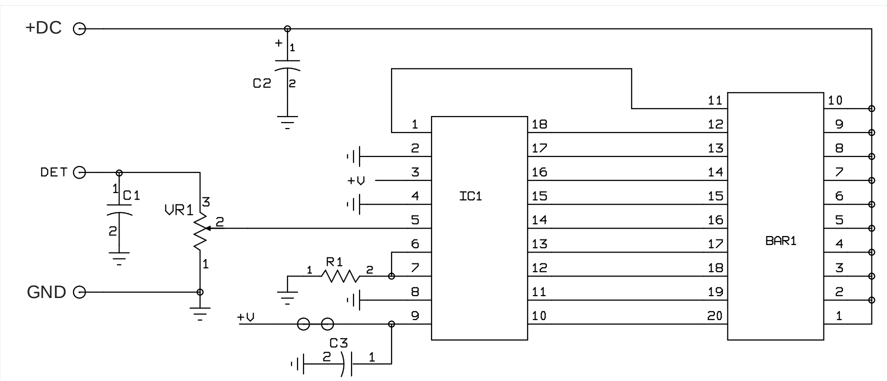
MAR-3 for IC7. For -20dBm, use a MAR-6. Other MMIC's may be used but the bias resistor R34 may need to be changed. Adjust R36 to obtain desired level in all cases. The important thing to understand is the IF drive range is wide and can accommodate different drive levels between the specified ranges.

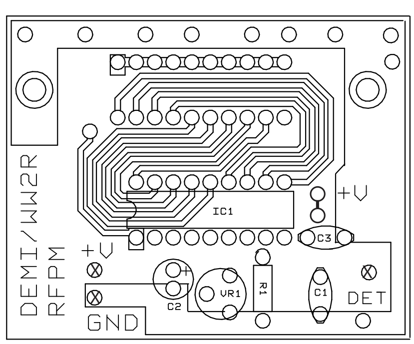
<u>Common or Split RF connections:</u> The transverter utilizes K2 as the common RF relay. It is mounted on the circuit board. The common port is marked ANT on the board. The split RF connections are labeled TX and RX on the board at each end of the relay. There is no need to remove the relay for the split connections. Simply remove C62 and solder RX coax directly to the C63 pad. The TX coax solders between C57 and K2 So--, depending on which way you are going, install/uninstall cables and connectors as required. Remember, if you have separate ports, they may be combined with an external coaxial relay to provide versatility.

<u>PTT on IF Coax:</u> A PTT-H signal on the IF coax from a transceiver may be used in the following way. A 1.0uH molded choke has been included in the kit. Connect it from the COM IF pad to the isolated pad with two via holes near the C94 indicator on the PCB. This isolated pad will then need a 1000ρF chip cap soldered to ground. Then, a wire from the remaining via hole to the PTT-H connection in either the Sequencer circuit (near R82) or directly to the transverters PTT-H input near C100.

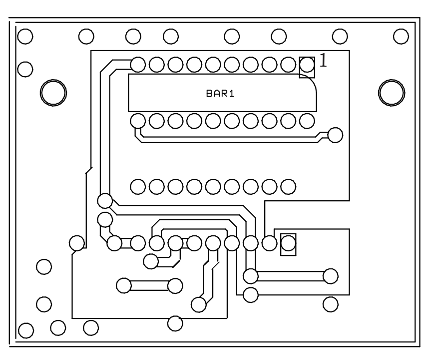
Power Meter

BAR1	BAR GRAPH DISPLAY	IC1	LM3914
C1	1000 DISC CAP	R1	2.7K 1/4W RESISTOR
C2	100µF ELECTROLYTIC CAP	VR1	10K POTENTIOMETER
C3	0.1µF DISC CAP		

