NORCAL 2N2/XX V1.2
Assembly Manual

Introduction

This is the assembly manual for the NORCAL 2N2/XX transceiver designed by Jim Kortge, K8IQY. A great deal of effort has gone into the design of the rig and this manual to assure that the kit you are about to build will work properly. This **is not** a beginning builders kit. It has a great many parts (over 300) and assumes the builder has some working knowledge of electronics and electronic parts. To successfully build this transceiver, one needs to be able to understand and follow a schematic diagram, convert resistor and molded inductor value call outs to the equivalent color code, and be able to recognize various capacitor types. In addition, one needs to be able to read and understand this manual, follow the instructions correctly, and work carefully.

A common assembly manual is used for all 2N2/XX rigs, therefore, no parts values are given in this manual, only part designators. This assembly manual is used with the band specific Bill of Material (BOM) and schematic diagram to identify the part values being installed. The schematic diagram for each band contains the actual part value for each designator. Using this approach encourages the builder to become familiar with the schematic diagram of the 2N2/XX transceiver being built so that he/she is familiar with the design of the rig should any troubleshooting be necessary. However, if all of the parts are installed in their correct locations, the rig will perform as designed and no troubleshooting will be required!

With that thought in mind, go slowly and double check your work to avoid having to ***remove*** either ***an incorrect part*** or a ***correct part installed in the wrong location*** on the PC board (PCB). As a suggestion, make a 2X size copy of the schematic diagram. While you are building, check off the parts installed in the brackets [ ] provided in this manual, while also highlighting the part on the schematic as a cross check. When you are done building, all of the parts shown on the schematic should be highlighted. (On 40-meters, the Receive RF Amplifier stage is not built, so those parts will not be highlighted.)

A parts overlay page is included in the Appendix. This page will show how the various transformers and trimmer capacitors are to be mounted. An “F” designates the “flat side” of a trimmer capacitor (TCx designation). When mounting a wound transformer, the primary (“Pri” notation) is always the winding with the most turns. The secondary (“Sec” notation) is the winding with the fewer or equal number of turns, if the transformer is a bifilar type. Transformer T5 is somewhat unique, as it has two secondaries, a 3-turn and a 1-turn. The primary is connected to the locations marked “P” as shown on the overlay, the 3-turn secondary to “S1” on the overlay, and the 1-turn secondary to “S2” on the overlay. All transformers having several turns for the primary and fewer turns for the secondary can be wound with the secondary interleaved between the primary winding turns from approximately centered on the primary winding to near the end where its leads will be soldered to the appropriate pads on the PCB. The location is not critical. An examination of the various figures supplied will illustrate this approach.

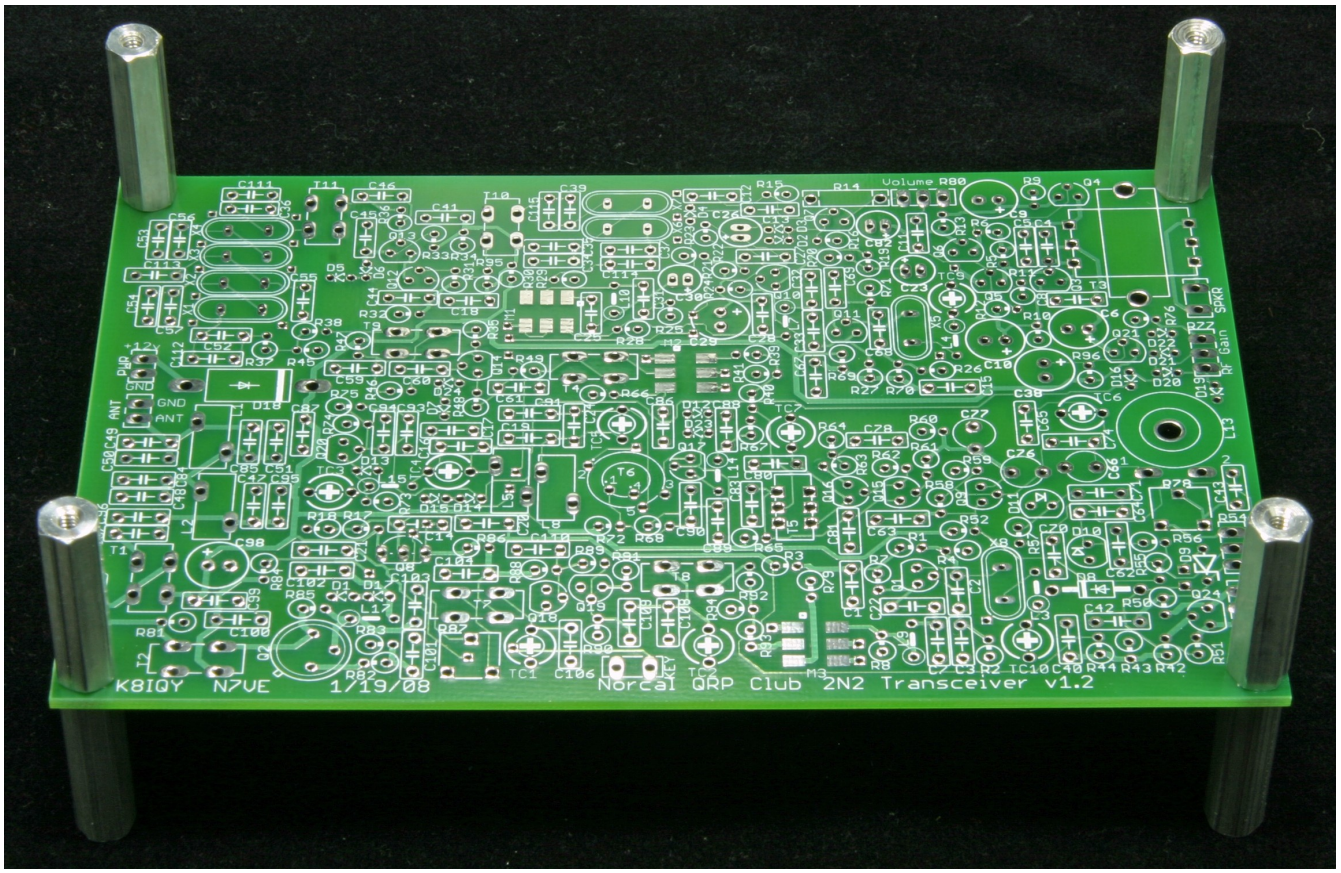
This manual is structured to build a section and then test it to assure it is working correctly, before moving on. Space is also provided at the end of each test section to write down your measurements and observations. You are encouraged to do this as it will help later on if you run into problems or need assistance. Using this approach promotes confidence the end product will work, since all of the previous stages worked. If you build a section and it doesn't work properly, **do not continue on,**

expecting that the section will fix itself. It will not and the remainder of the build will be compromised. Please fix any and all problems as they occur!

PCB Preparation

[ ] Assemble the four 1-inch hex screws and 1-inch hex nuts to the four corners of the PCB. The screws go on the bottom side and the nuts on the top side. This hardware holds the PCB up off the work surface and makes it easy to work on regardless of which side is up.

Your PCB should look like that shown in the figure.



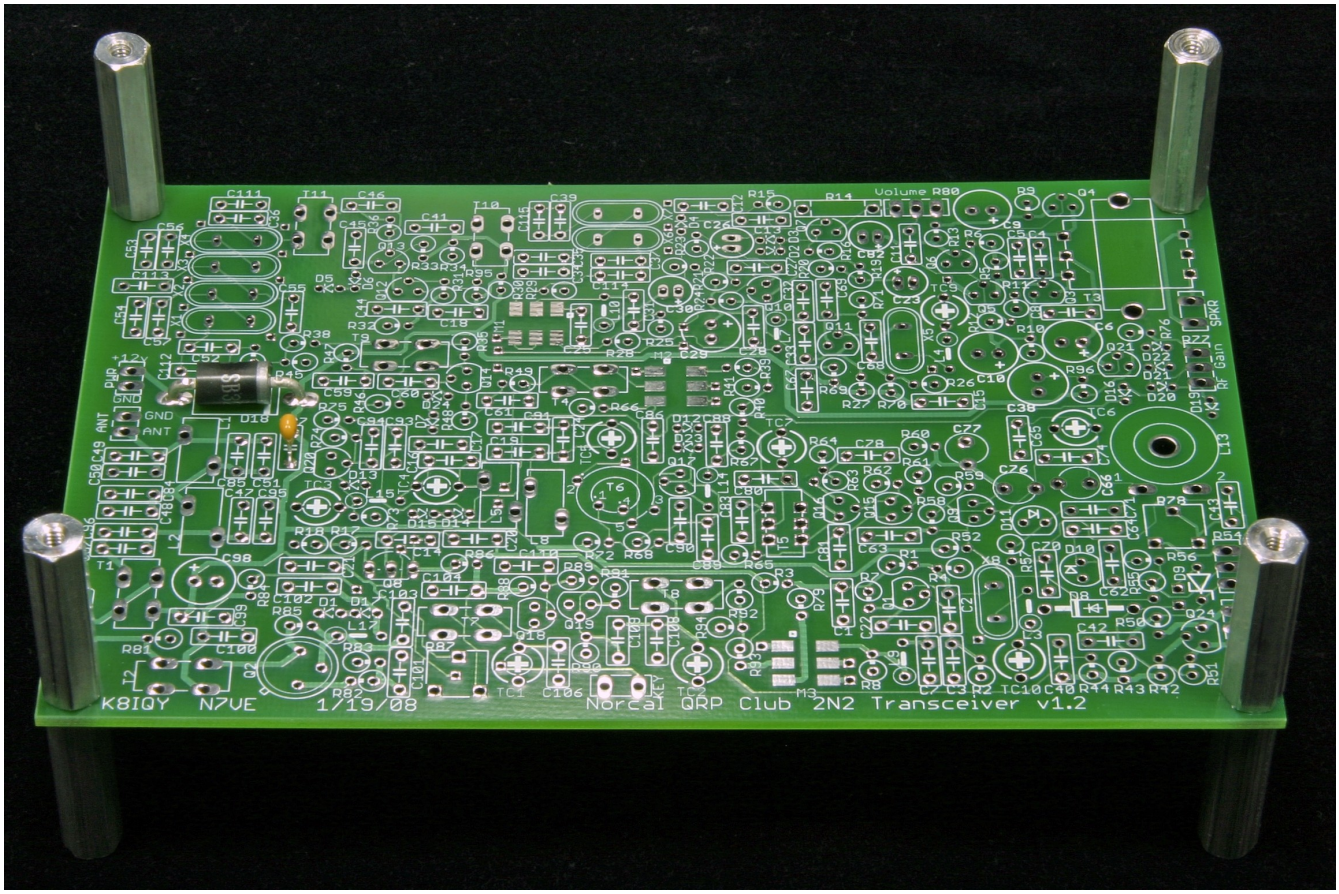
- Figure 1 -

Power protection

[ ] Install diode D18

[ ] Install capacitor C87.

Your PCB should look like that shown in the next figure.



- Figure 2 -

Test - Apply 12 volts to the board. With a DVM or VOM, measure that more than 11.7 volts appears at the junction of D18 and C87.

Your Measurements/Observations - _____

_____

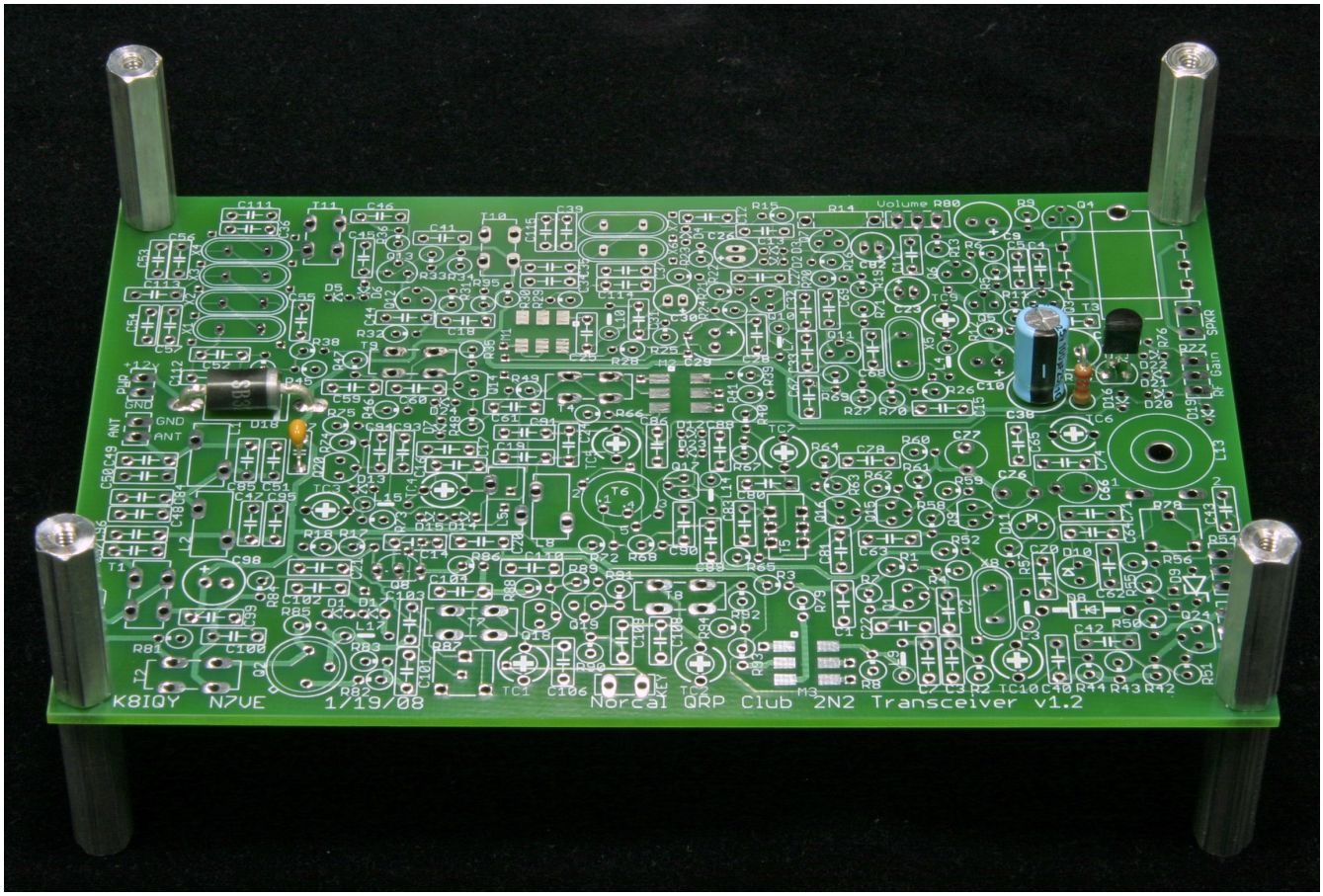
Receive Active Power Decoupler

[ ] Install transistor Q21

[ ] Install resistor R96

[ ] Install capacitor C38 matching the polarity markings on the capacitor case with those on the PCB.

Your PCB should look like that shown in the next figure.



- Figure 3 -

Test – Apply 12 volts to the board. Measure with a DVM or VOM that 11.5 volts (or more) appears at the left center pad where transformer T3 will be installed.

Your Measurements/Observations - _____

_____

Receive Main Audio Amplifier

[ ] Install transformer T3; note orientation, "P" side toward the interior of the PC board. There is no need to solder the mounting tabs; doing so makes it virtually impossible to remove the transformer should it be mounted incorrectly.

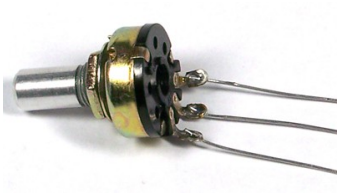
[ ] Install transistors Q3, Q4, Q5 and Q6.

[ ] Install resistors R5, R6, R9, R10, R11, R12 and R13.

[ ] Install capacitors C4, C5, C8 and C11.

[ ] Install electrolytic capacitors C6, C9, C10 and C82 matching the polarity markings on the case with those on the PCB.

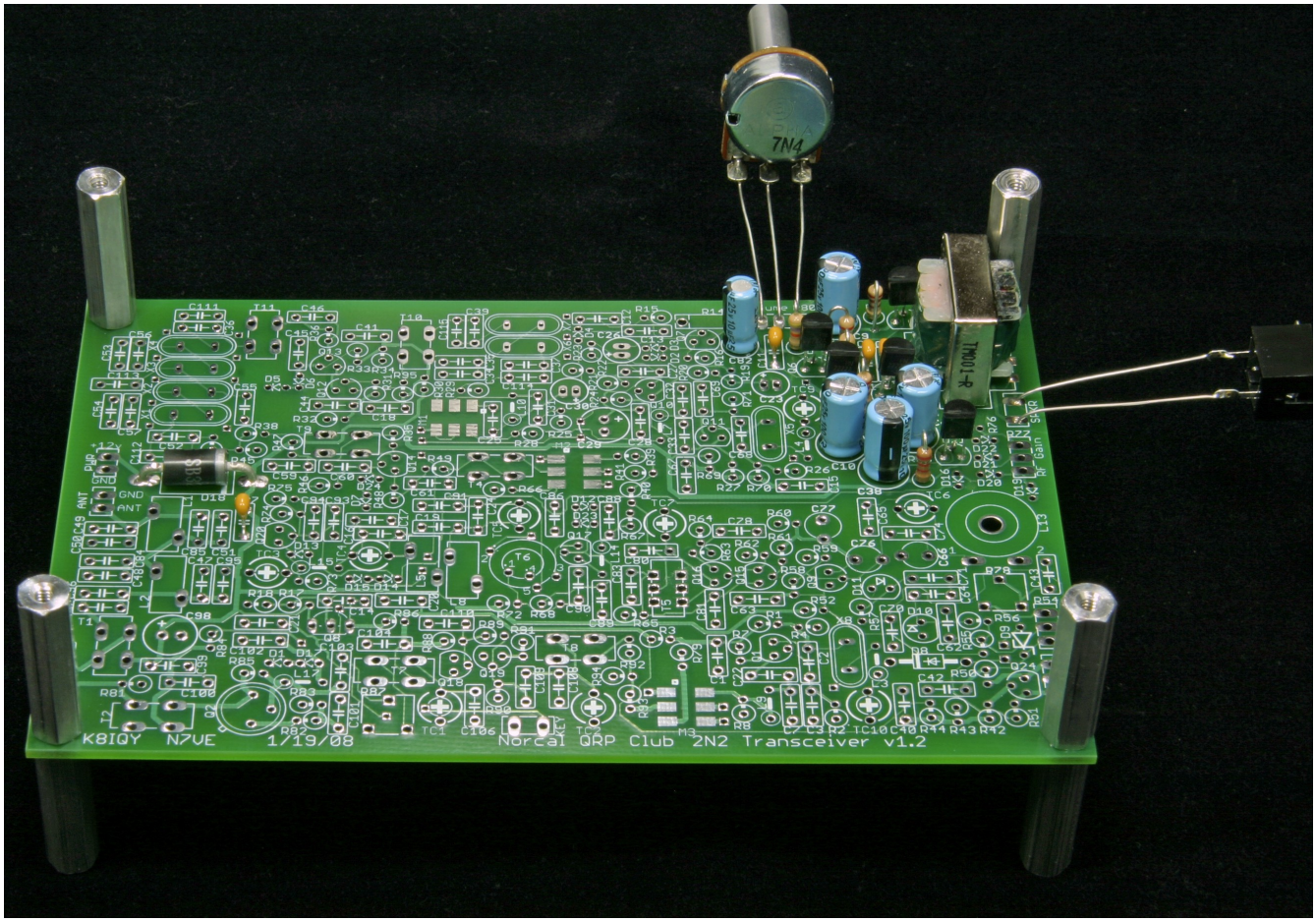
[ ] Install volume control R80 (marked A10K) to the pads marked “VOLUME” using discarded leads from previously installed components as shown in the next figure.



- Figure 4 -

[ ] Install the SPKR jack, using the rear terminals, to the pads marked “SPKR” using discarded leads from previously installed components as was done above. Other controls will be installed on a temporary basis similar to these two elements. Once the rig is completed and working, these parts will be removed and rewired when the PCB and controls are installed in the case.

Your PCB should look like that shown in the next figure.



- Figure 5 -

Test – Connect a speaker or headphones to the “SPKR” jack. Apply power to the board. Rotate the volume control fully clockwise and touch the center pad of the pad set marked “VOLUME”;

60 Hz hum should be heard coming from the speaker or headphones.

Your Measurements/Observations - _____

_____

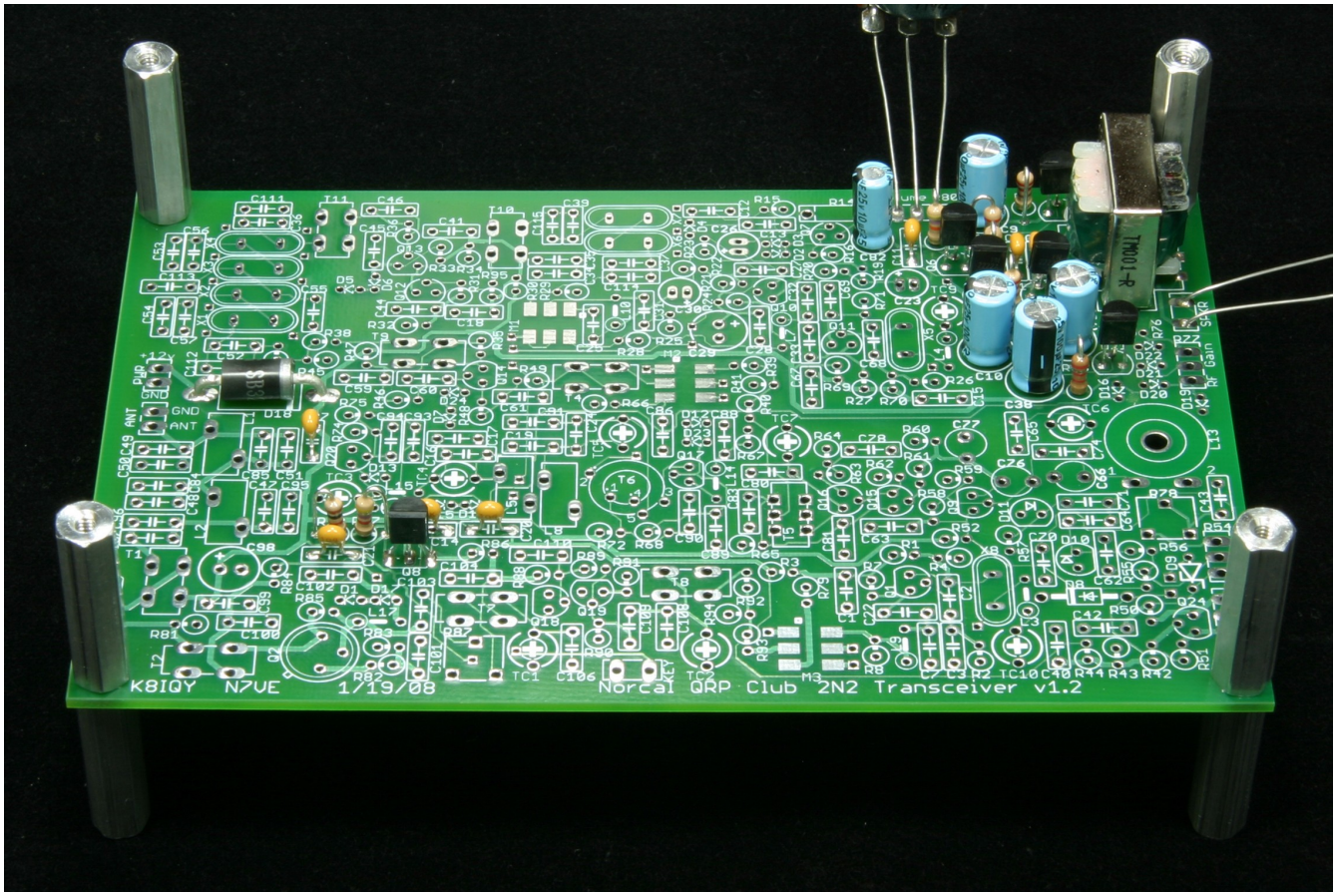
Receive/Transmit Keying

[ ] Install the **PN2907A PNP** transistor at Q8

[ ] Install resistors R17 and R18

[ ] Install capacitors C14, C20 and C21

Your PCB should look like that shown in the next figure.