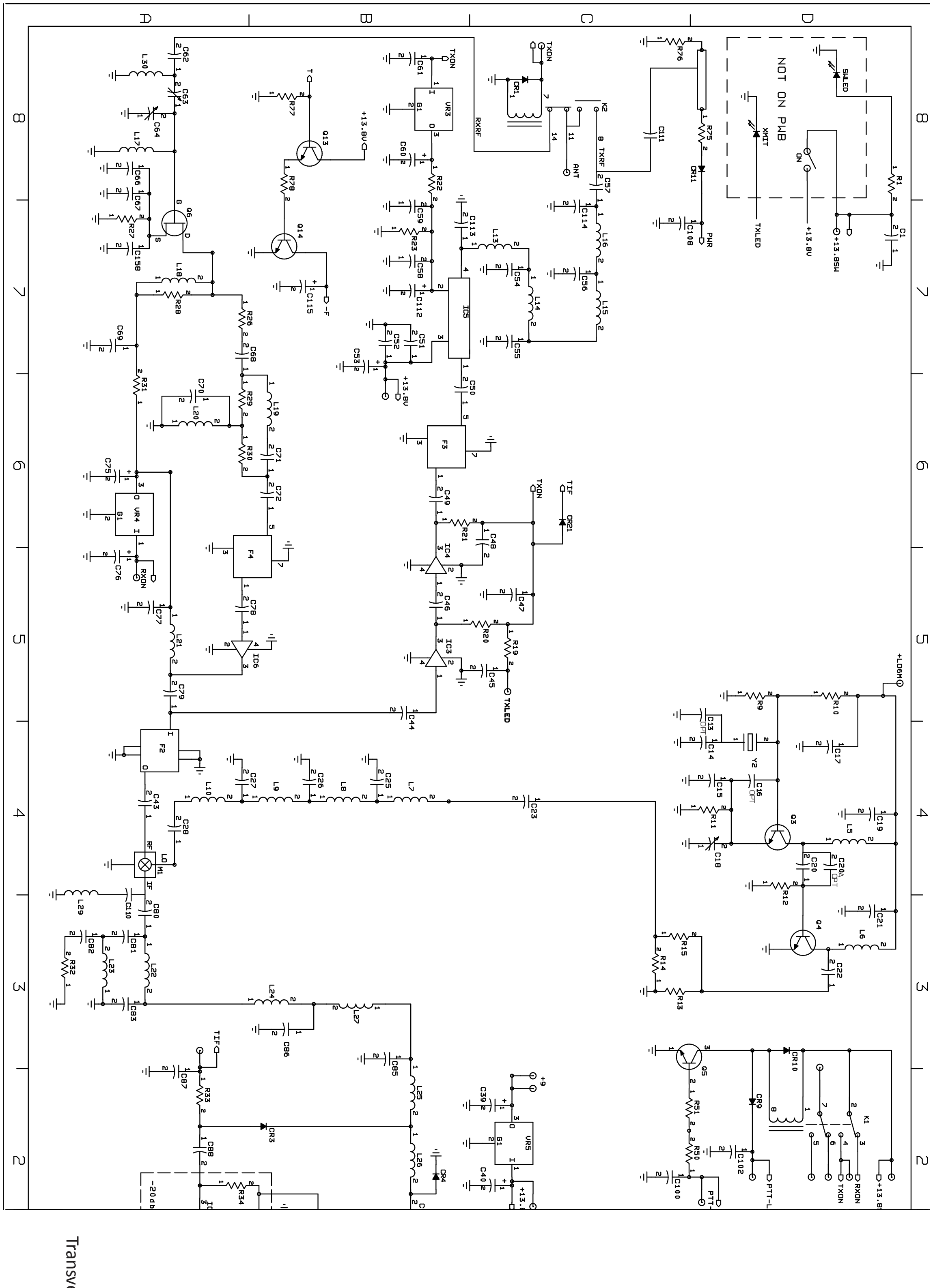




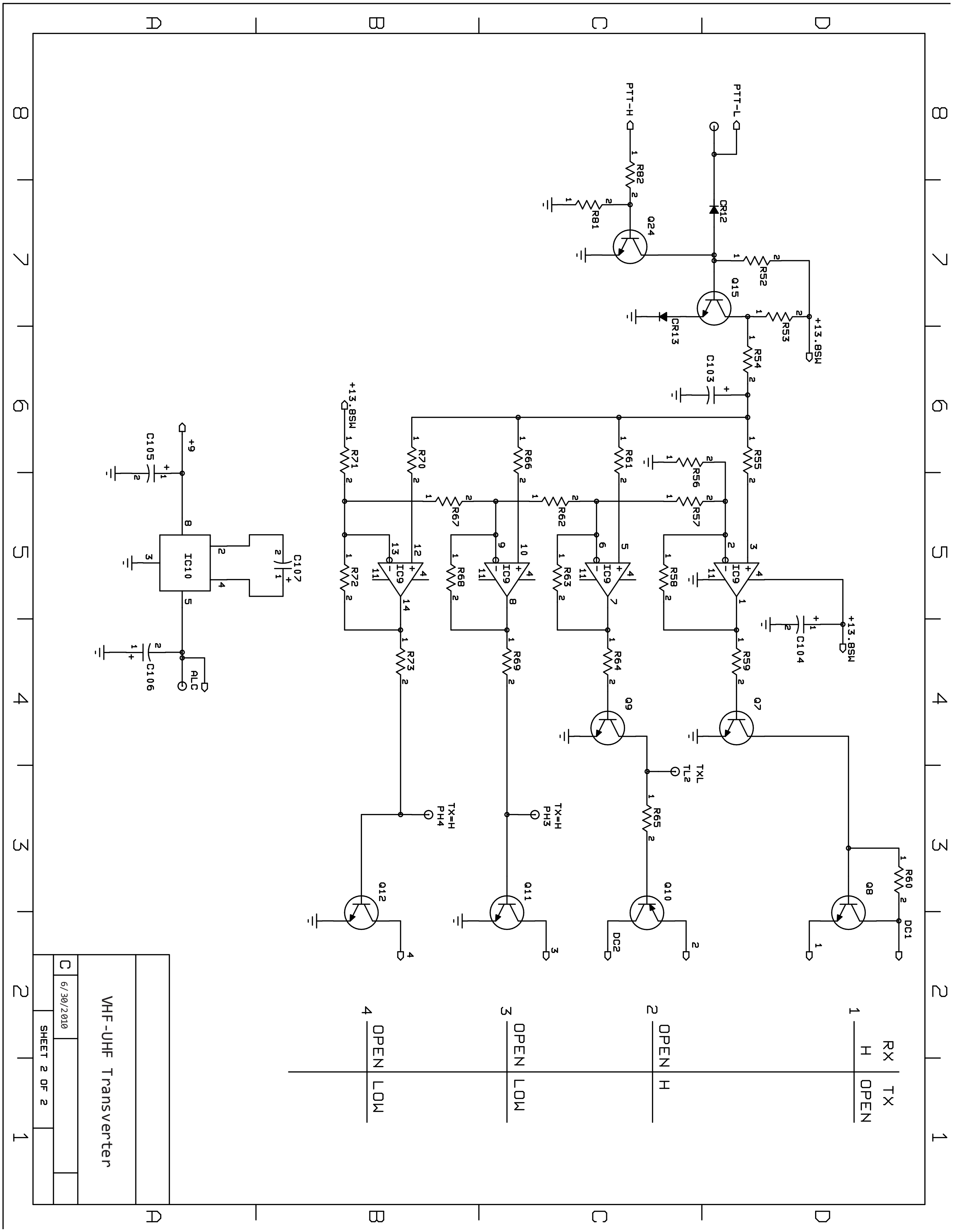
RFPM
TOP SIDE ASSEMBLY

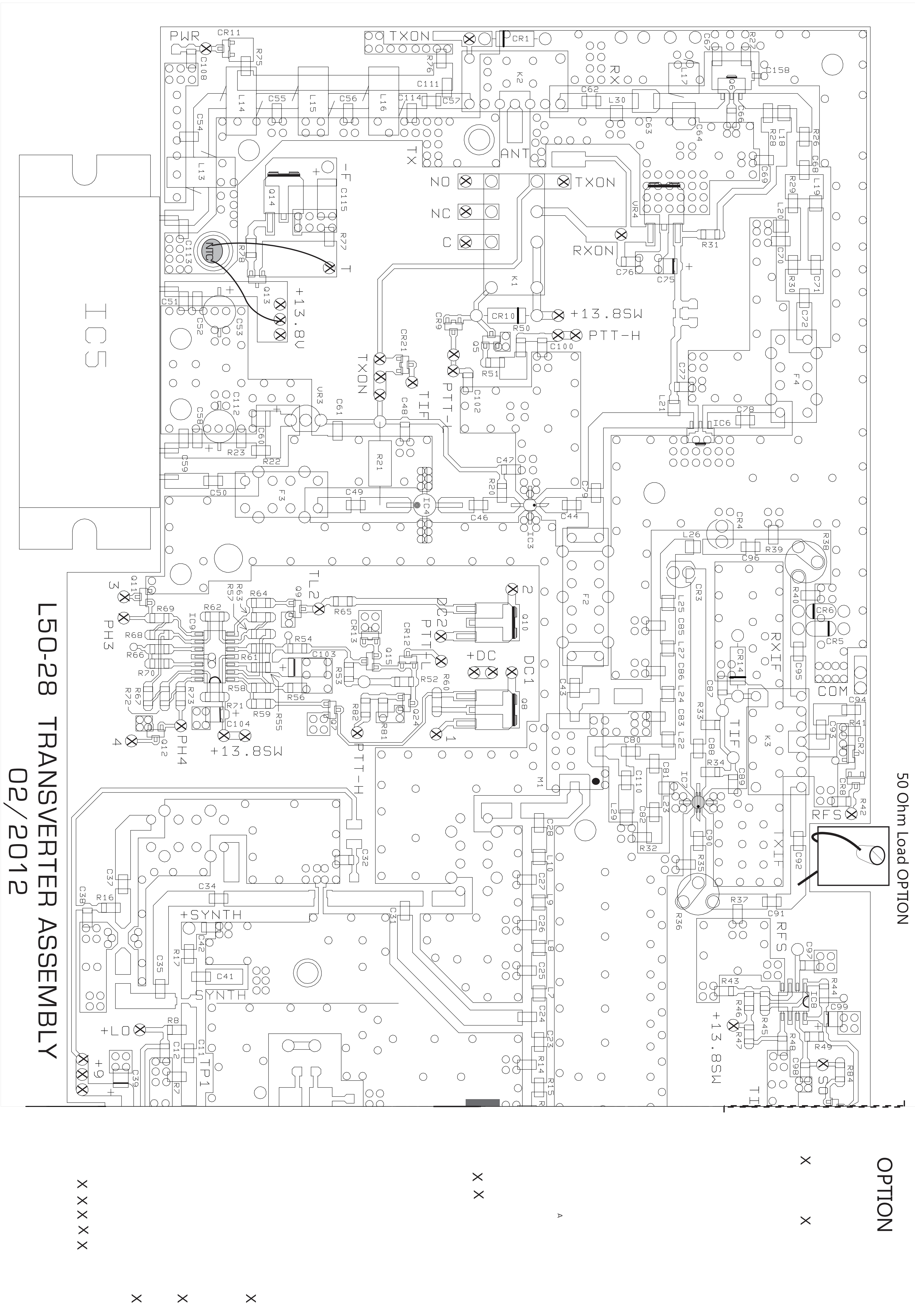


RFPM
BOTTOM SIDE ASSEMBLY

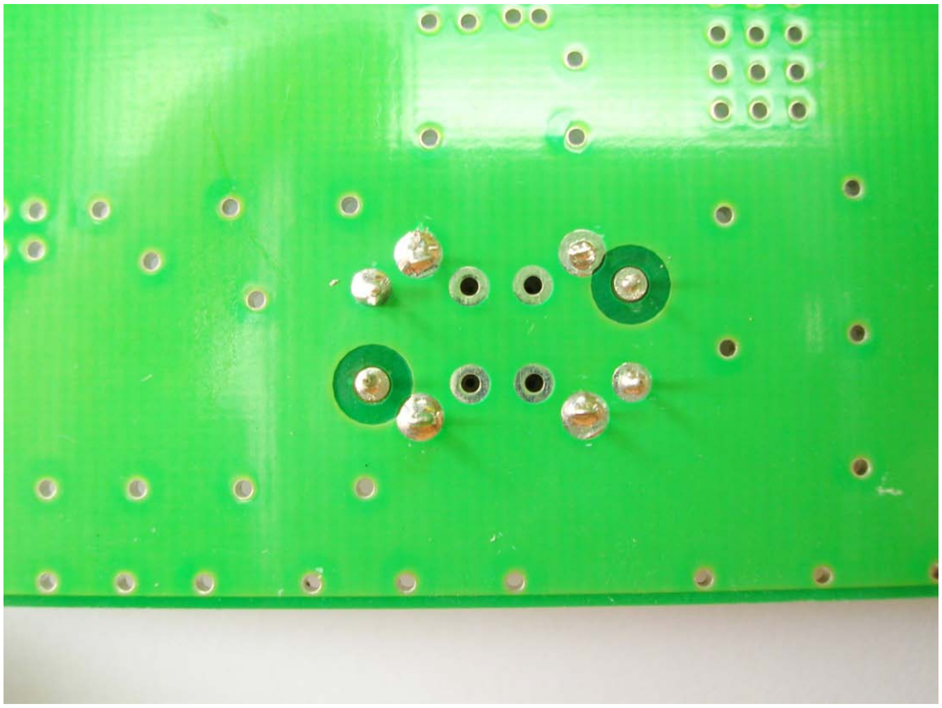


50MHz
Transverter Schematic
01/2012

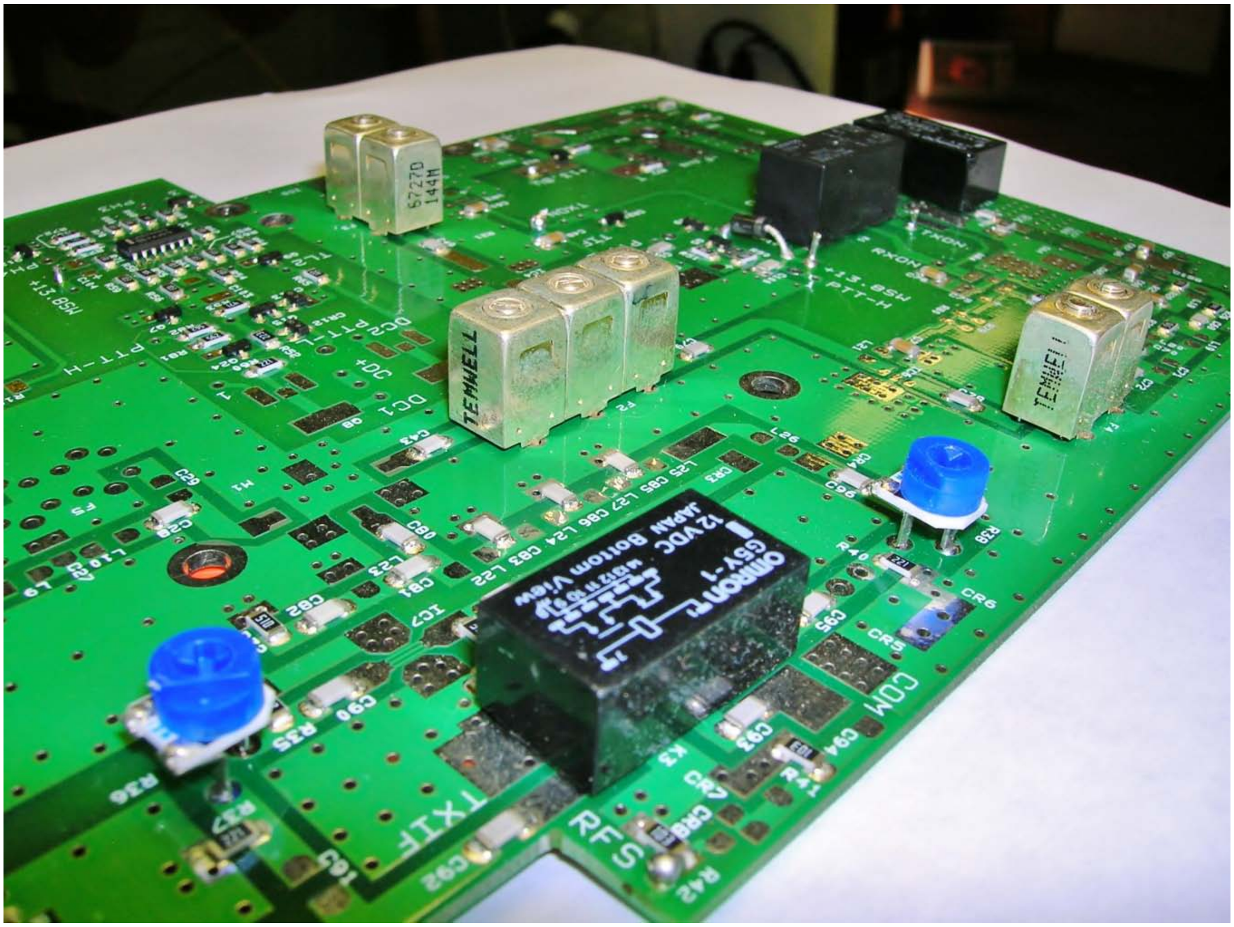

PTT-H
PTT-L
+13.8SW
+9
ALC
IC10
IC9
TXL
TL2
TX=H
PH4
PH3
DC1
DC2
RX
TX
1 H OPEN
2 OPEN H
3 OPEN LOW
4 OPEN LOW
C
6/30/2010
VHF-UHF Transverter
SHEET 2 OF 2


L50-28 TRANSVERTER ASSEMBLY
02/2012
IC5
PWR
TXON
ANT
TX
RX
NO
NC
C
RXON
+13.8SW
PTT-H
+13.8V
+DC
DC1
DC2
PH3
PH4
+SYNTH
SYNTH
+LO
TP1
RXIF
TXIF
TIF
COM
RFS
50 Ohm Load OPTION
OPTION

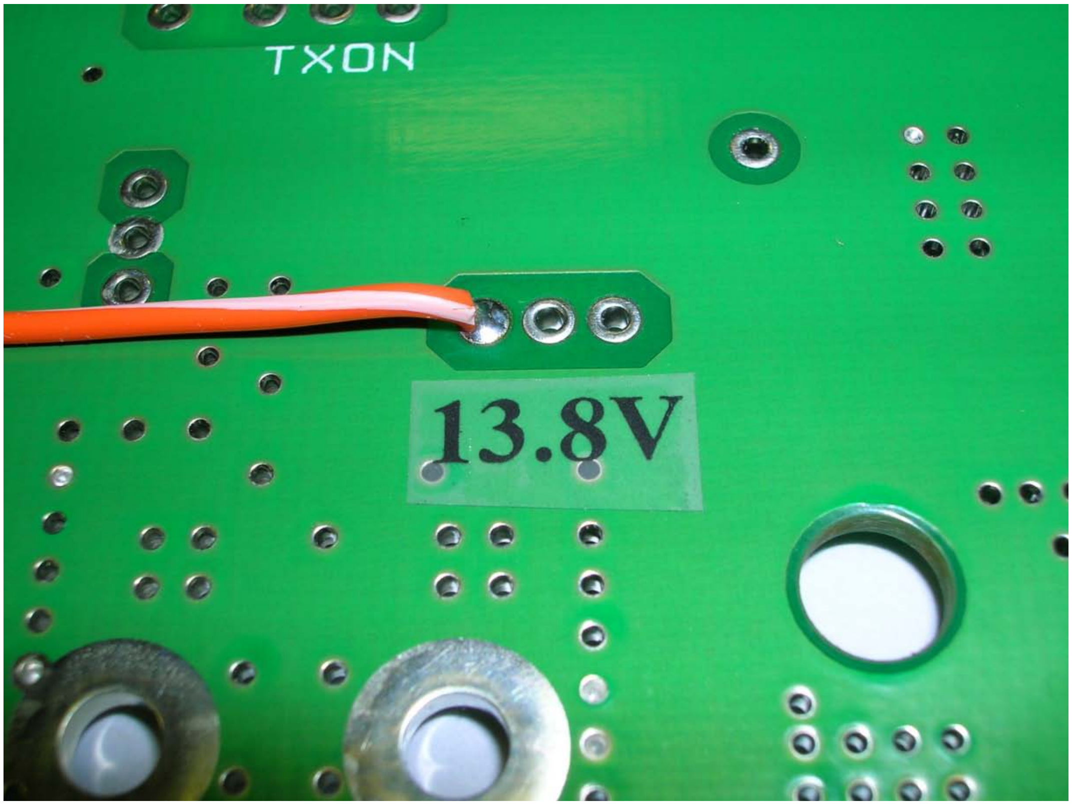
1. Proper Filter soldering on bottom side.



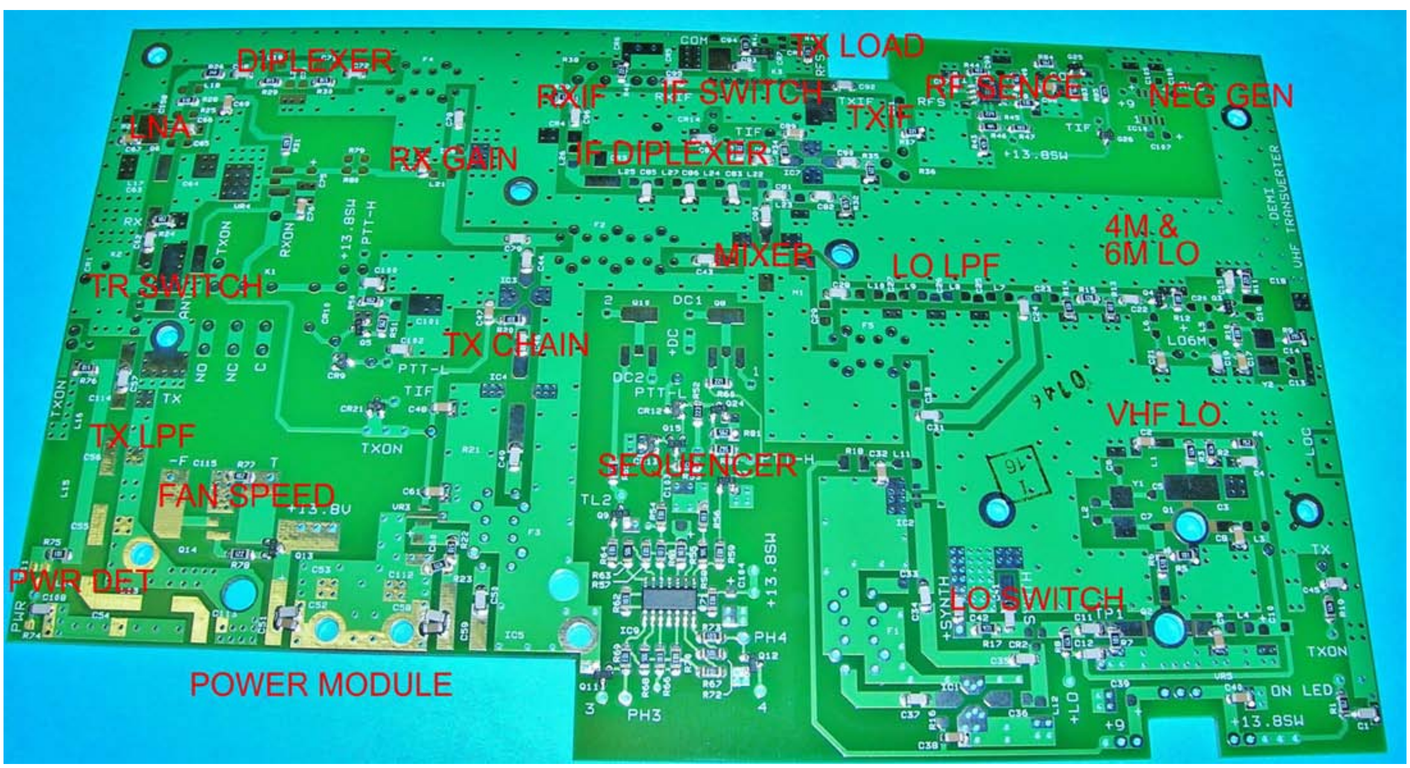
2. Some bottom side soldered, topside components.



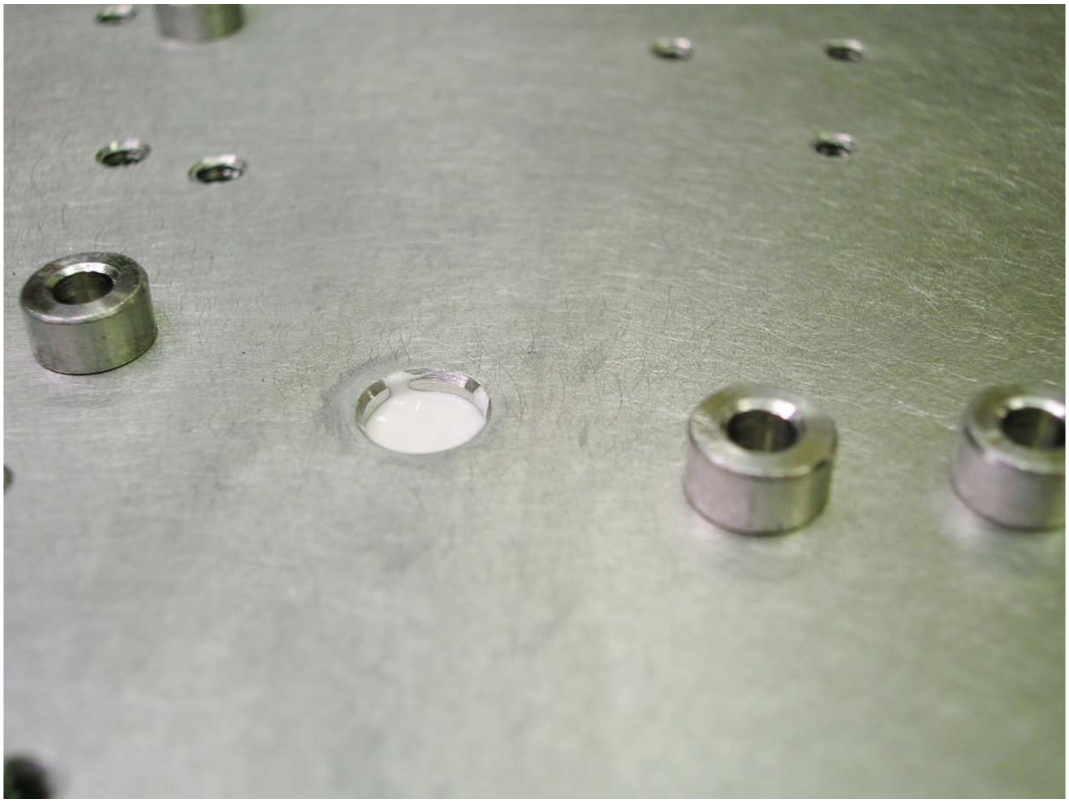
3. Correct soldering of wire on bottom side.



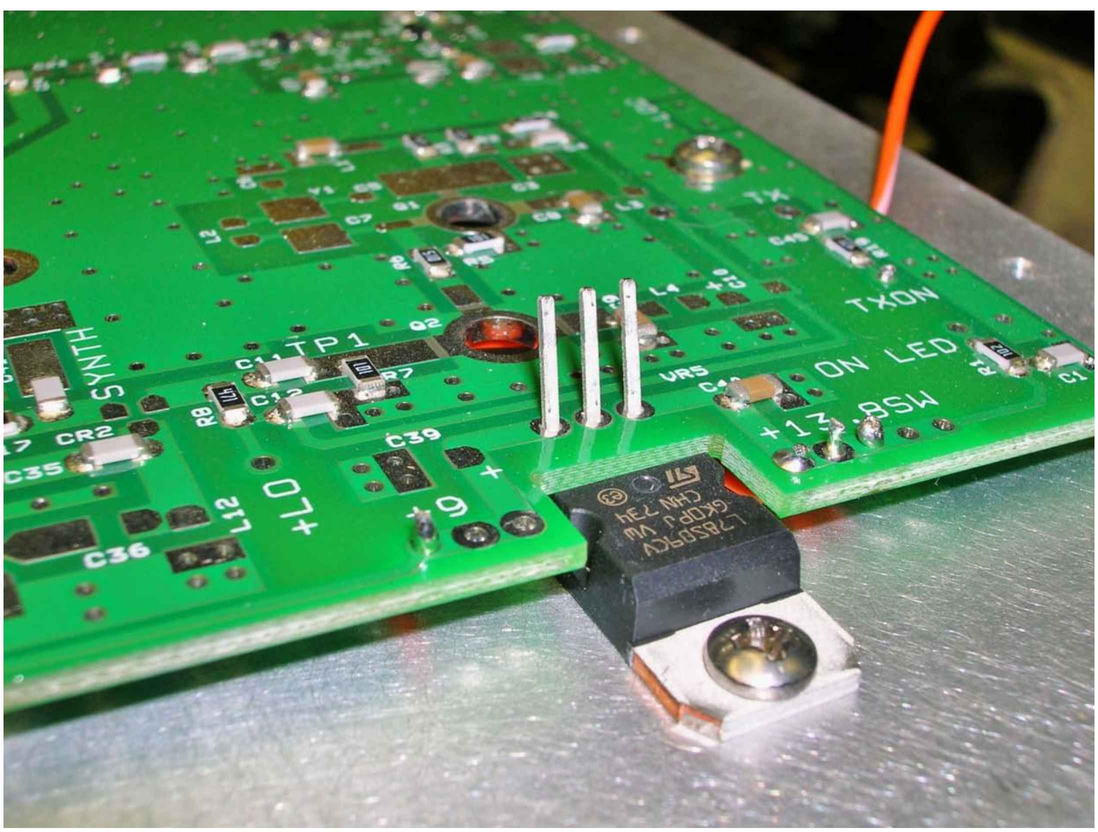
4. Topside board layout and labeled sections.



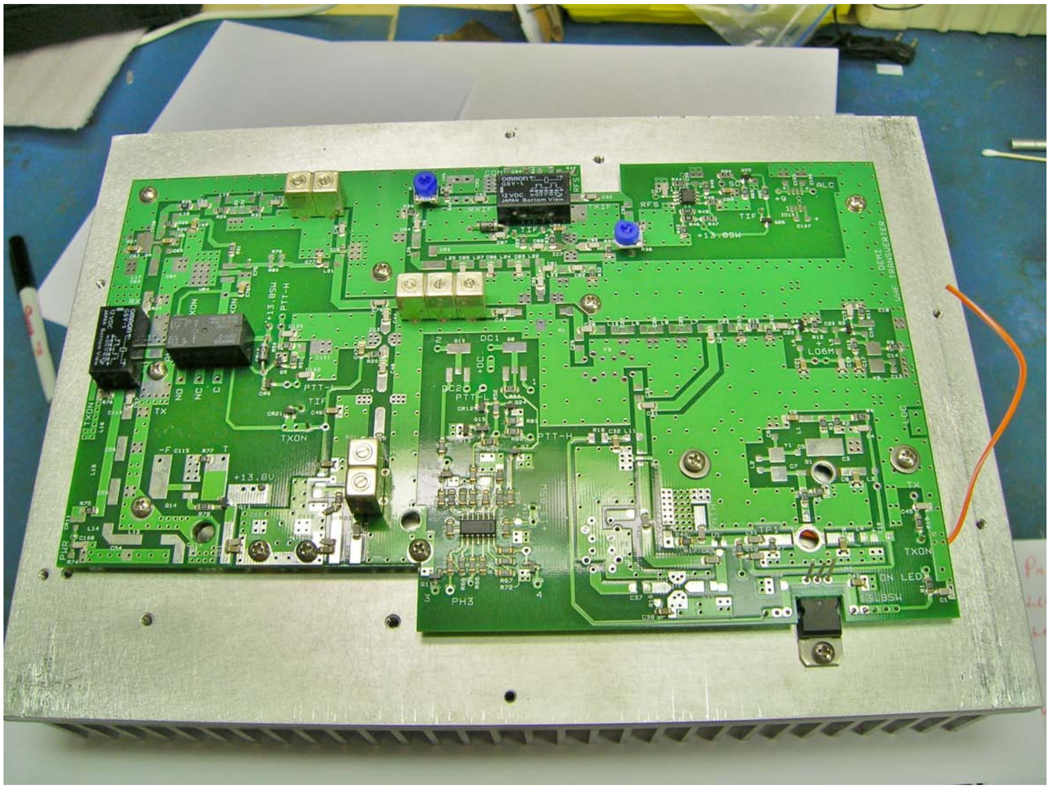
5. Shoulder bushings and NTC hole with thermal compound.