- Figure 6 -

Test – Apply 12 volts to the board. Confirm with a DVM or VOM that at least 11.5 volts (+V Tx) appears at the collector of Q8 (left pad of R86 location) when the "KEY" pads are connected together.

Your Measurements/Observations - _____

_____

Receive Mute

[ ] Install the **J176 JFET** at Q7

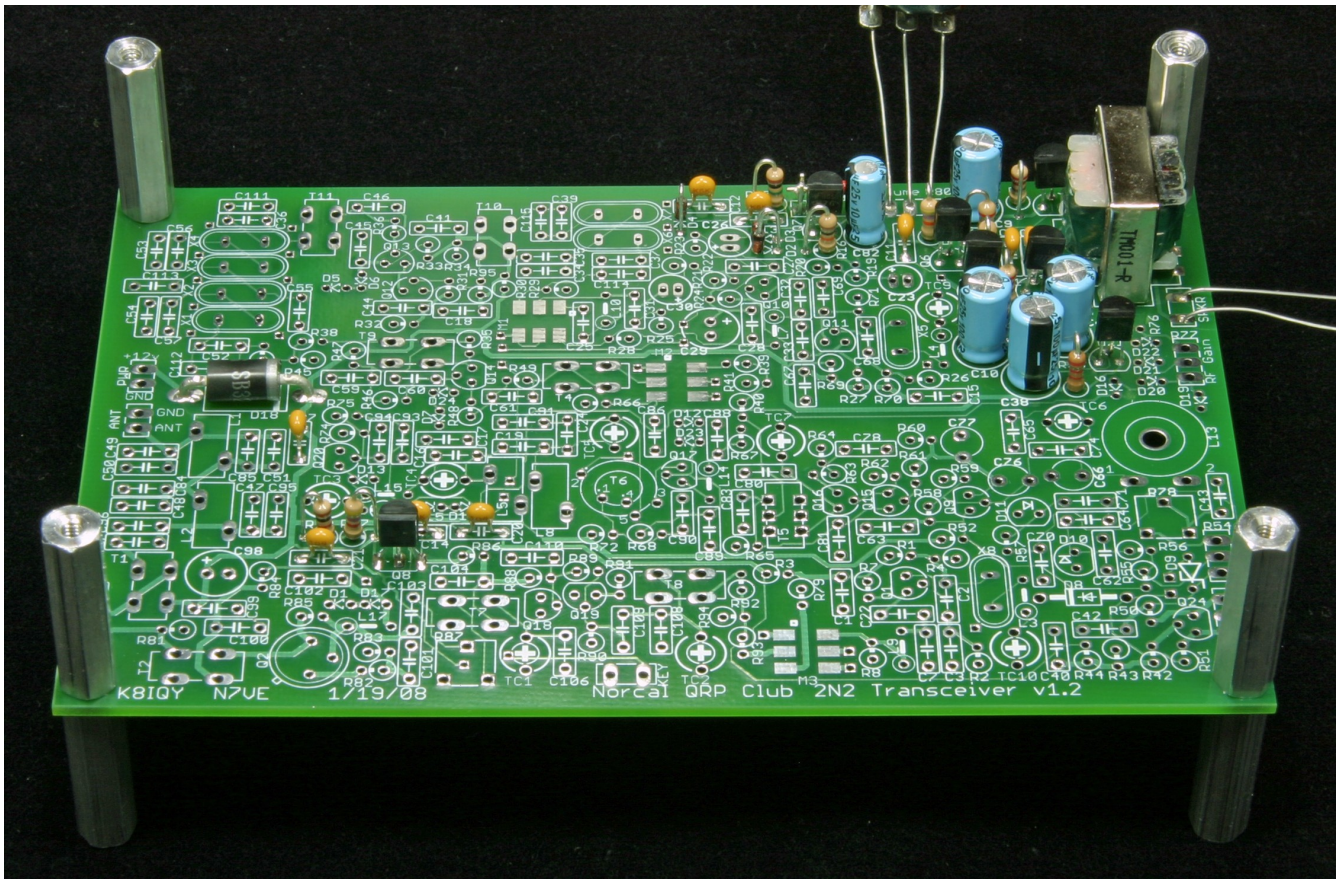
[ ] Install diodes D2, D3, and D4. **Note cathode ends (bar) so they are installed correctly.** The anode of D3 and the cathode of D2 should be the non-grounded ends.

[ ] Install the two test points provided for the R14 location, then install R14. Using these test points allows R14 to be easily removed and replaced should the audio level during transmit not be set to your liking.

[ ] Install resistors R15 and R16.

[ ] Install capacitors C12 and C13.

Your PCB should look like that shown in the next figure.



- Figure 7 -

Test – Connect a speaker or headphones to the "SPKR" jack. Apply power to the board. Advance the volume control to maximum. Touch the top (ungrounded end) of diode D2; 60 Hz hum should be heard coming from the speaker or headphones. Rotate volume control R80 counter clock wise (CCW) to verify the hum level changes. At full volume, jumper the pads marked "KEY" and verify that the 60 Hz hum is muted.

Your Measurements/Observations - _____
_____

Receive Audio Preamplifier

[ ] Install transistor Q10.

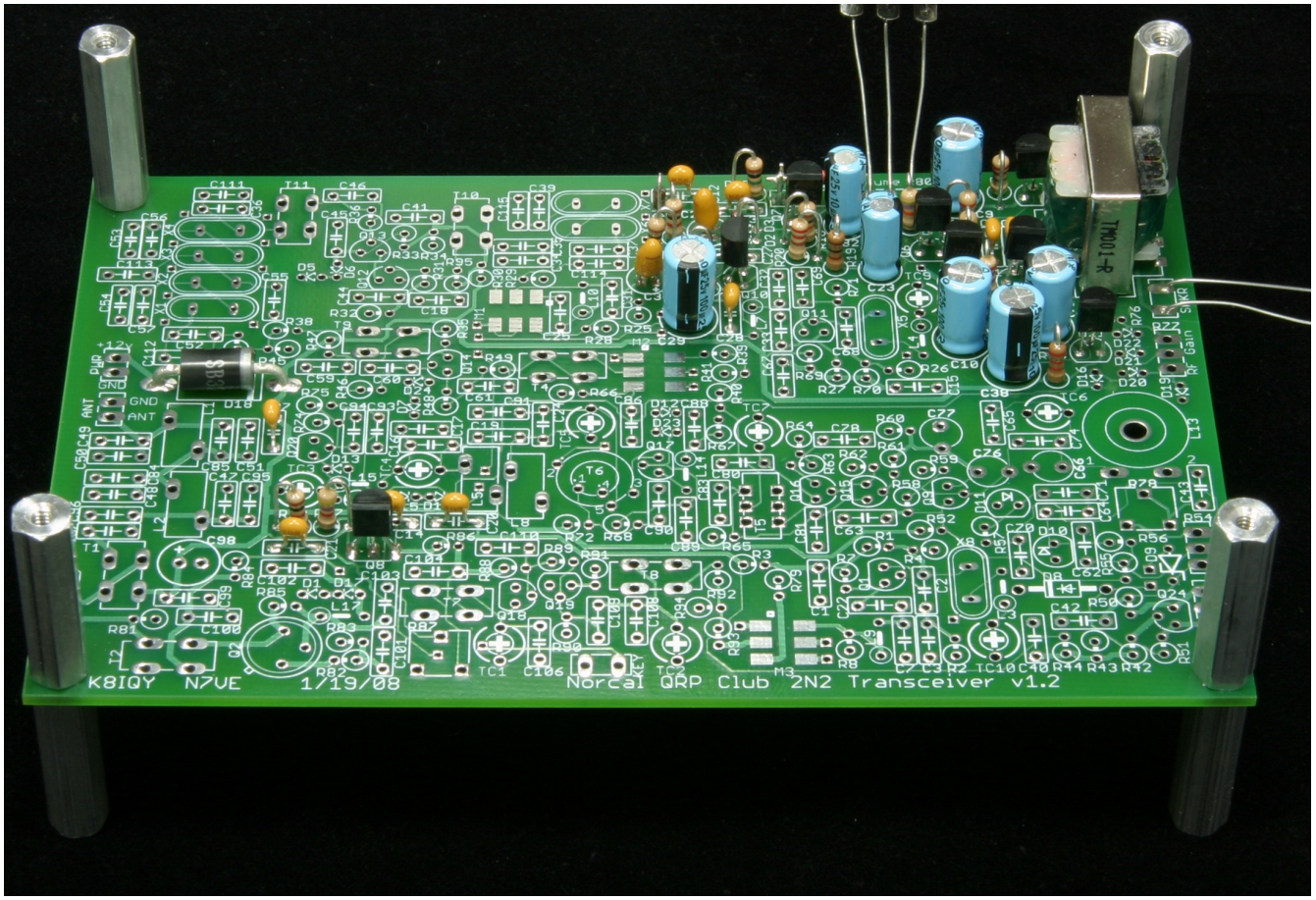
[ ] Install resistors R19, R20, R21, R22, R23 and R24.

[ ] Install capacitors C27 and C28.

[ ] Install tantalum (tan color, both leads on one end) capacitors C26 and C30 matching the polarity markings on the case with those on the PCB.

[ ] Install electrolytic capacitors C23 and C29 matching the polarity markings on the case with those on the PCB.

Your PCB should look like that shown in the next figure.



- Figure 8 -

Test – Connect a speaker or headphones to the "SPKR" jack. Apply power to the board. Touch the pad on the minus end of tantalum capacitor C30 or the lower pad for L10. The hum volume should be louder than it was before this stage was added.

Your Measurements/Observations - _____

_____

Receive Local Oscillator (RxLO)

[ ] Install inductors L4 and L7.

[ ] Install trimmer capacitor TC9. The rounded end is the grounded end.

[ ] Install transistor Q11.

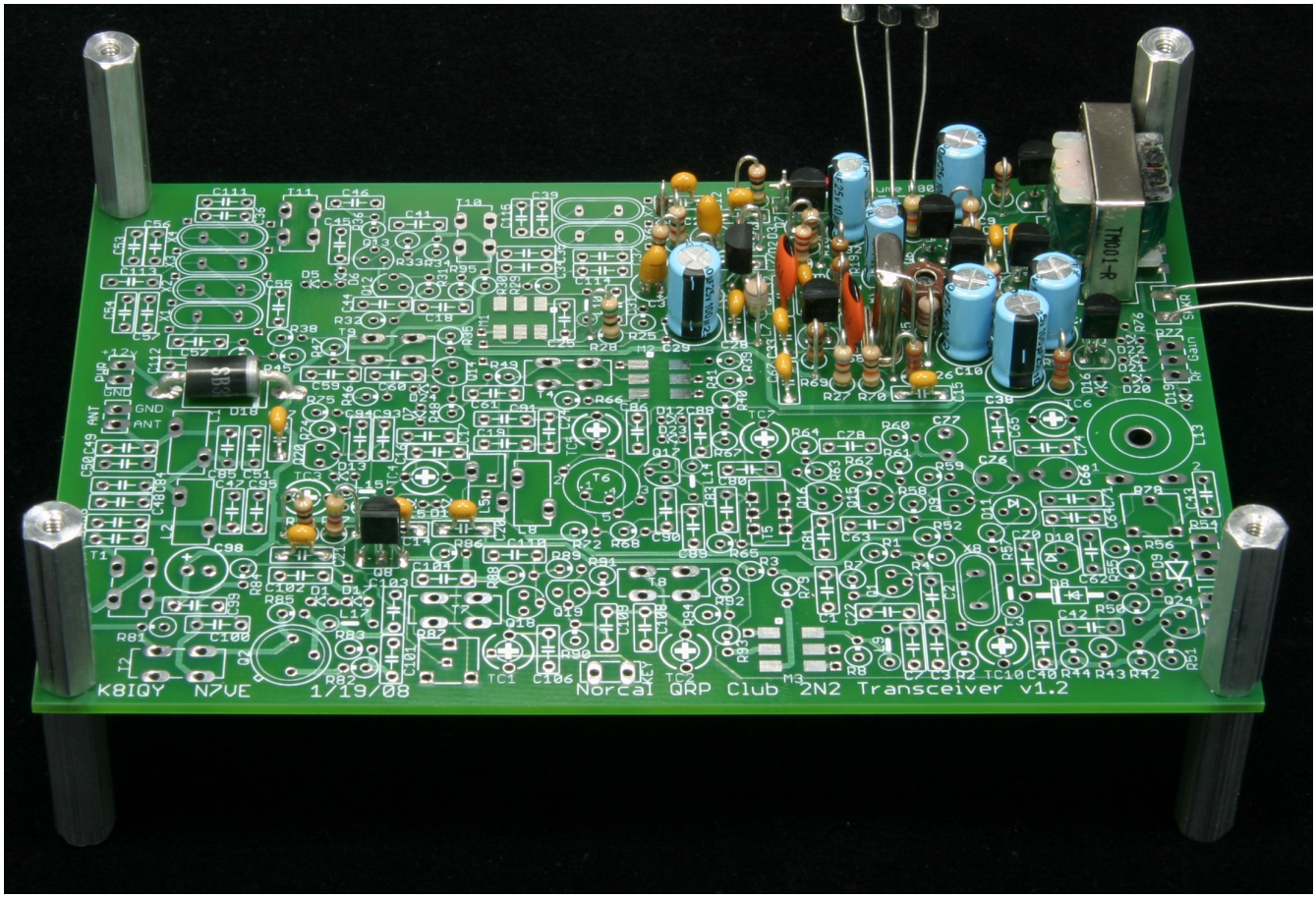
[ ] Install resistors R26, R27, R28, R69, R70 and R71.