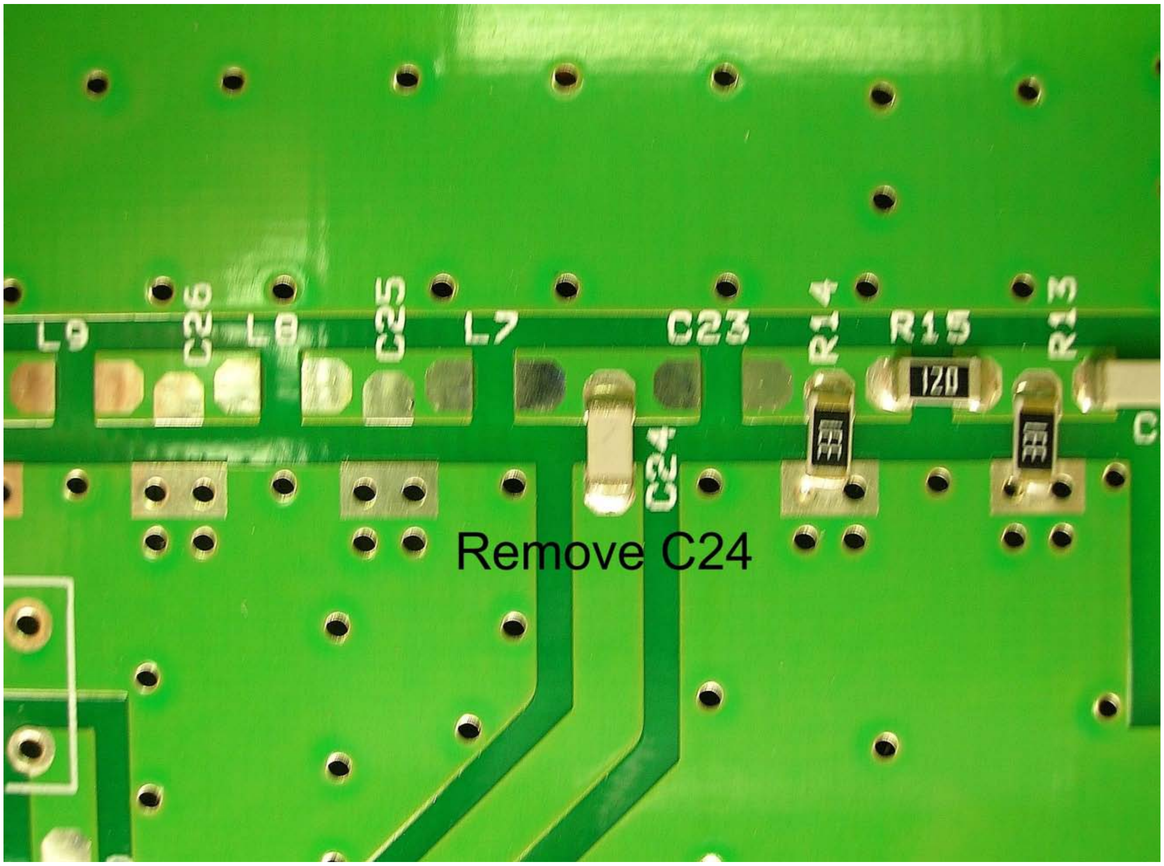
6. VR5 and PCB mount.



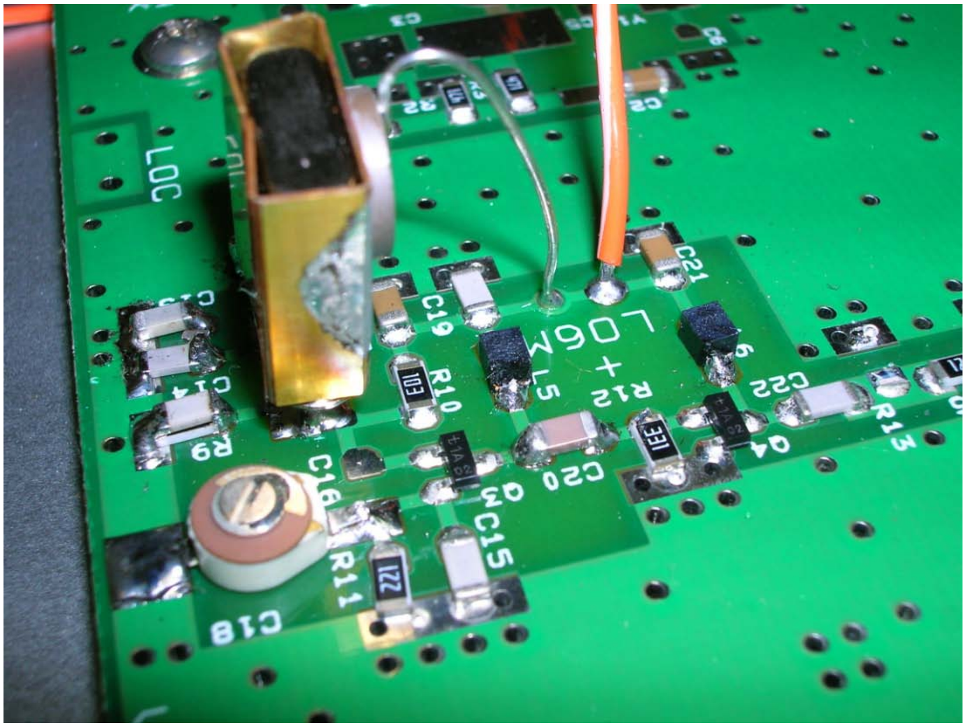
7. PCB correctly mounted.



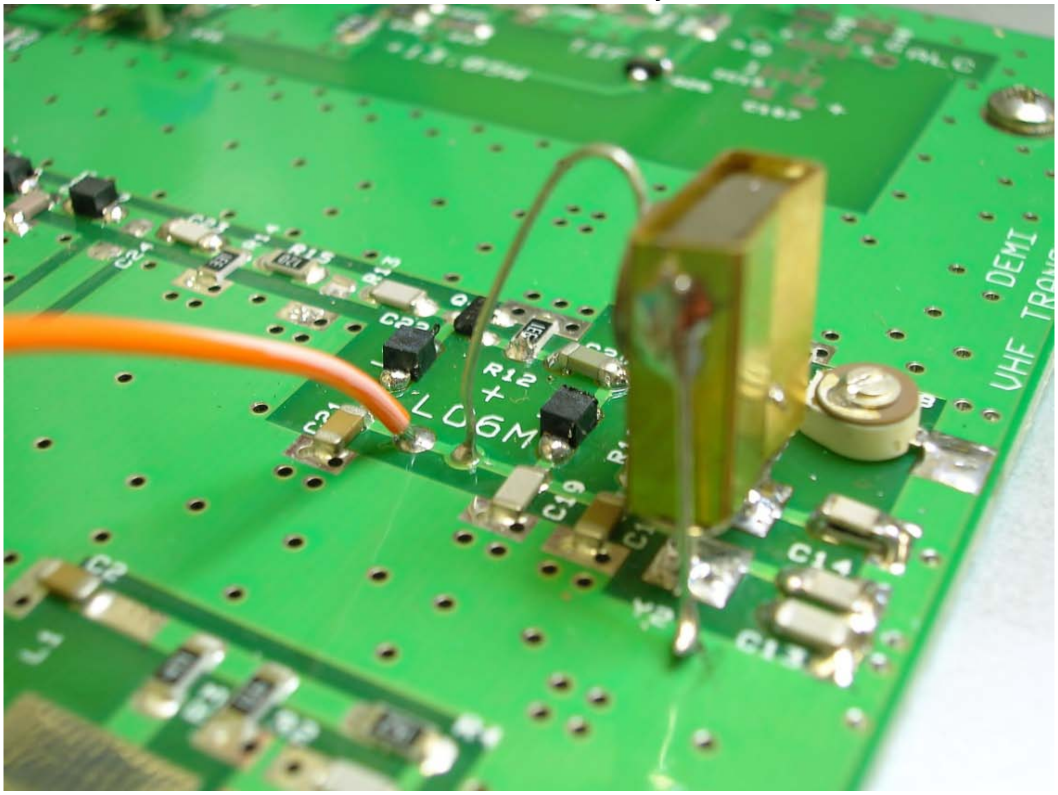
8. Circuit modifications in the LO6M circuit.



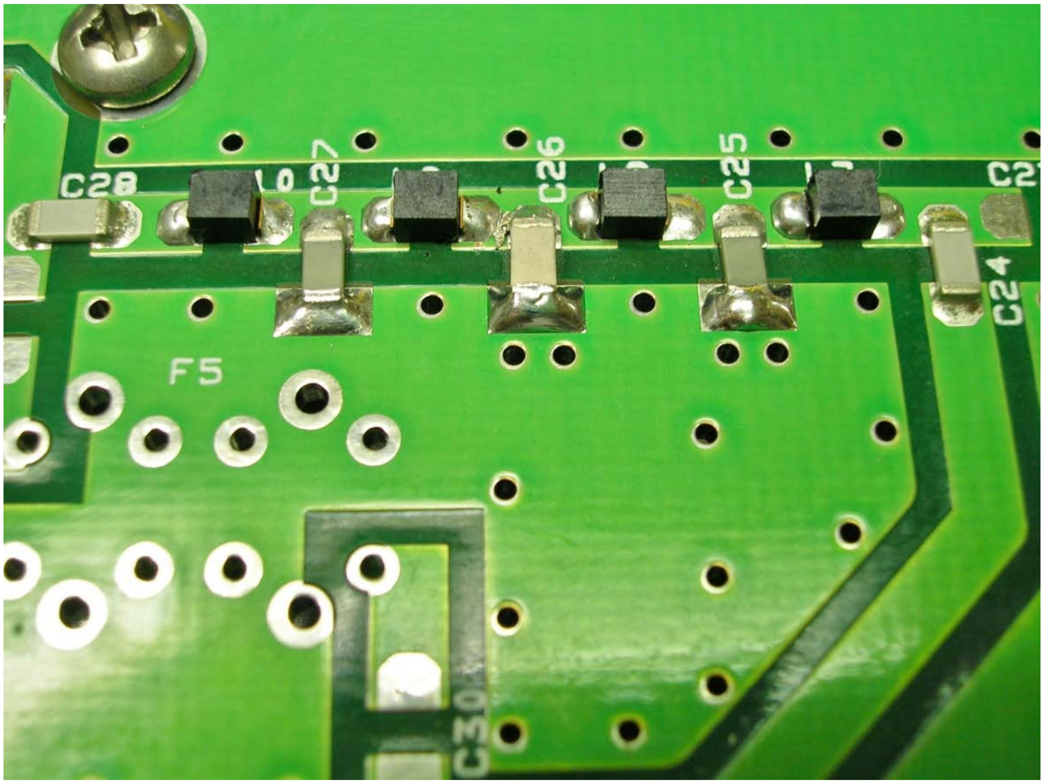
9. LO Assembly



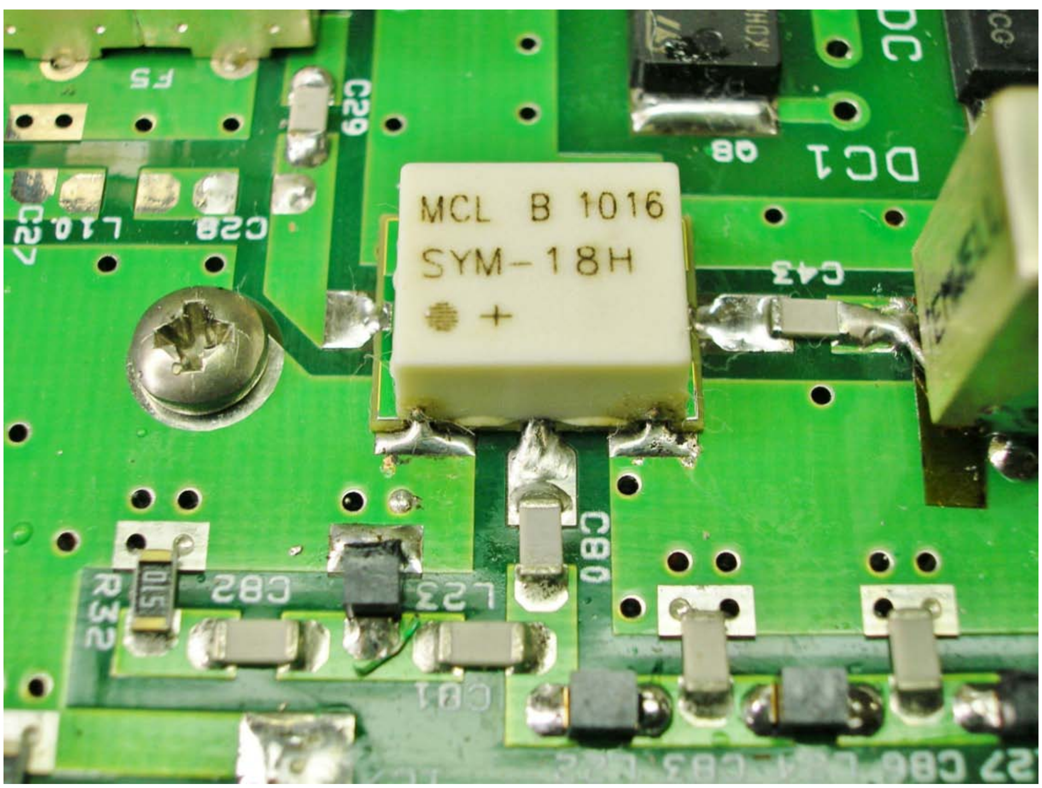
10. LO Assembly



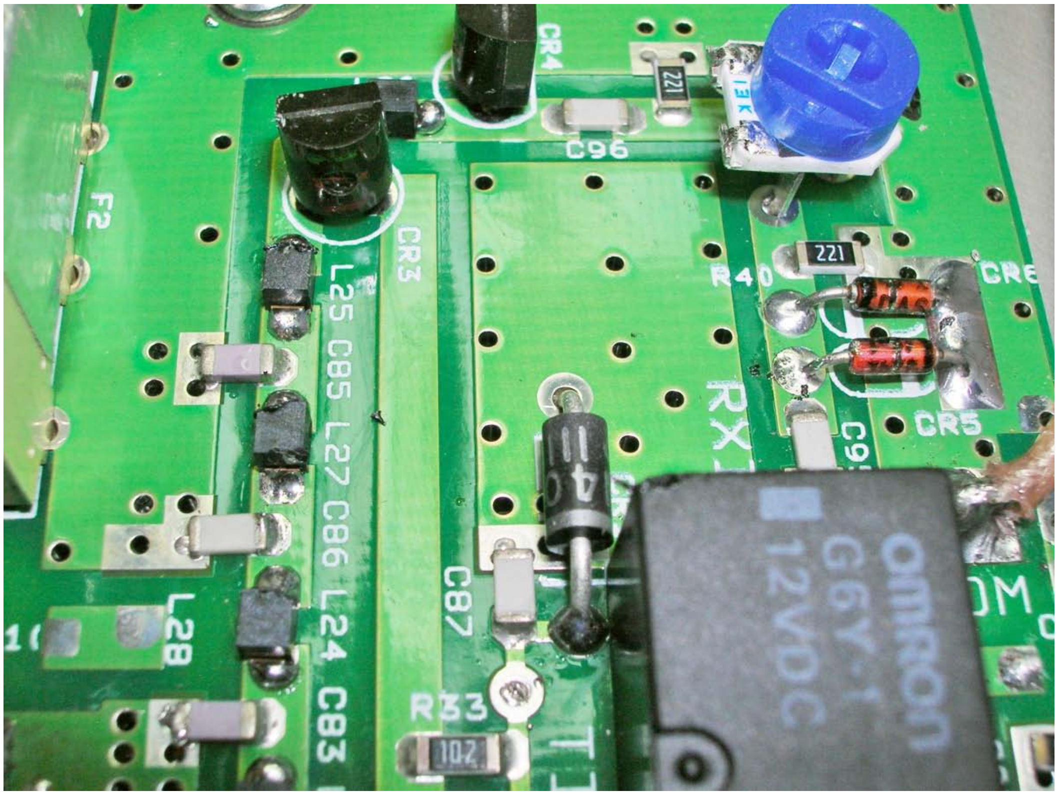
11. Low pass filter for the L50-28CK LO (C24 not removed)



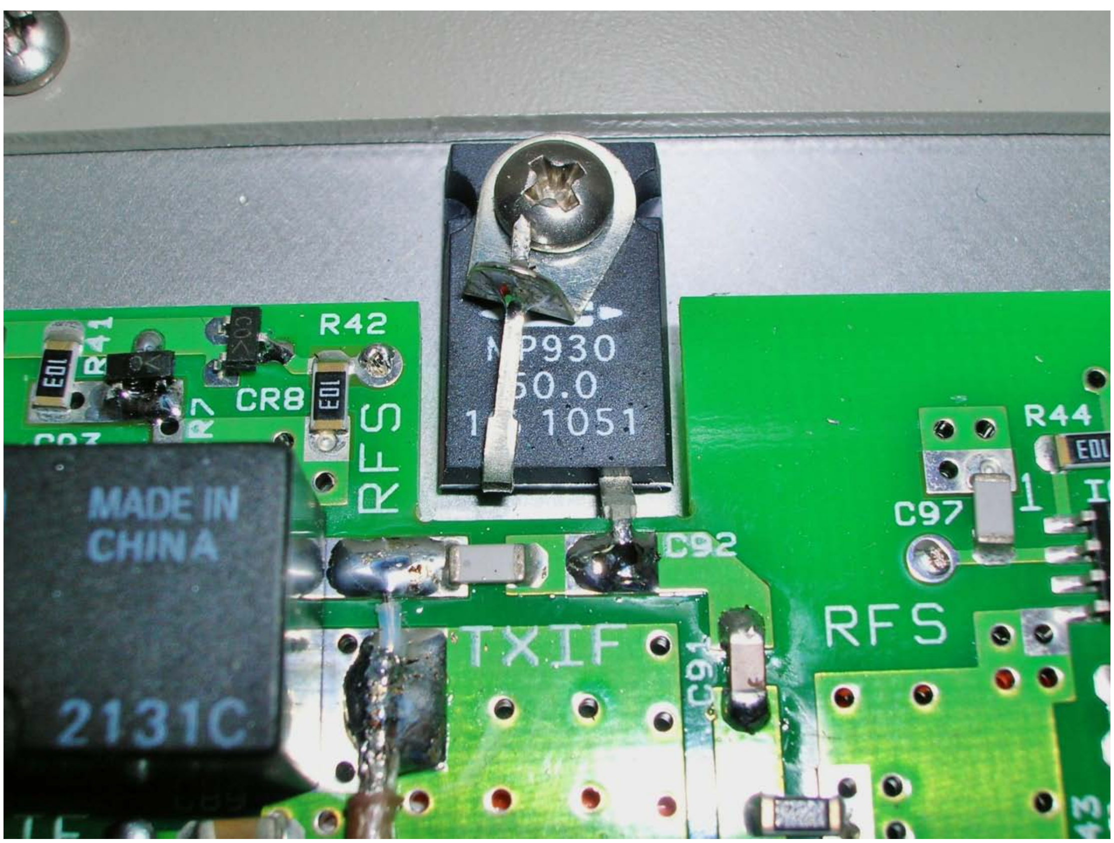
12. The correct mixer installation.



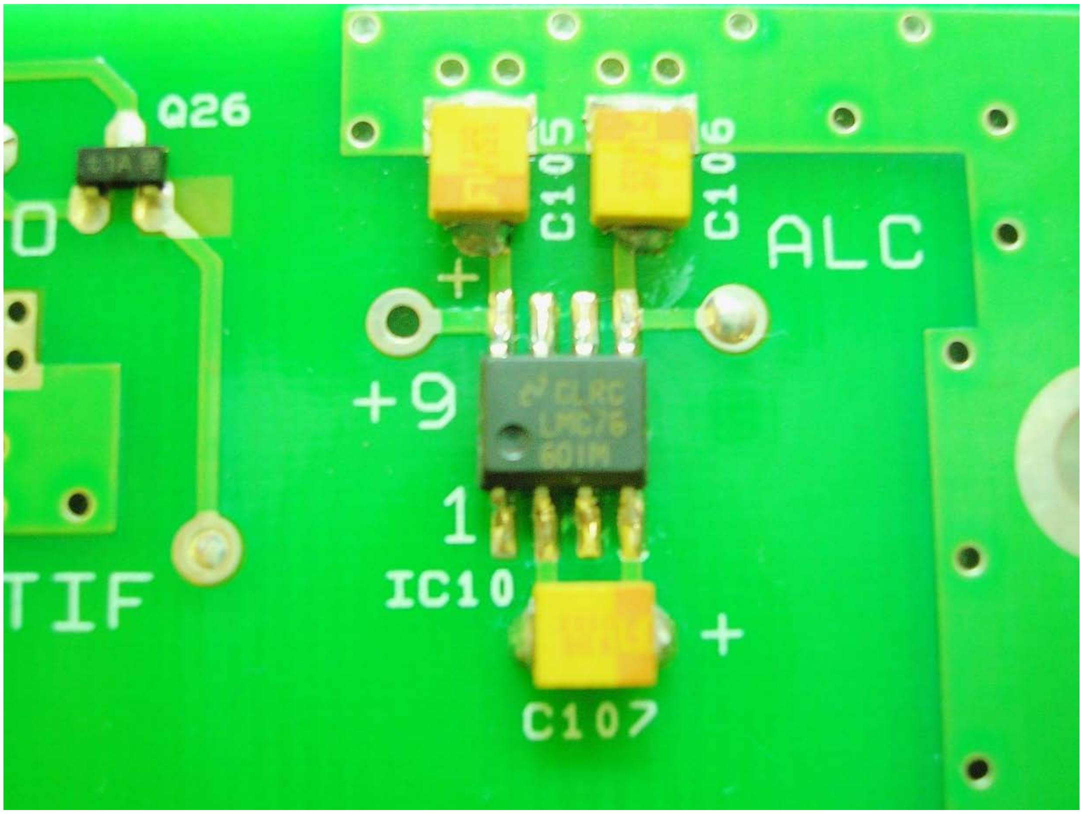
13. IF filter and Diodes



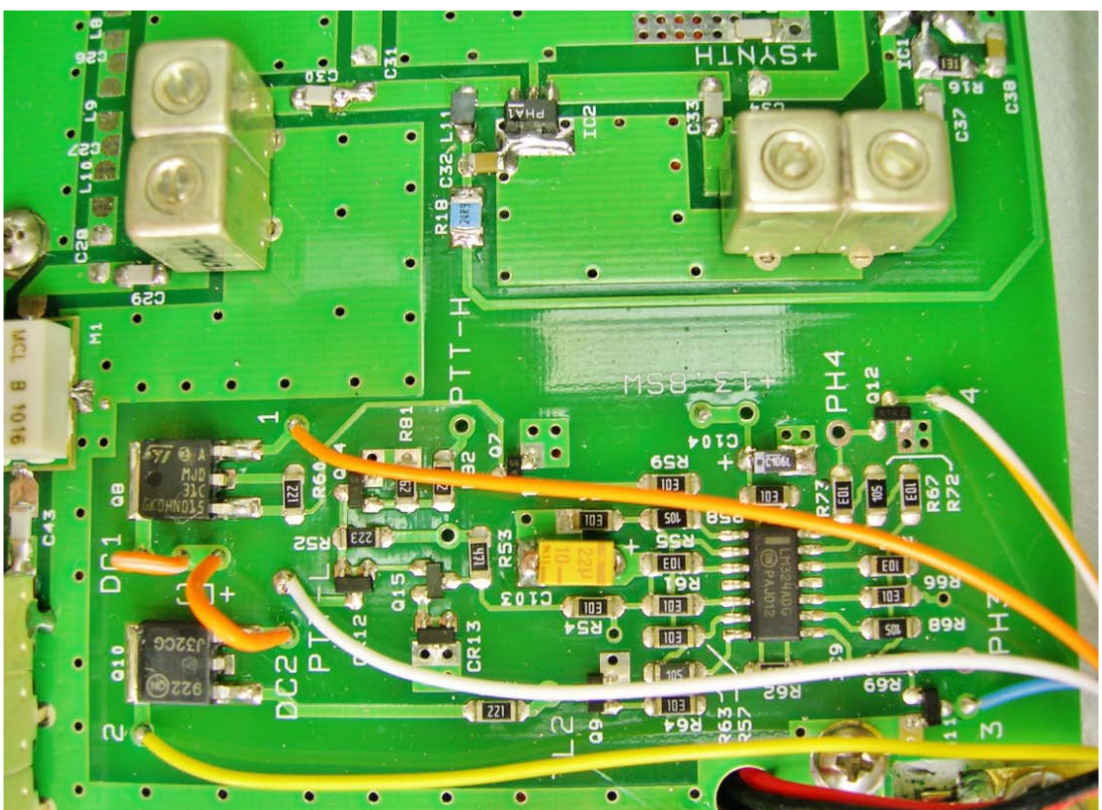
14. TX load installation.