[ ] Install capacitors C15, C32, C33, C67, C68 and C69.

[ ] Install crystal X5; it will be one of two marked LO or XX. Place a spacer (made from brown

bag paper) over the crystal leads before soldering it to the PCB or leave a small space between the case and the PCB. This will keep the crystal case from shorting out PCB traces. Ground the crystal case with a short piece of wire to the provided adjacent ground pad.

Your PCB should look like that shown in the next figure.



- Figure 9 -

Test – Apply power to the board. Measure the LO output at the top of resistor R28 with a suitable device. Either an oscilloscope or RF Probe with readout device can be used. The output should be at least 1.8 volts peak-to-peak, or 0.60 volts RMS when measured on an oscilloscope and 0.7 volts peak when measured using a typical passive RF probe connected to a DVM.

Your Measurements/Observations - _____
_____

Receive Product Detector

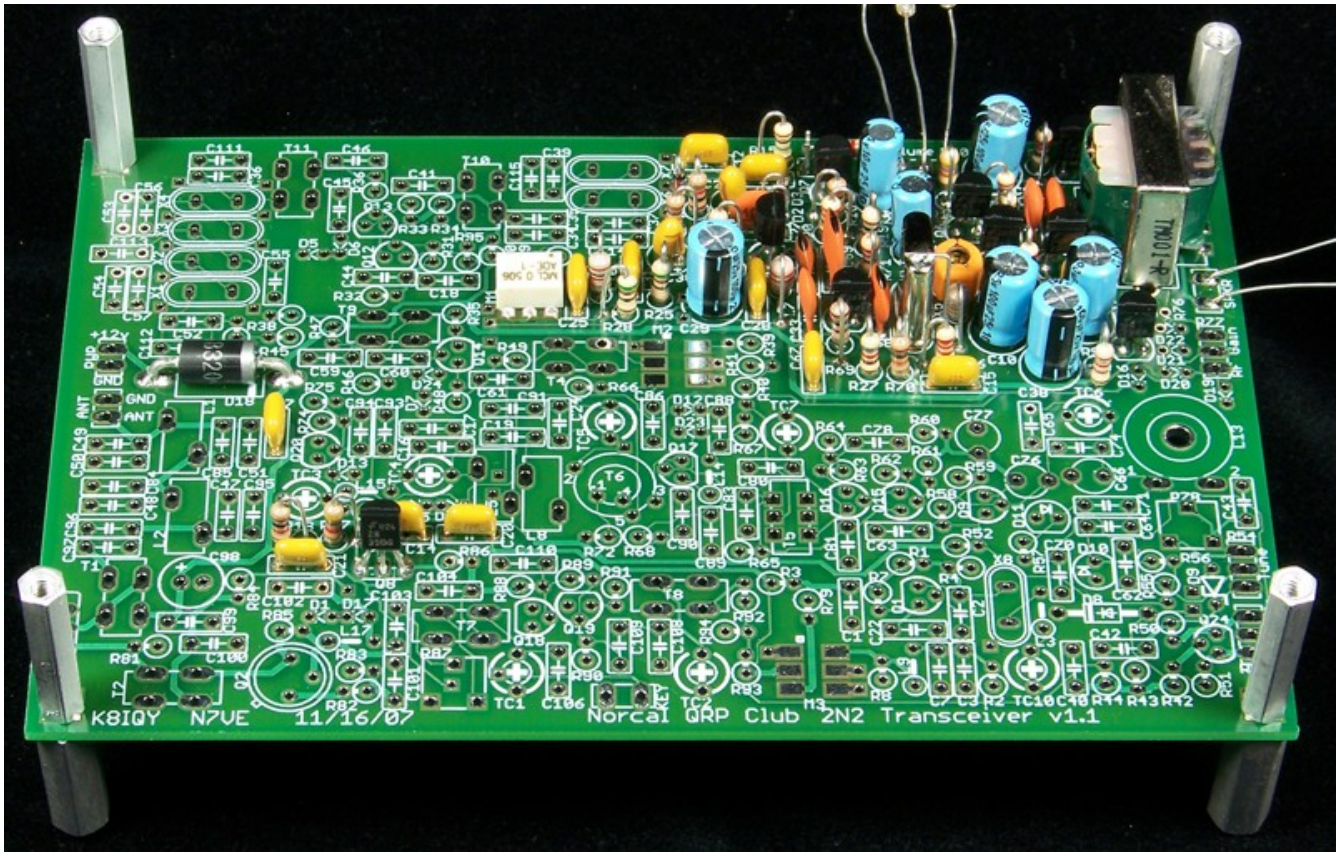
[ ] Install mixer M1. A black dot on the part and a white dot on the PCB denote the location of Pin 1. Solder the pin 1 lead only. ***Reconfirm this part is oriented correctly before soldering the remaining leads.***

[ ] Install resistor R25.

[ ] Install capacitors C25 and C31.

[ ] Install molded inductor L10.

Your PCB should look like that shown in the next figure.



- Figure 10 -

Test – Connect a speaker or headphones to the "SPKR" jack. Apply power to the board. Measure the mixer drive at the top of resistor R28. It should now show an output level of at least 0.60 volts peak-to-peak, or 0.27 volts RMS when measured on an oscilloscope and 0.2 volts peak when measured using a typical passive RF probe connected to a DVM. Connecting an antenna to pin 3 of mixer M1 or the left pad for C37 should provide atmospheric noise (static) at the audio output.

Your Measurements/Observations - _____

_____

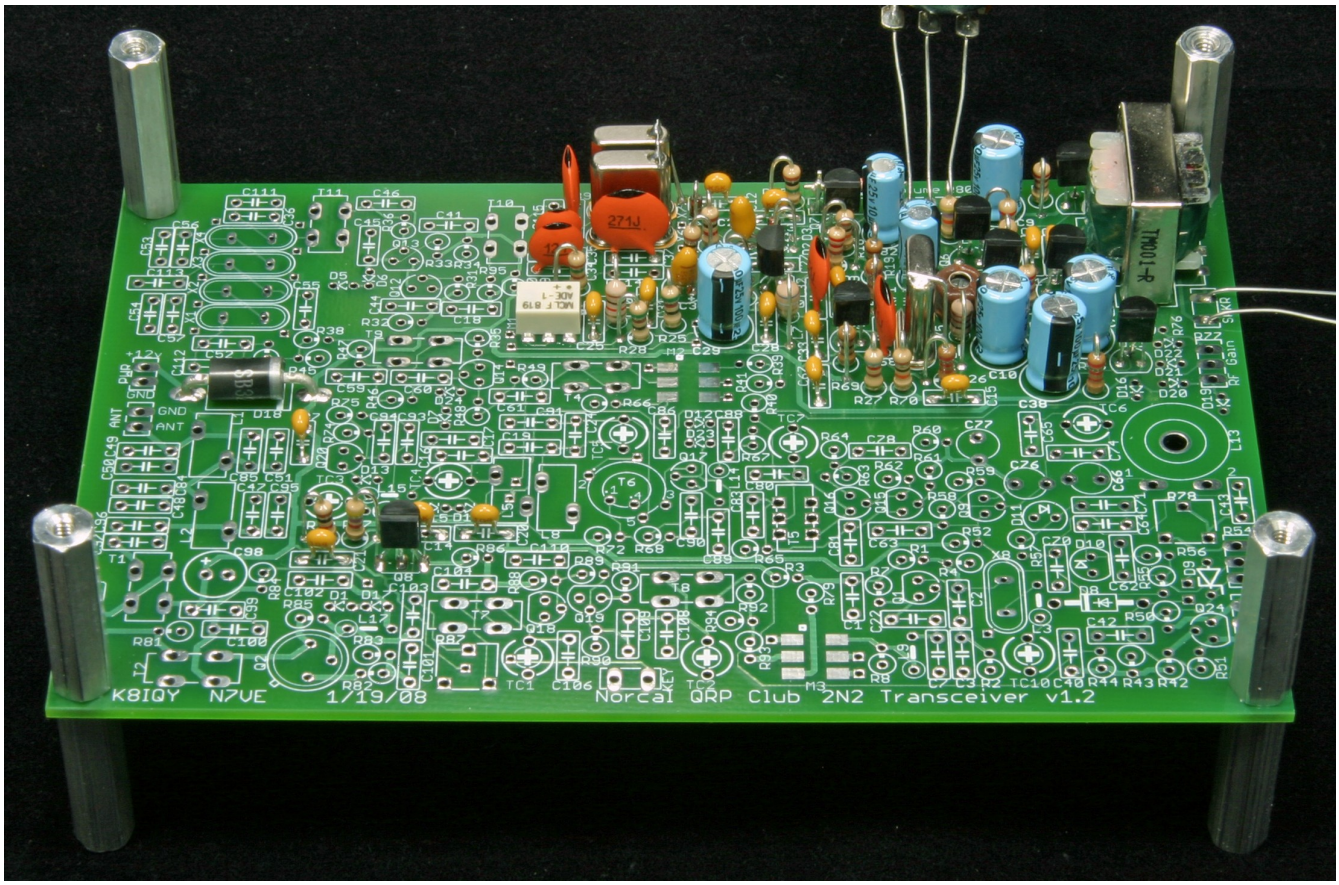
Receive Post IF Amplifier Crystal Filter

[ ] Install resistor R29.

[ ] Install capacitor pairs C37/C114, C34/C35, and C39/C115. Some of these capacitors may not be used at the IF frequency employed in your rig. ***Unused capacitors are shown on the schematic with a value of 0 pF.***

[ ] Install crystals X6 and X7. Place a spacer (made from brown bag paper) over the crystal leads before soldering it to the PCB or leave a small space between the case and the PCB. This will keep the crystal case from shorting out PCB traces. Ground each crystal case with a short piece of wire to the provided adjacent ground pad.

Your PCB should look like that shown in the next figure.



- Figure 11 -

Test – Connect a speaker or headphones to the "SPKR" jack. Apply power to the board. Connect an antenna to the output side of capacitor C39. Listen to the restricted noise bandwidth due to the crystal filter. If doing this test in the evening, you may be able to hear a shortwave broadcast station on the IF frequency of your rig.

Your Measurements/Observations - _____

_____

Receive IF Amplifier

[ ] Wind and install transformers T10 and T11. Each time a wire passes through the center of the toroid, it is counted as 1-turn.