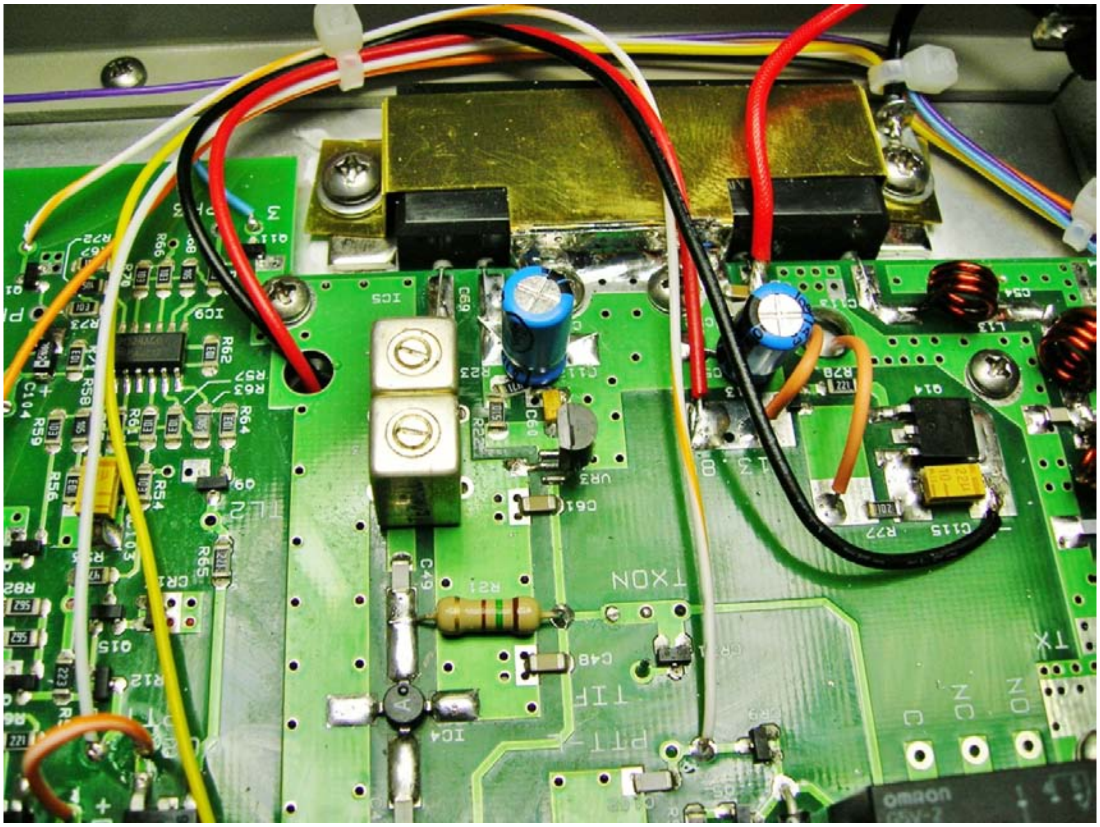
15. Negative Voltage generator installation on proto board.



16. Sequencer and wiring.

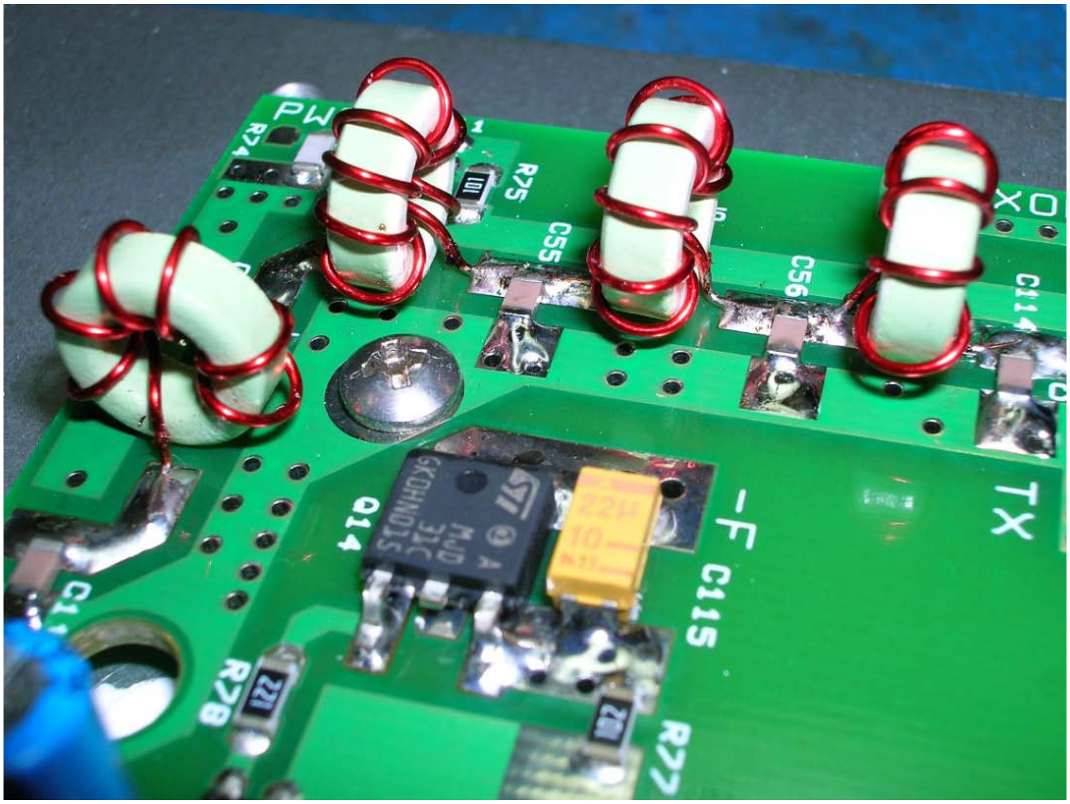


17. R21,C60,C112,C53 and NTC install with general wiring.

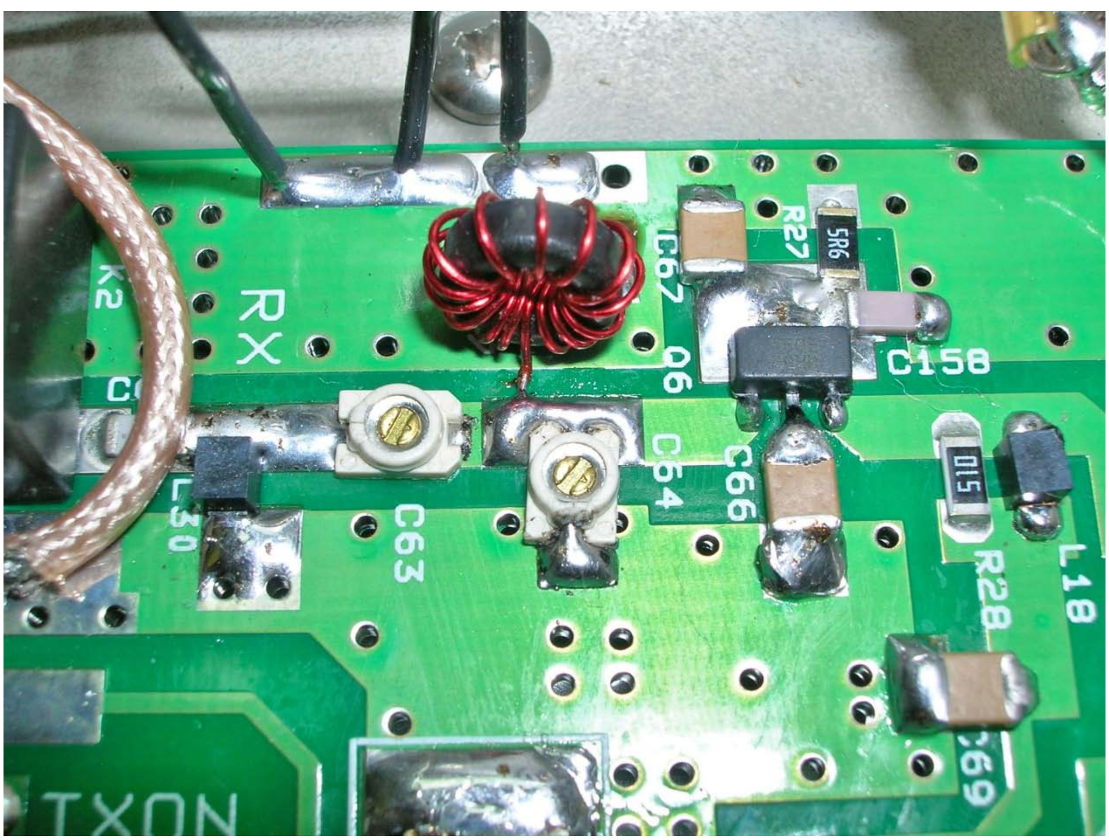


18. Low Pass Torroids

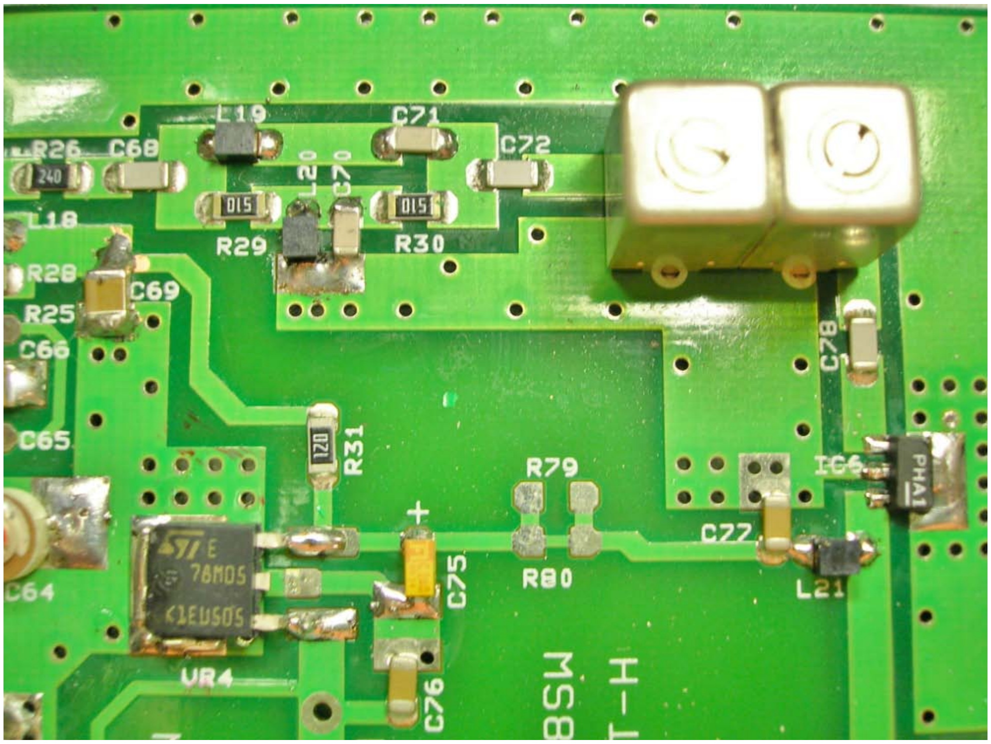
19. TX low pass filter, fan speed and power detect circuit.



20. LNA Assembly



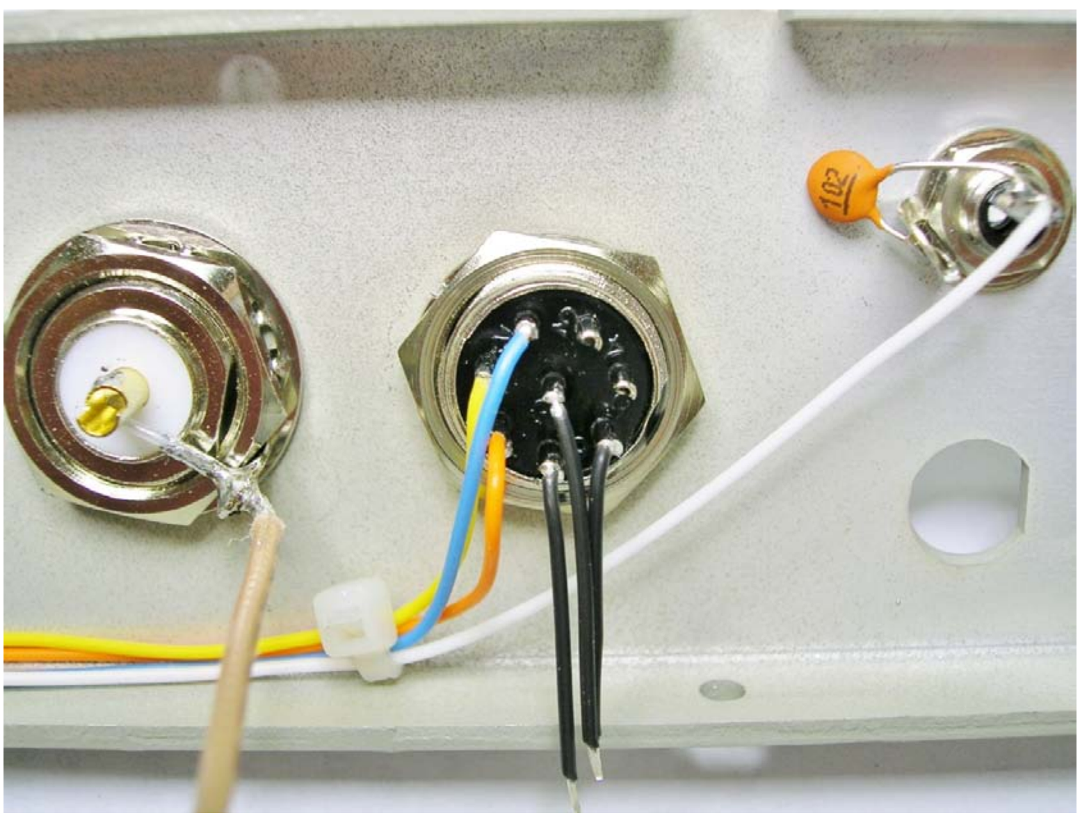
21. RX diplexer, gain stage and filter.



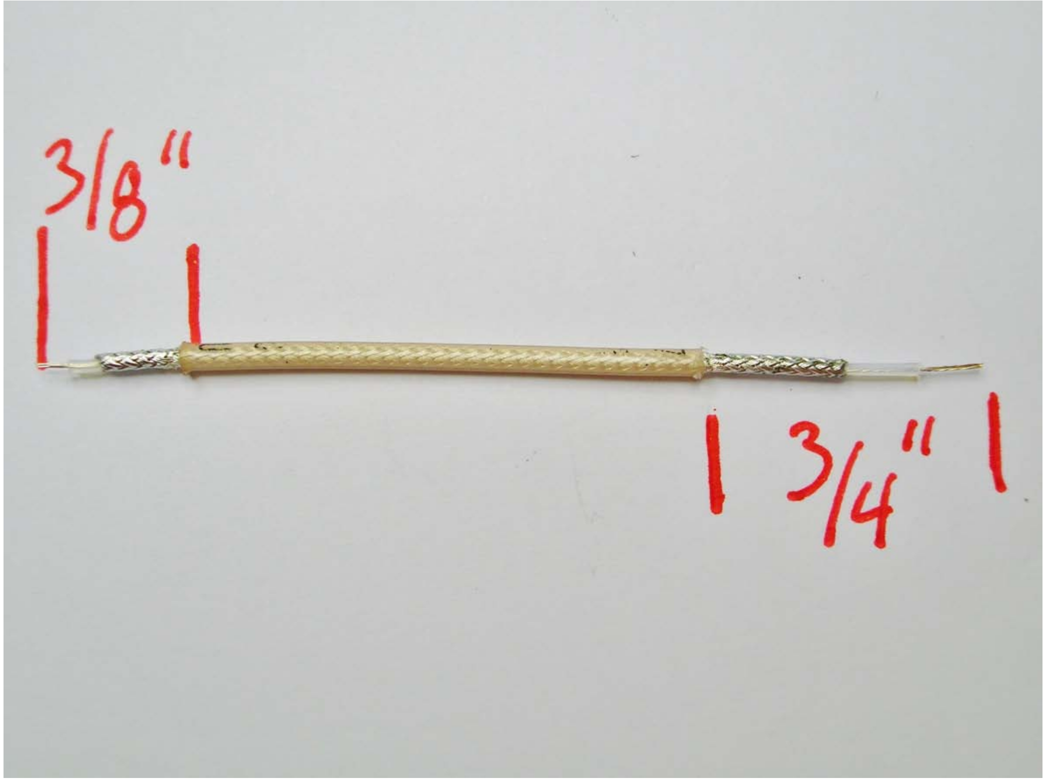
22. Power module shield install.