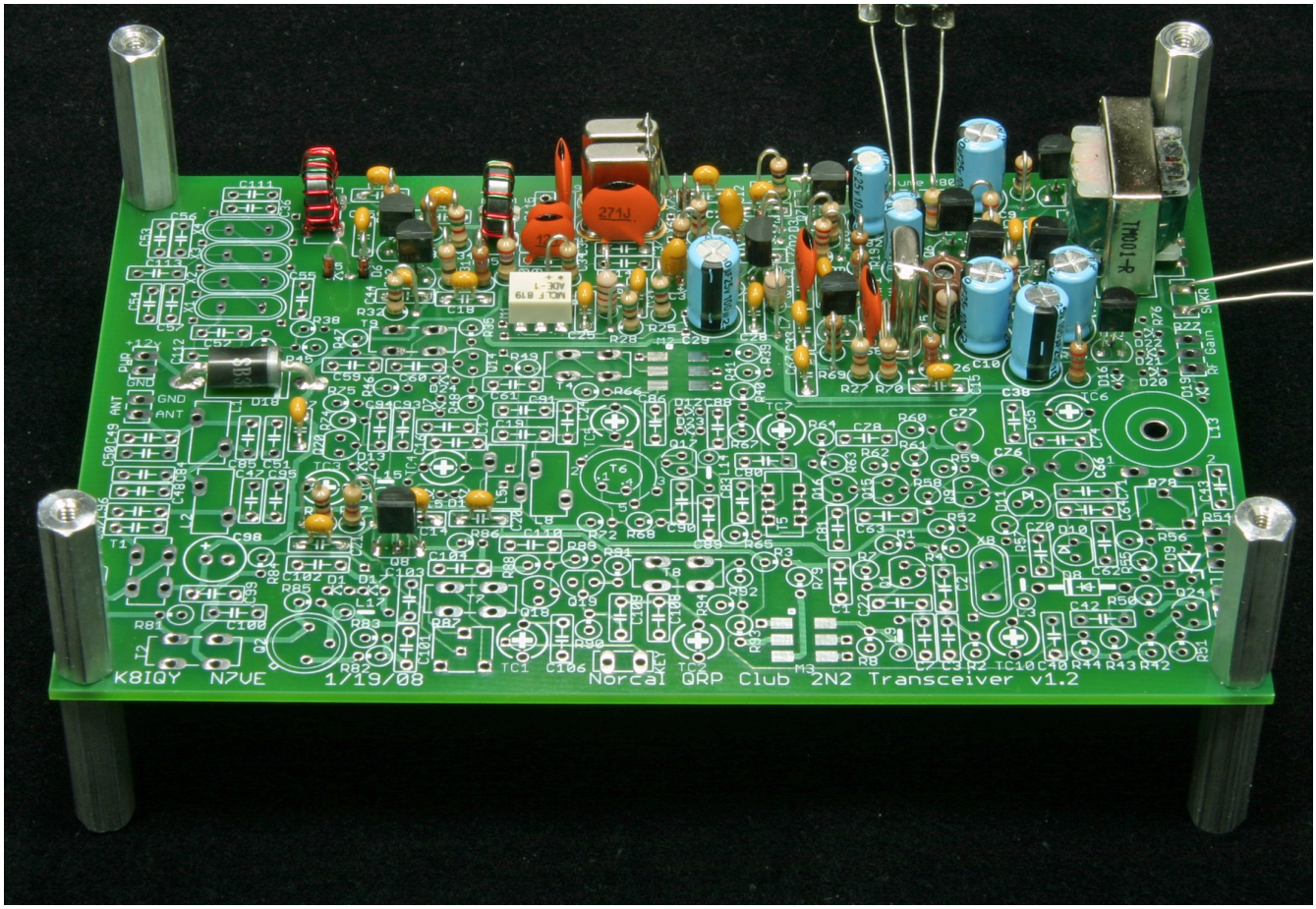
[ ] Install the **MPSH10** transistors at Q12 and Q13. These devices look similar to several of the other plastic encased transistors. ***Make sure the correct pair is selected.***

[ ] Install diodes D5 and D6. ***Make sure the cathode ends (bar) are oriented correctly.***

[ ] Install resistors R30, R31, R32, R33, R34, R36, and R95.

[ ] Install capacitors C18, C41, C44, C45, and C46.

Your PCB should look like that shown in the next figure.



- Figure 12 -

Test - Connect a speaker or headphones to the “SPKR” jack. Apply power to the board. Connect an antenna to the primary side of transformer T11 or to the right pad where C36 will be installed. You should hear band noise, mostly static, at a very loud level.

Your Measurements/Observations - _____

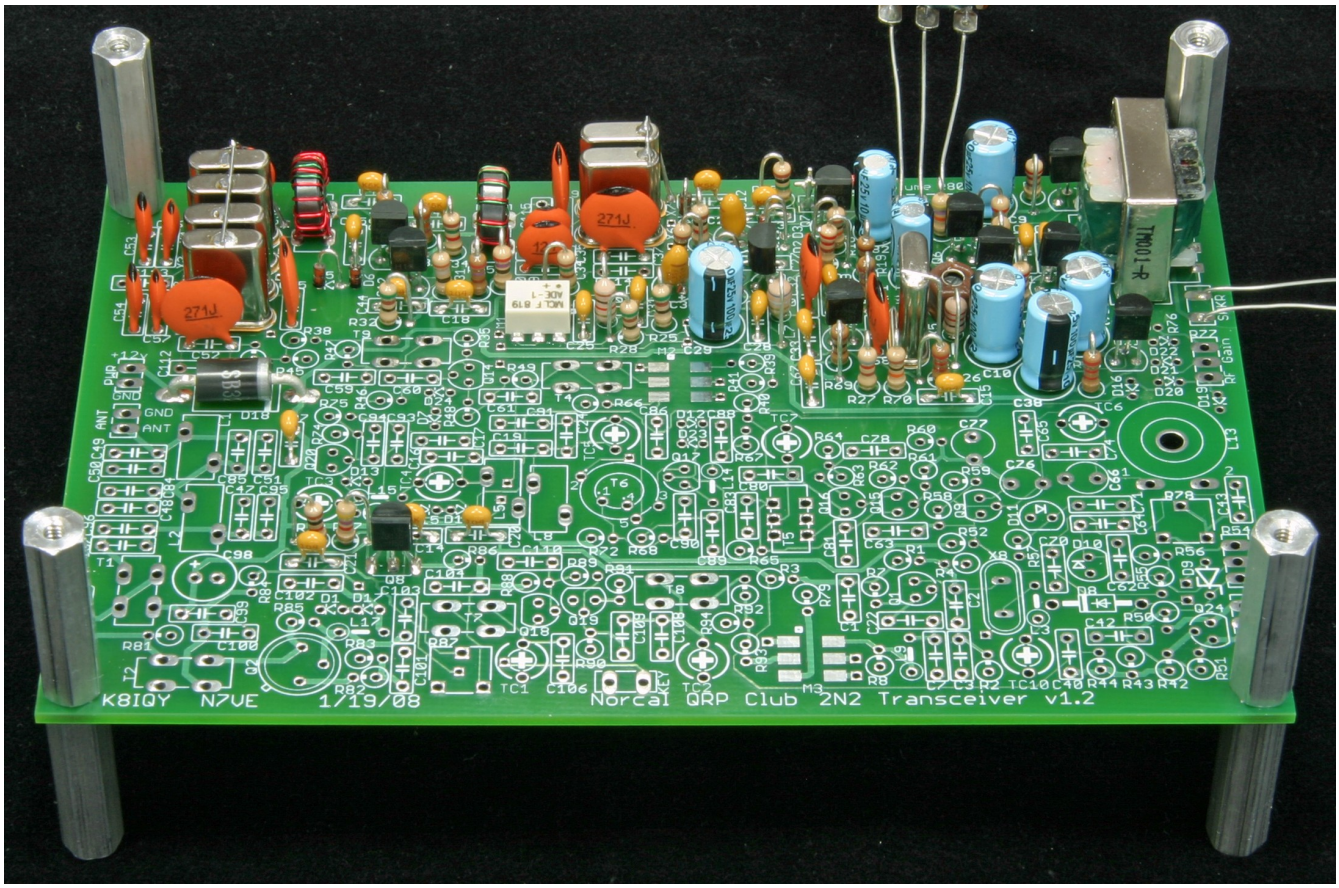
_____

Receive Main Crystal Filter

[ ] Install capacitor pairs C36/C111, C53/C56, C55/C113, C54/C57 and C52/C112. Some of these capacitors may not be used at the IF frequency employed in your rig. ***Unused capacitors are shown on the schematic with a value of 0 pF.***

[ ] Install crystals X1, X2, X3, and X4. Place a spacer (made from brown bag paper) over the crystal leads before soldering it to the PCB or leave a small space between the case and the PCB. This will keep the crystal case from shorting out PCB traces. Ground the case of each crystal with a short piece of wire to the provided, adjacent ground pads.

Your PCB should look like that shown in the next figure.



- Figure 13 -

Test - Connect a speaker or headphones to the “SPKR” jack. Apply power to the board. Connect an antenna to the right pad of C52 or to the upper pad where R37 will be installed. You should hear band noise, mostly static, at a loud level and very restricted in bandwidth due to the action of this crystal filter.

Your Measurements/Observations - _____

_____

Receive Post-Mixer Amplifier

[ ] Wind and install transformers T4 and T9. T4 can be wound with either a pair of wires twisted together at 8-10 turns per inch and then wound on the core, or with the pair of wires wound in parallel. Either method will yield a suitable transformer. An example of each method is shown in the next figures.

- Figure 14 -

- Figure 15 -

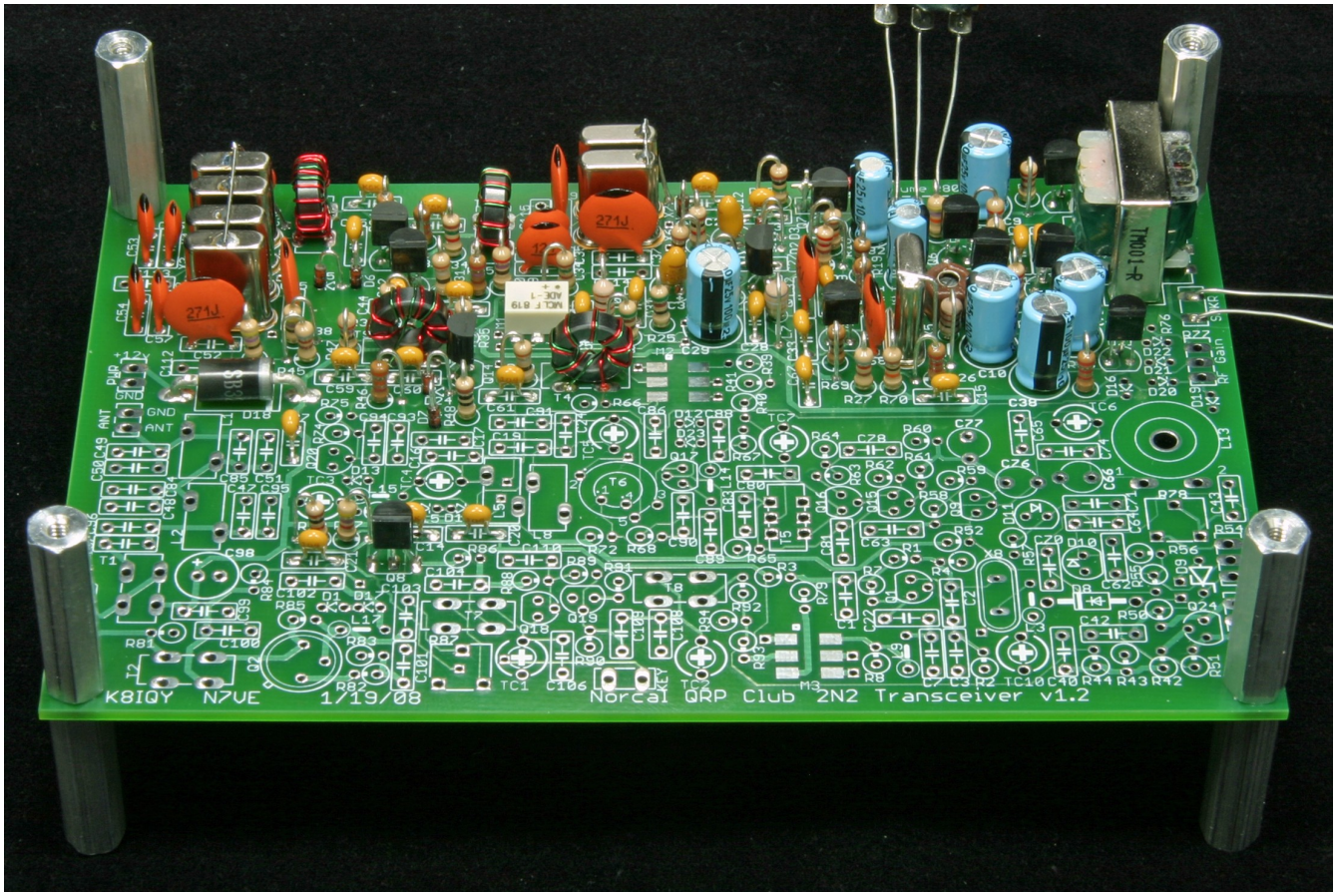
[ ] Install transistor Q14.