23. Connector panel and correct placement of lugs.

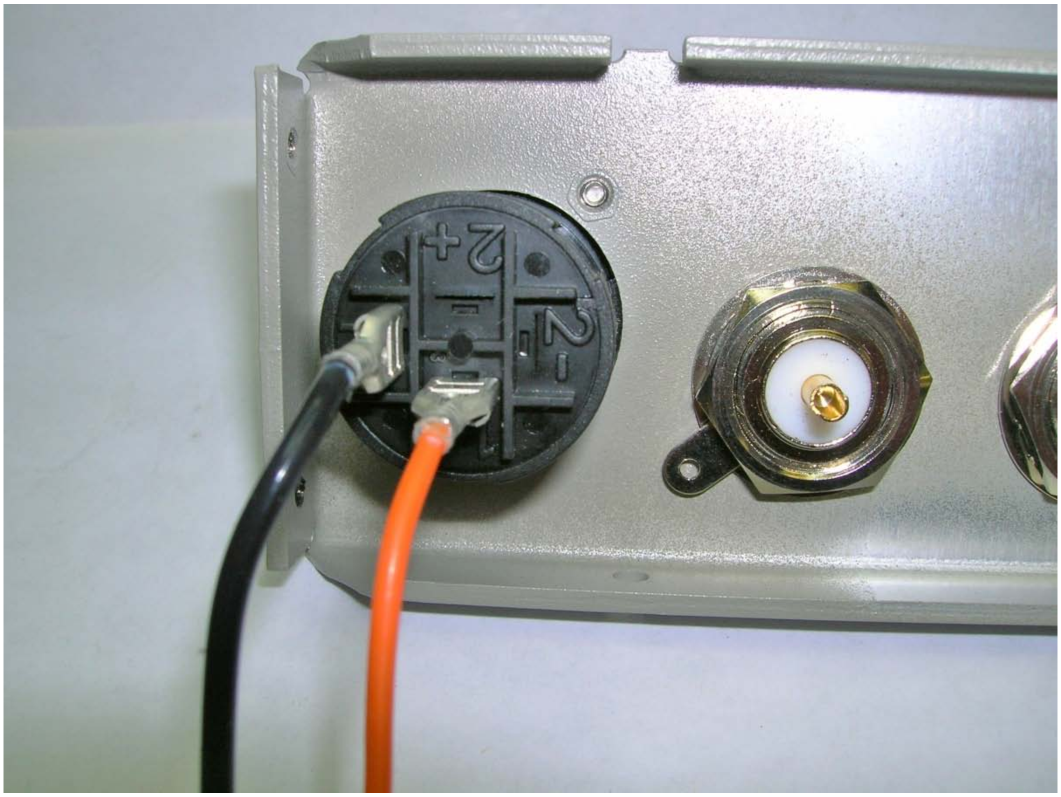
24. AUX, PTT and ANT connector wiring



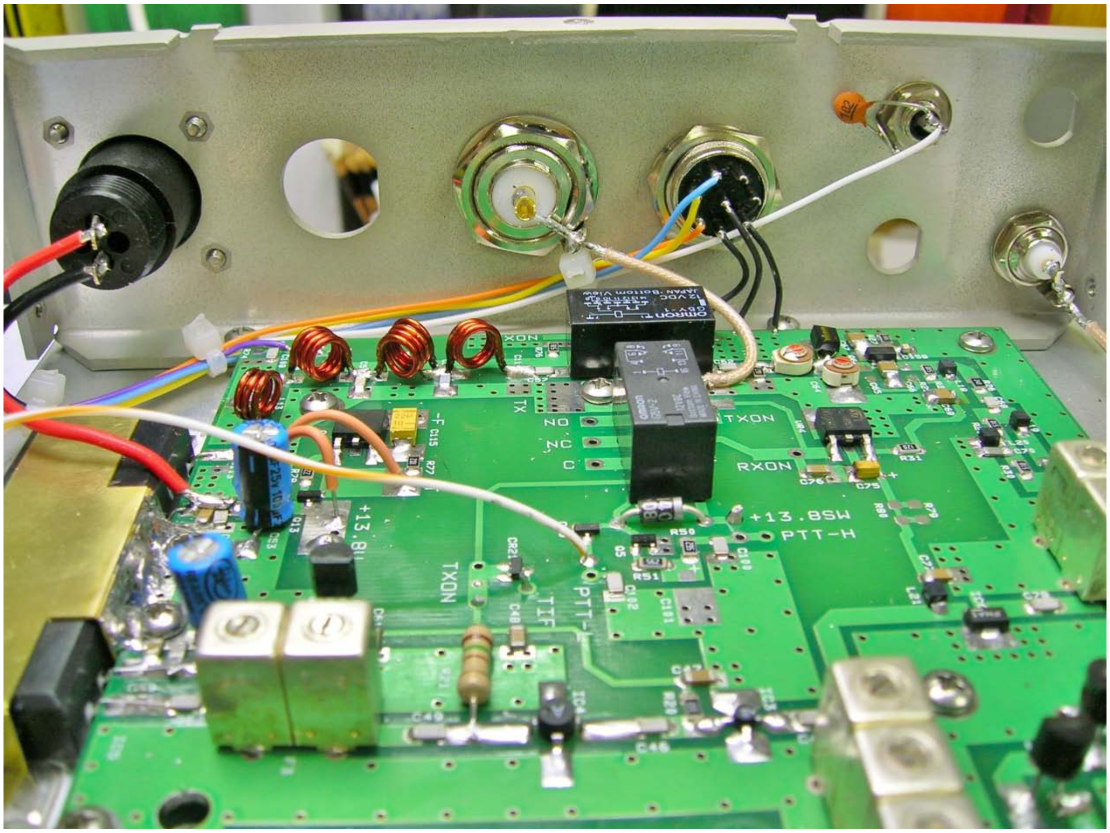
25. Correct coax preparation



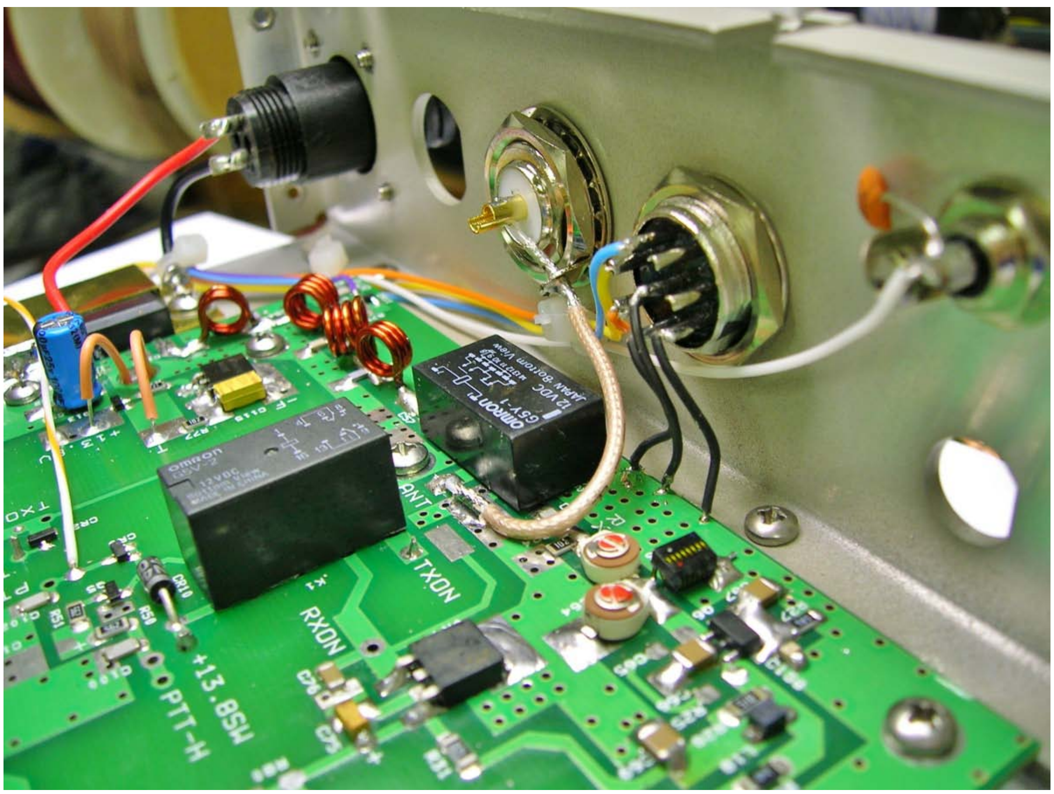
26. DC power connector



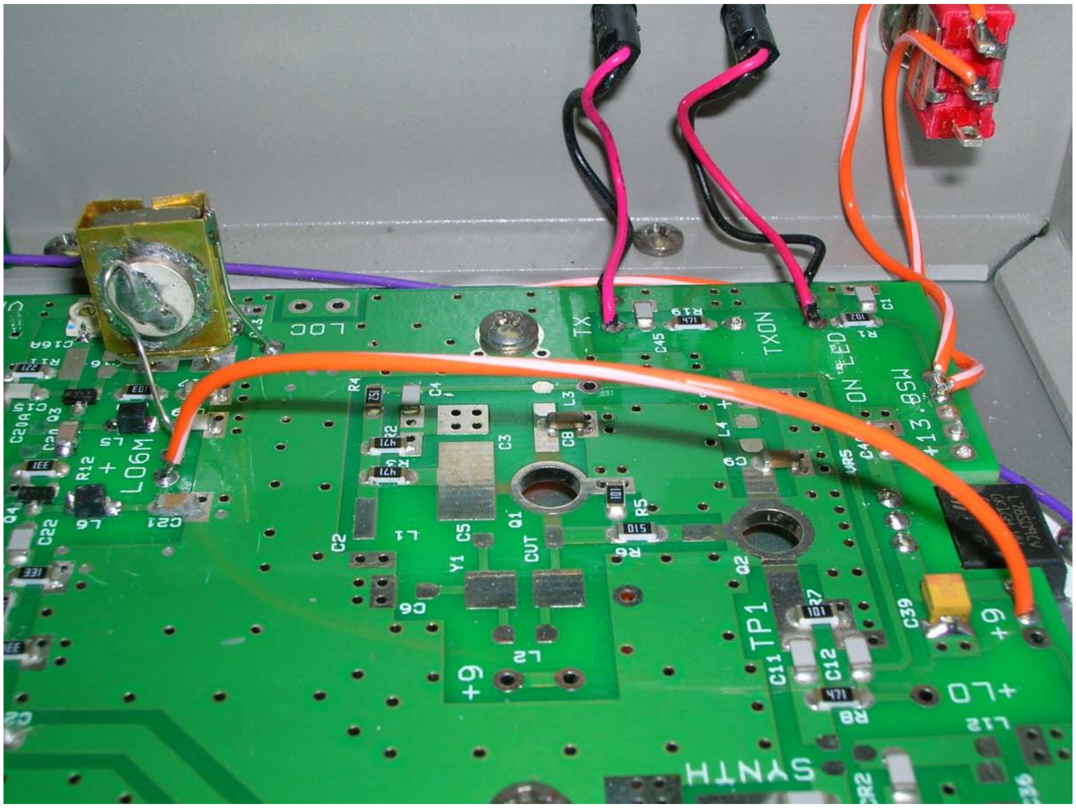
27. Connector panel installation and wiring of Generic Transverter.



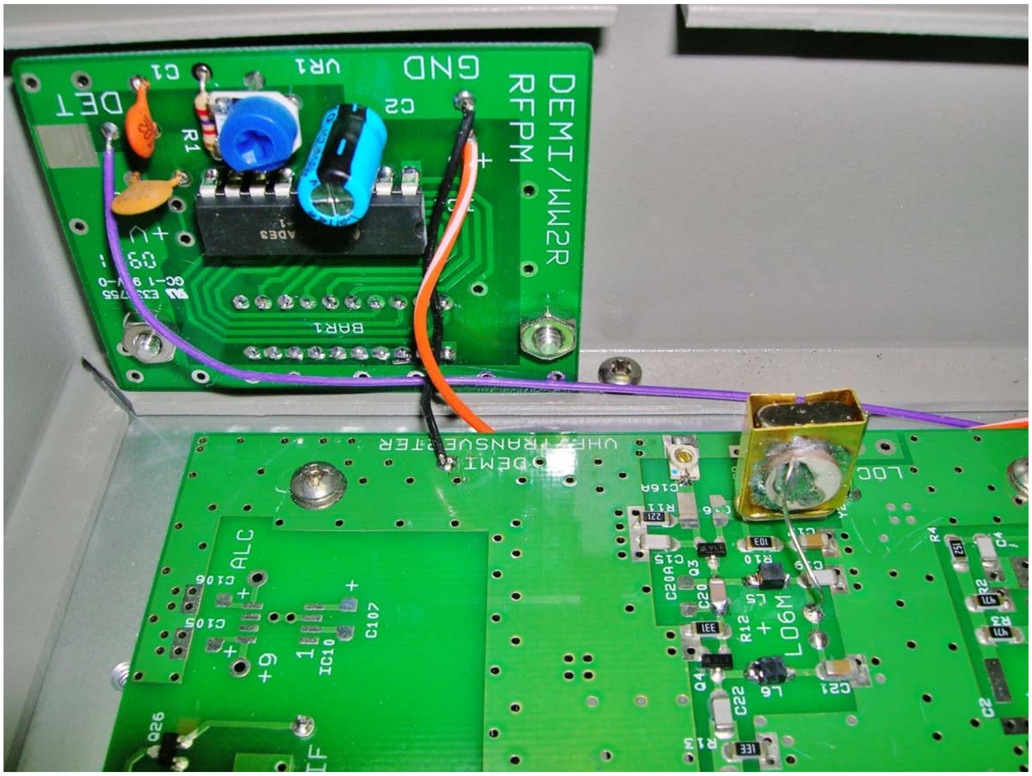
28. Coax and AUX Ground wire install.



29. LO wiring and LED's and switch.

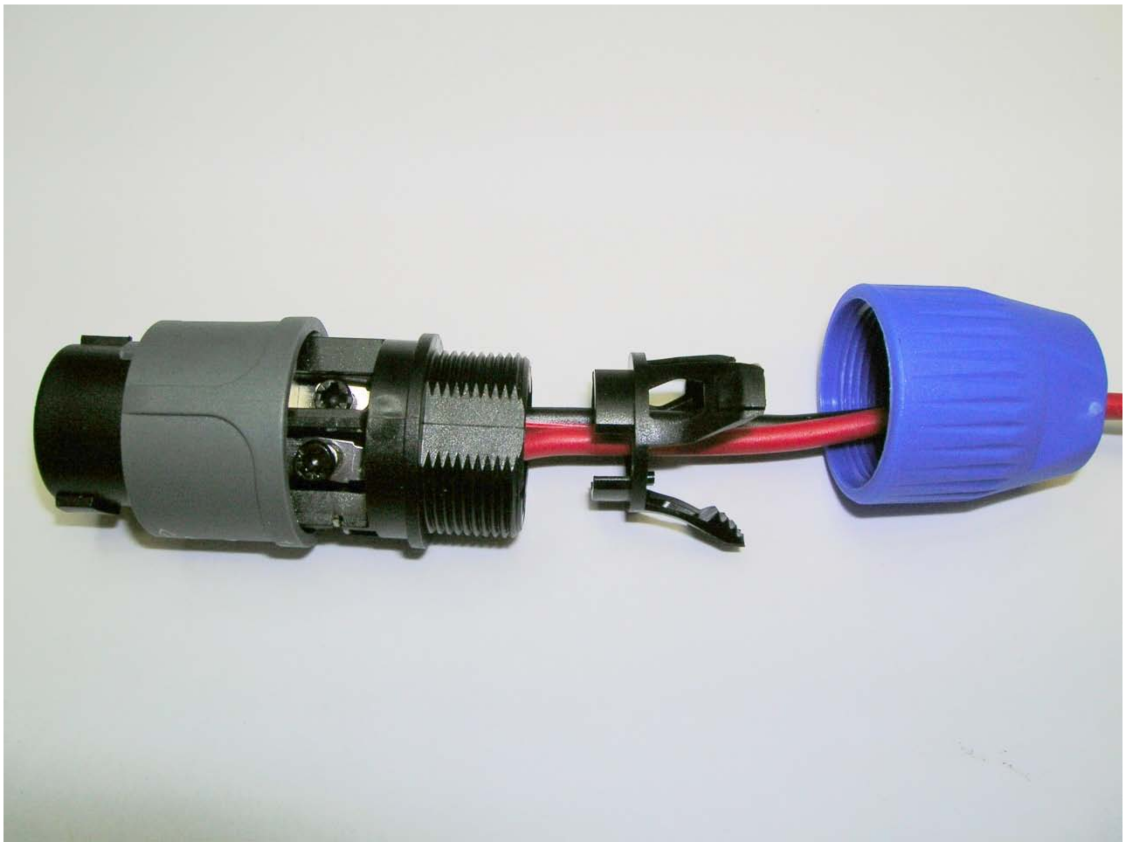


30. Power meter install, front panel wiring

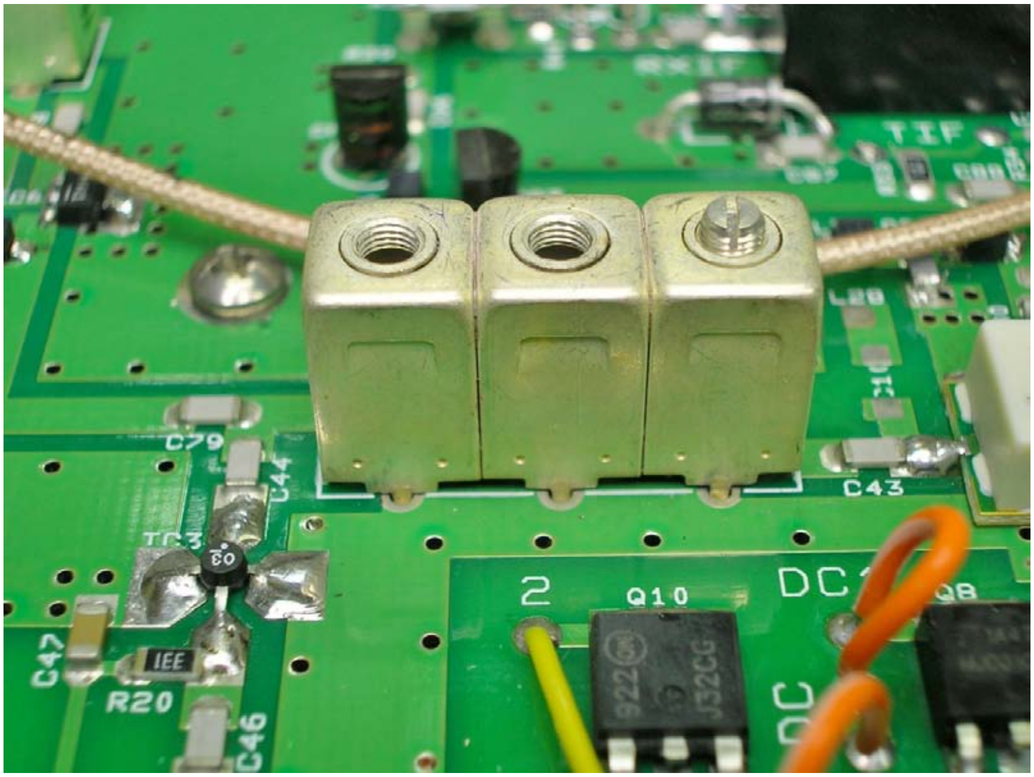


31. Rear view of transverter and fan install.

32. DC power connector assembly.



33. Filter slugs removed for 44 MHz.



34. Aluminum tape on filter