[ ] Install diodes D7 and D24. **Note cathode ends (bar) so they are installed correctly.**

[ ] Install resistors R35, R37, R38, R45, R46, R47, R48 and R49.

[ ] Install capacitors C59, C60 and C61.

Your PCB should look like that shown in the next figure.



- Figure 16 -

Test - Connect a speaker or headphones to the “SPKR” jack. Apply power to the board. Connect an antenna to the upper-right pad of T4 or the pin 2 pad of where mixer M2 will be installed. You should hear band noise, mostly static, at a very loud level and very restricted in bandwidth due to the action of the crystal filters. As you are listening, rotate trim capacitor to change the LO frequency being injected into mixer M1. Starting with the capacitor at minimum capacitance, (the highest sounding static) rotate this trimmer until the lowest sounding static occurs. This adjustment will be used to optimize the LO injection point to center the received signal in the middle of the main crystal filter in the final receiver alignment.

Your Measurements/Observations - _____

_____

VFO

[ ] Wind and install inductor L13. Use the supplied shouldered nylon washers on either side of toroid and the nylon screw and nut to secure it to the PCB. Tighten until the wound toroid is snug, but do not over tighten and strip the screw threads. Cut off excess screw material protruding through the nut.

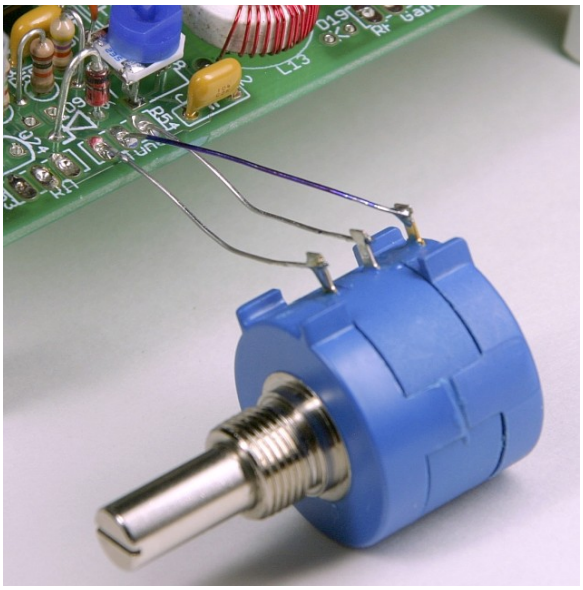
[ ] Install trim capacitor (orange color) TC6.

[ ] Install Q9

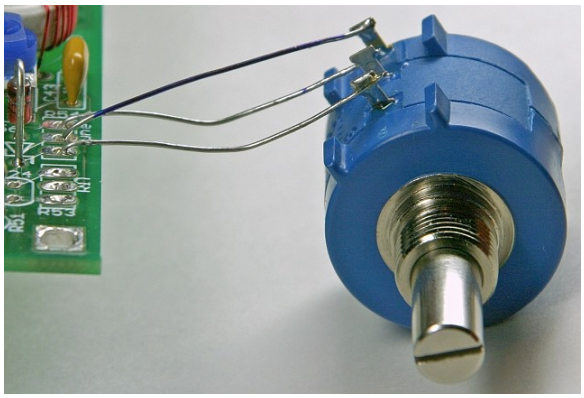
[ ] Install diodes D8, D9 and D10. Note cathode ends (bar) on D8 and D9 so they are installed correctly. D10 (a **MV1662**) looks like a transistor with only two leads and has no markings on it, just colored bands.

[ ] Install resistors R52, R55, R56, R58, R59 and R60.

[ ] Install trim potentiometer R78 and control potentiometer R54. R54 is wired using leads from previously installed components and oriented so that when wired to the PCB, the terminals are pointing as shown in the next figures.



- Figure 17a -



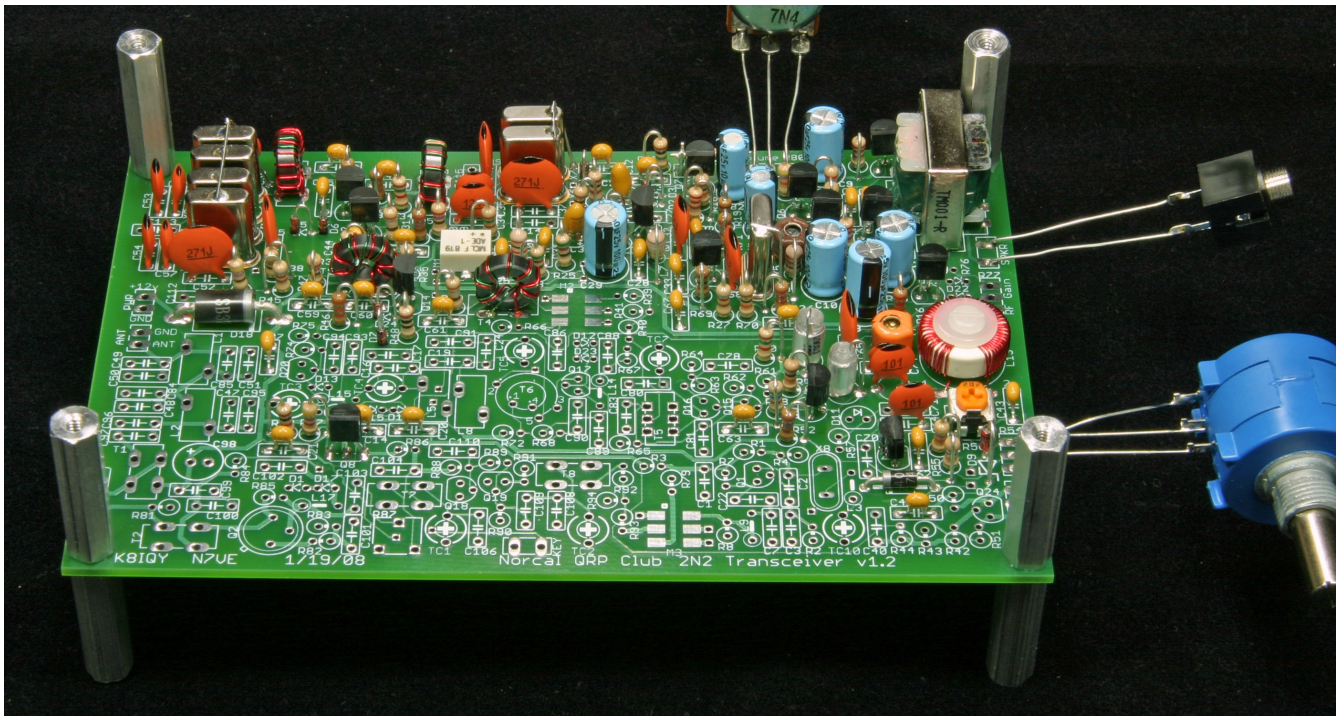
- Figure 17b -

[ ] Install polystyrene capacitors C76, and C77. This set of capacitors is mounted “on end” as shown in the next figure.

- Figure 18 -

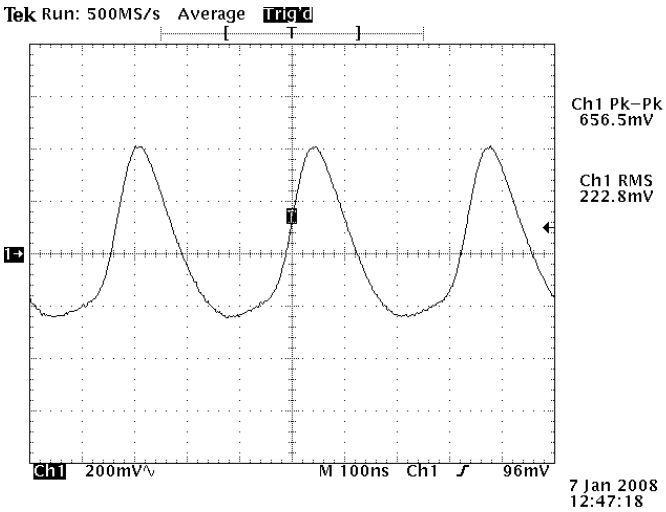
[ ] Install capacitors C42, C43, C62, C63, C64, C65, C66 and C74.

Your PCB should look like that shown in the next figure.



- Figure 19 -

Test – Apply power to the PCB. Connect an RF probe or oscilloscope to the top of resistor R60. The RF probe should show an output level of approximately 0.16 volts. On an oscilloscope, the waveform should approximately match that shown in the next figure.



- Figure 20 -

If a frequency counter is available, connect it to the top of R60 and measure the frequency. The

displayed frequency will change with the rotation of R54, the tuning potentiometer. The high frequency end of the VFO tuning range is set by trim capacitor TC6 and the low frequency end by trim resistor R78. Adding in the RIT circuitry (in a later step) will change the tuning range and span of the VFO.

Your Measurements/Observations - _____
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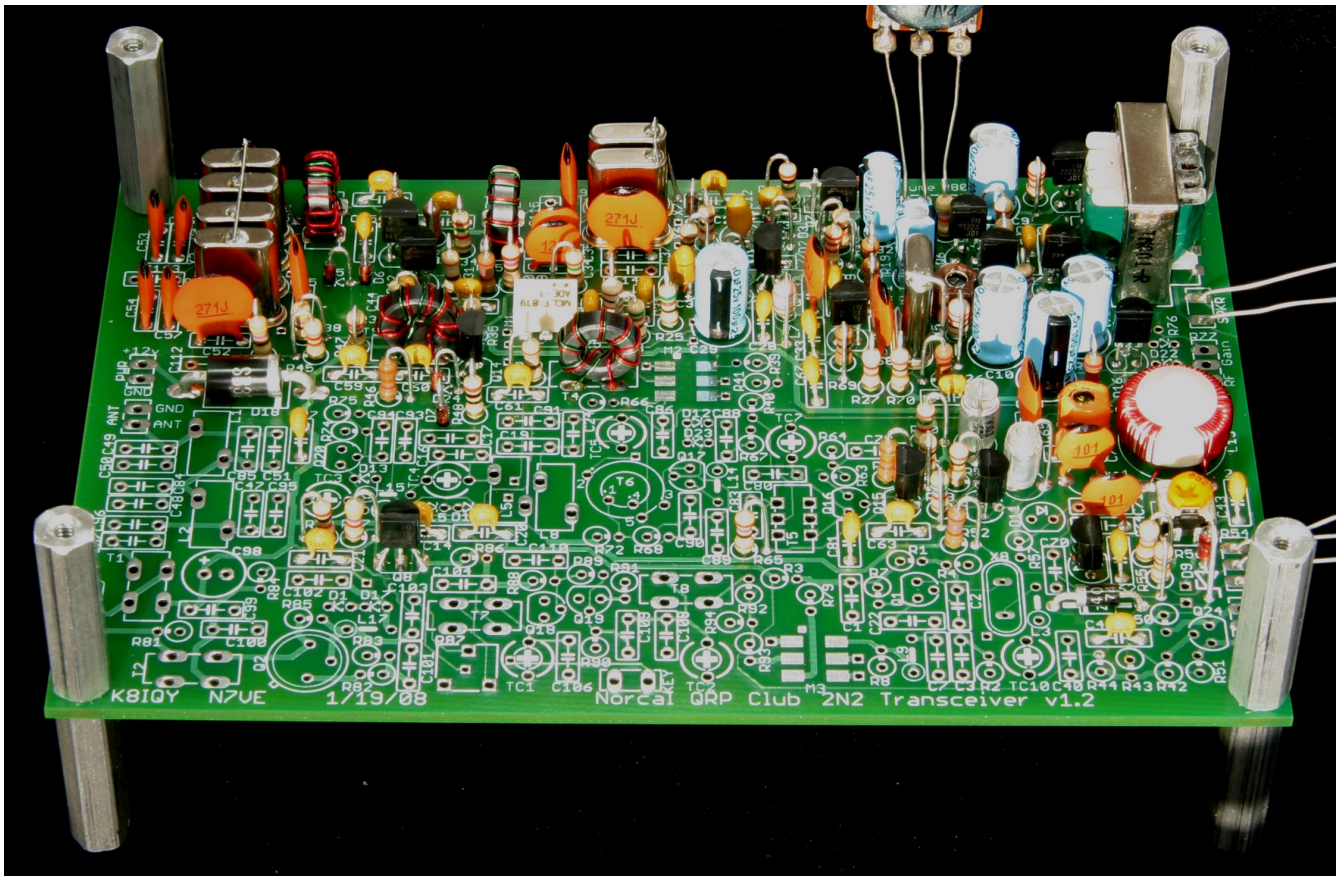
VFO Buffer

[ ] Install Q15

[ ] Install resistors R61, R62, and R65.

[ ] Install capacitor C81.

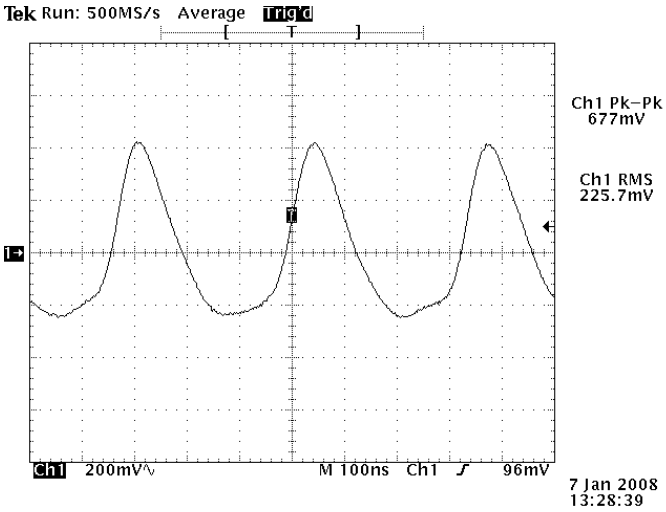
Your PCB should look like that shown in the next figure.



- Figure 21 -

Test – Apply power to the PCB. Connect an RF probe or oscilloscope to the top of resistor R62.

The RF probe should show an output level of approximately 0.15 volts. On an oscilloscope, the waveform should approximately match that shown in the next figure.



- Figure 22 -

Your Measurements/Observations - _____

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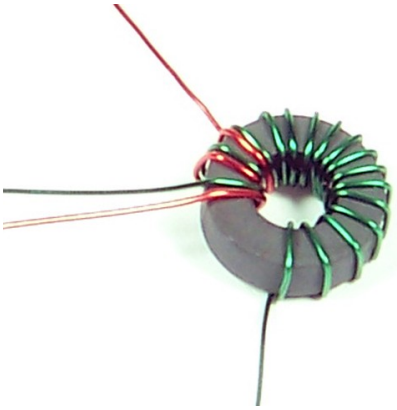
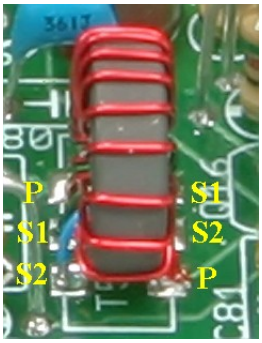
VFO Driver

[ ] Wind transformer T5. Put the 16-turn primary (use red wire, not green wire as shown) and the 3-turn secondary (use green wire, not red as shown) windings on the ***T37-61 dull gray core with green dot,*** as shown in the next figure.



- Figure 23 -

Install it onto the PCB. After it is secured, add the remaining 1-turn secondary winding. When installed, the toroid will look like that in the next figure.



- Figure 24 -

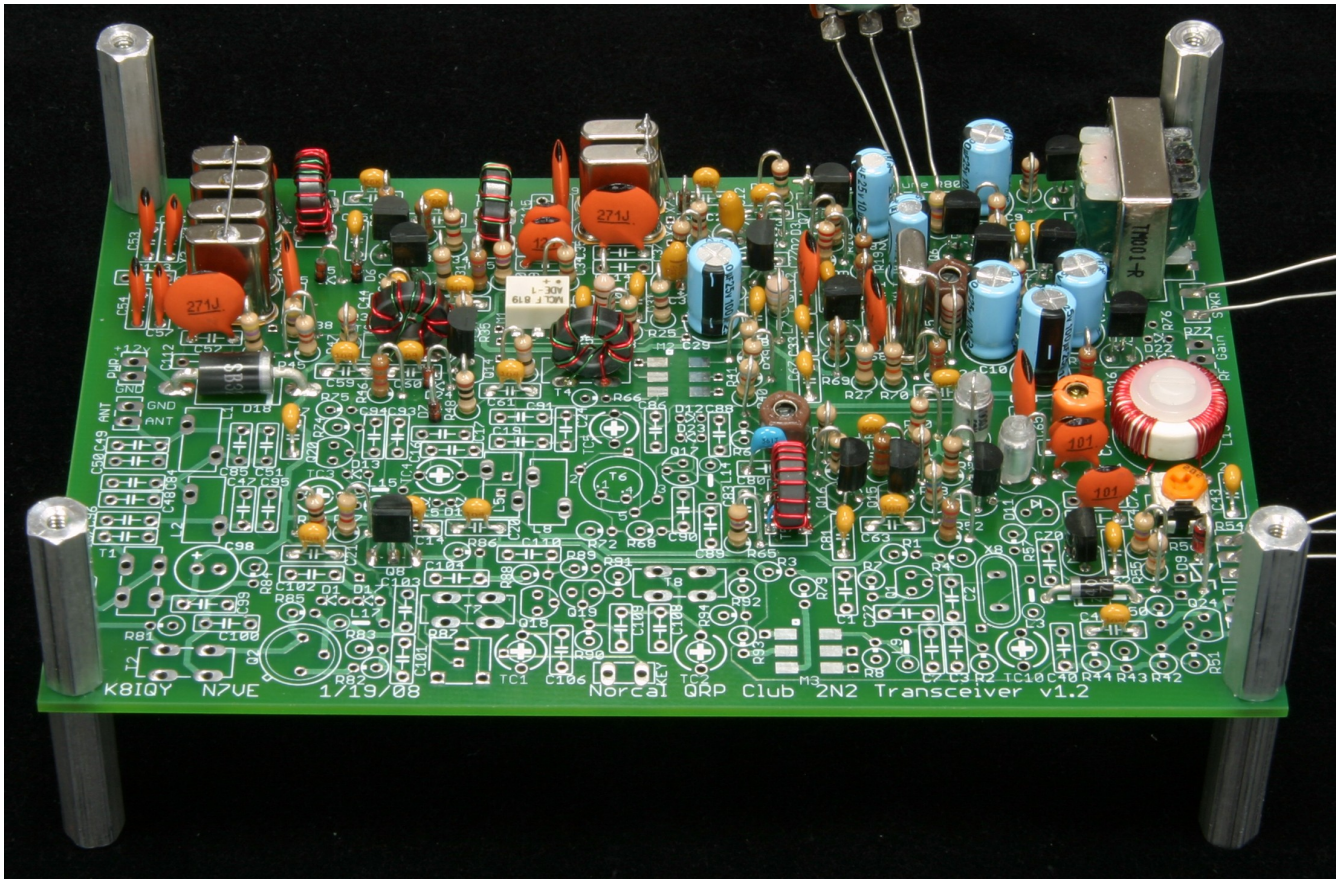
[ ] Install trim capacitor TC7.

[ ] Install transistor Q16.

[ ] Install resistors R39, R40, R41, R63, and R64.

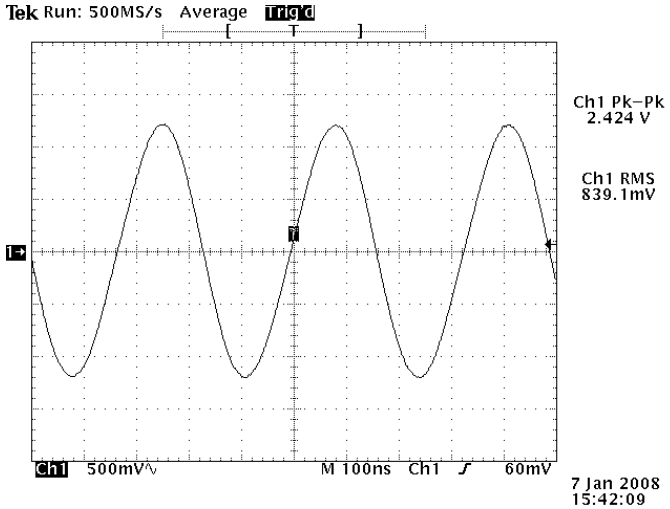
[ ] Install capacitors C78, C80, and C83.

Your PCB should look like that shown in the next figure.



- Figure 25 -

Test – Temporarily connect a 51 Ohm resistor from the top of resistor R40 to ground. This resistor supplies a load for the VFO driver stage. Apply power to the PCB. Connect an RF probe or oscilloscope to the top of resistor R40. Peak the driver tuned circuit by rotating TC7 while watching the output level. At the peak setting, the RF probe should show an output level of approximately 0.9 volts. On an oscilloscope, the waveform should approximately match that shown in the next figure.



- Figure 26 -

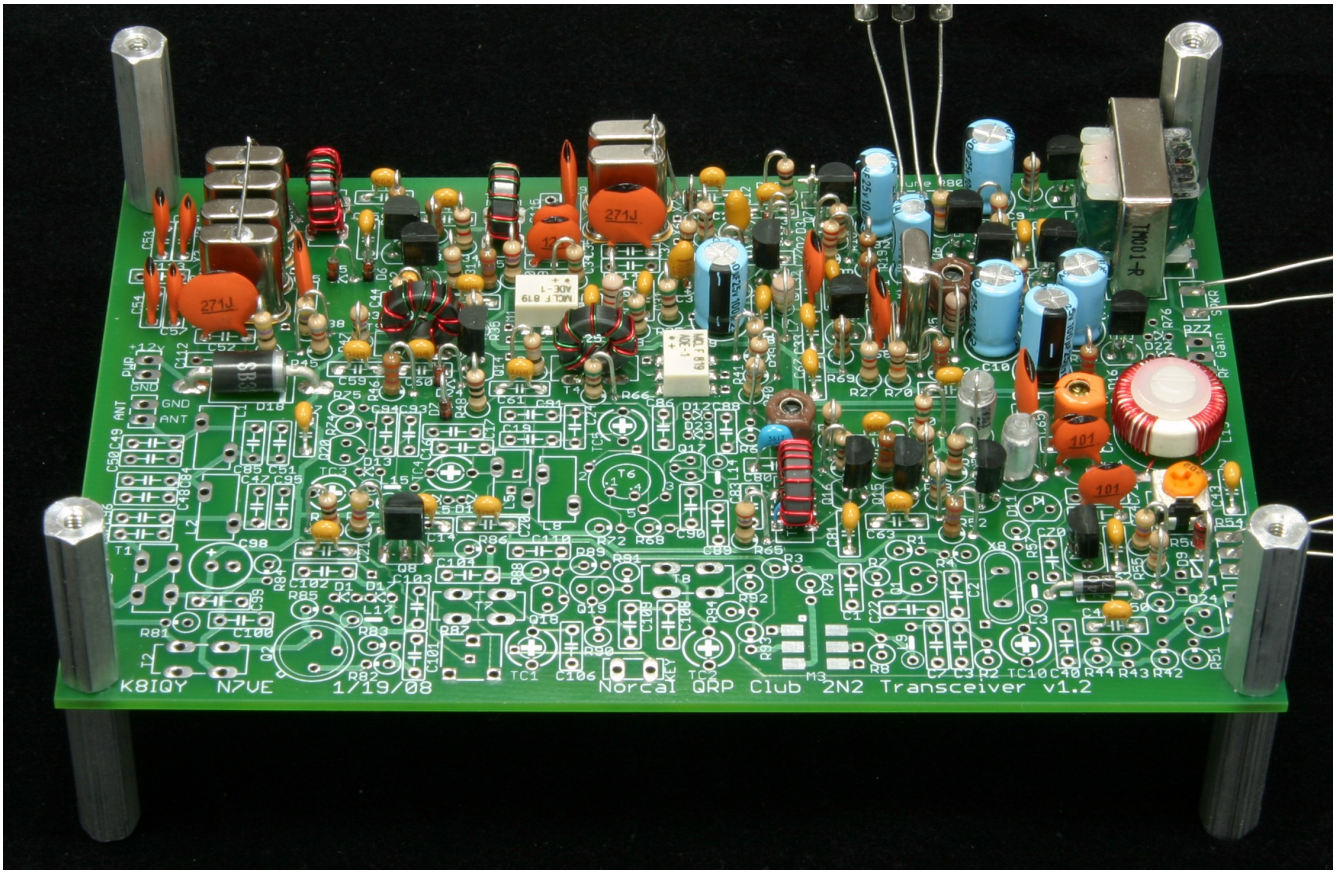
Your Measurements/Observations - _____
_____

Receive Main Mixer

[ ] Install mixer M2. ***Before soldering all of the leads, make sure it it oriented correctly.*** A dot on the part and on the PCB denote the location of Pin 1.

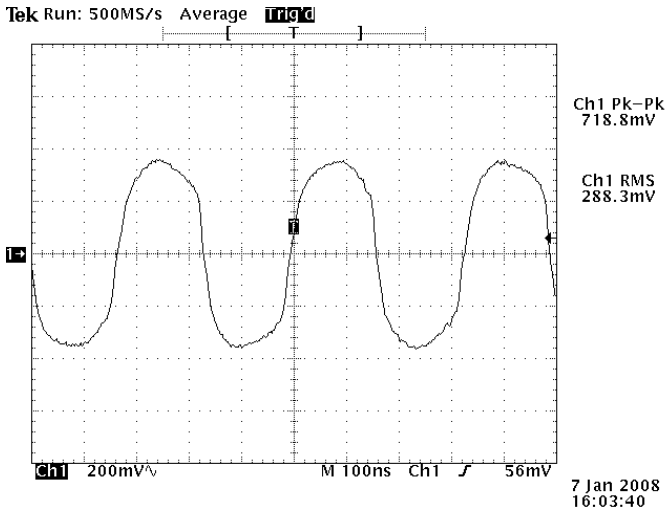
[ ] Install resistor R66.

Your PCB should look like that shown in the next figure.



- Figure 27 -

Test – Connect a speaker or headphones to the "SPKR" jack. Apply power to the PCB. Connect an RF probe or oscilloscope to the top of resistor R39. The RF probe should show an output level of approximately 0.25 volts. On the oscilloscope, the waveform should approximately match that shown in the next figure.



- Figure 28 -

Connect an antenna to the top of resistor R66. Band noise and maybe a station can be heard. Adjust LO trim capacitor TC9 until the received band noise sounds the loudest and is at approximately 1 KHz. This isn't a critical adjustment at this time, just use your ears and let them be your guide. The receiver is listening to signals in the band and at the image frequency, so you may hear CW and shortwave broadcast signals together.

Your Measurements/Observations - _____
_____

Receive RF Amplifier

[ ] The Receive RF Amplifier stage ***is not used*** on 40-meters. Instead, a jumper is connected between the upper pad for capacitor C86 and transformer pad T6-5. 40-Meter builders can proceed directly to the "**Receive Input Band Pass Filter" section.**

[ ] Wind and install transformer T6. The finished transformer should look like the next figure with a 3-turn winding, a tap, and then followed with a 5-turn winding.

- Figure 29 -

The 1-turn emitter winding is added after the transformer is soldered on to the PCB. ***On 30-meters, this transformer has a 2-turn winding, a tap, and a 1-turn winding.***

[ ] Install inductor L14.

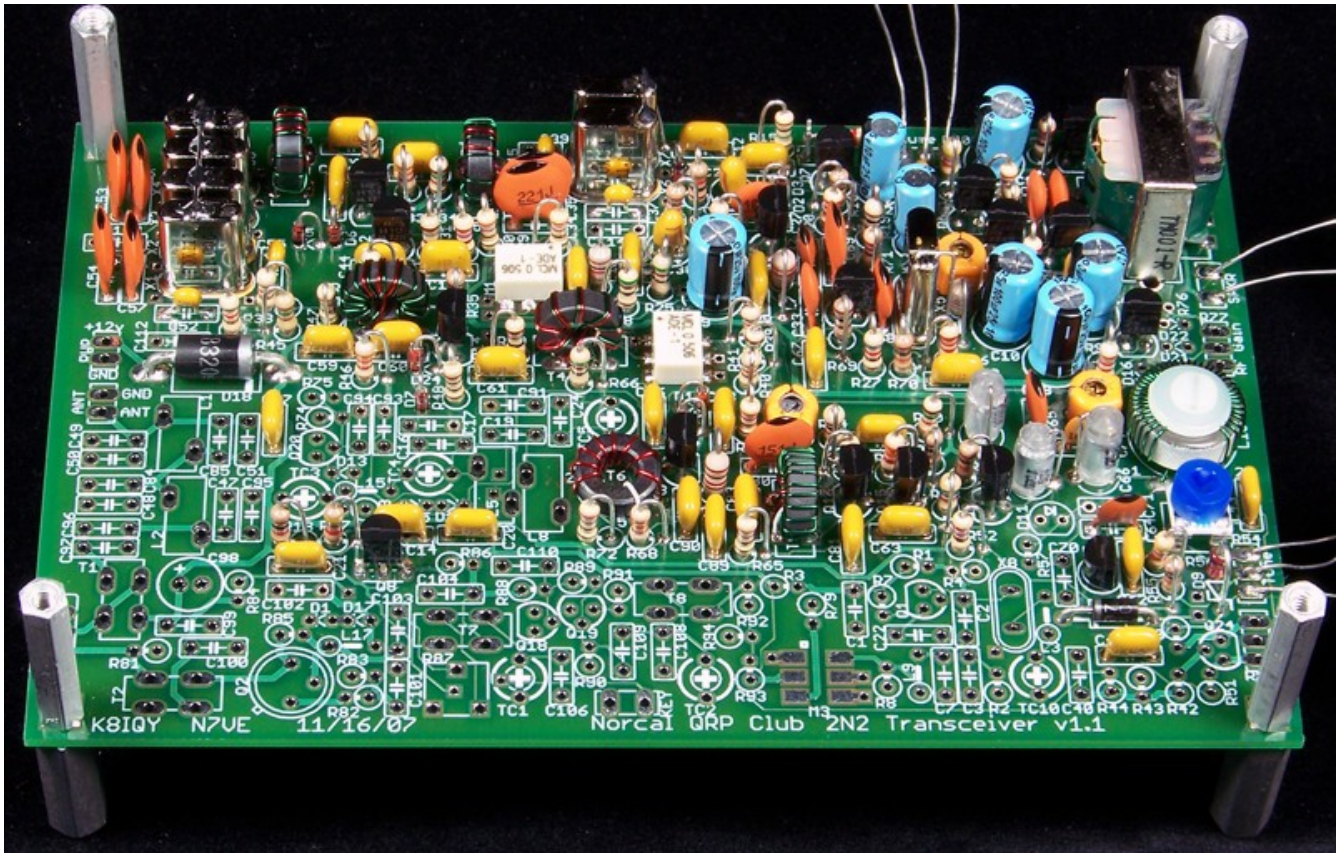
[ ] Install transistor Q17.

[ ] Install diodes D12 and D23. Note cathode ends (bar) so they are installed correctly.

[ ] Install resistors R67, R68, and R72.

[ ] Install capacitors C86, C88, C89, and C90.

Your PCB should look like that shown in the next figure.



- Figure 30 -

Test – Connect a speaker or headphones to the "SPKR" jack. Apply power to the PCB. Connect an antenna through a 0.1uF capacitor to the upper pad where trim capacitor TC5 will be mounted. The band noise and stations heard should be louder than in the previous step due to the gain of this stage.

Your Measurements/Observations - _____

_____

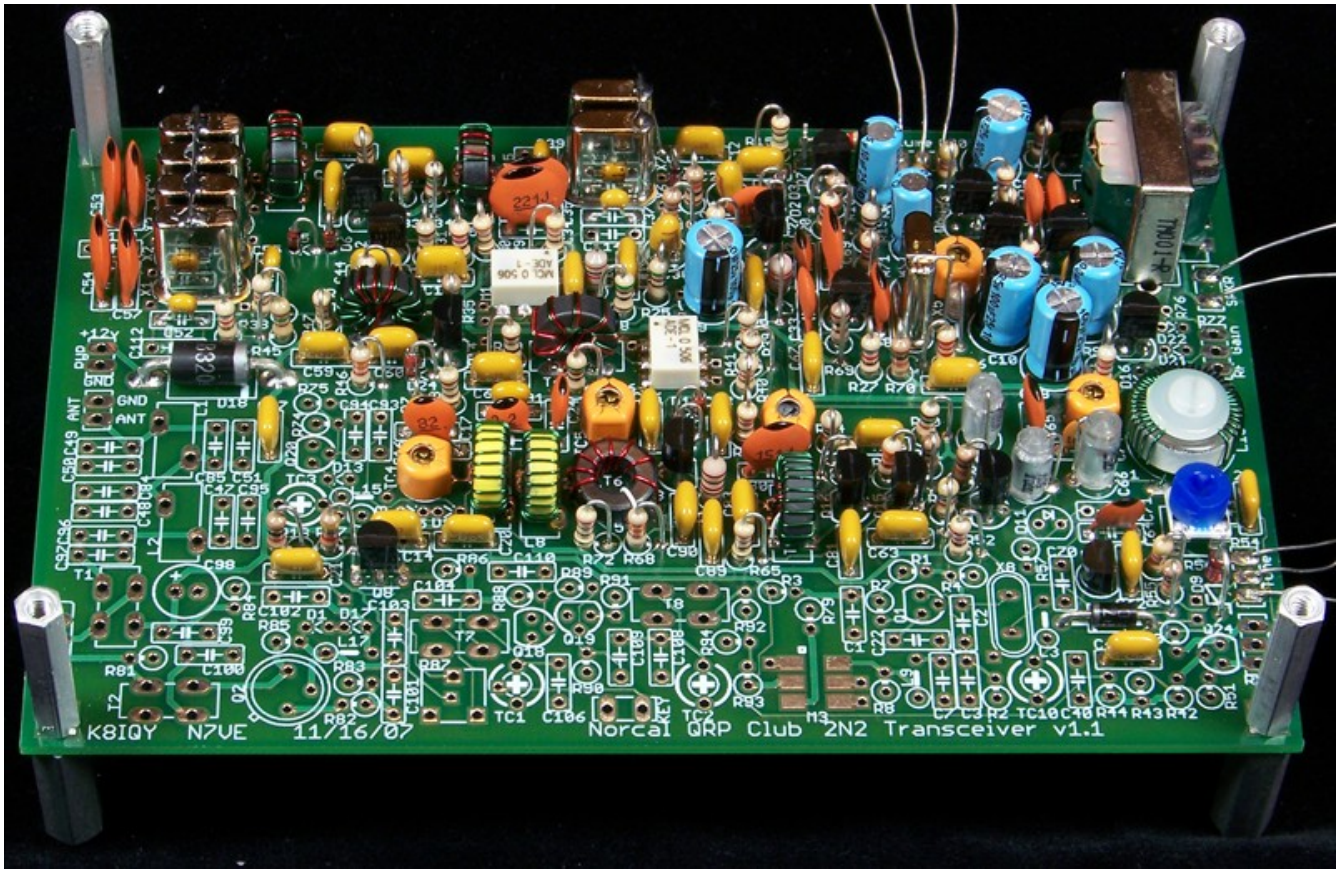
Receive Input Band Pass Filter

[ ] Wind and install inductors L5 and L8.

[ ] Install trim capacitors TC4 and TC5.

[ ] Install capacitors C16, C17, C19, C24, and C91.

Your PCB should look like that shown in the next figure.



- Figure 31 -

Test – Connect a speaker or headphones to the "SPKR" jack. Apply power to the PCB. Connect an antenna to the right pad where inductor L15 will be mounted. Alternately peak trim capacitors TC4 and TC5 until the band noise is the loudest. Only stations in the band should now be heard.

Your Measurements/Observations - _____

_____

Receive RF Gain and RF Mute

[ ] Install inductor L15.

[ ] Install trim capacitor TC3.

[ ] Install the **2N4124 NPN** transistor at Q20. Make sure this is the correct transistor.

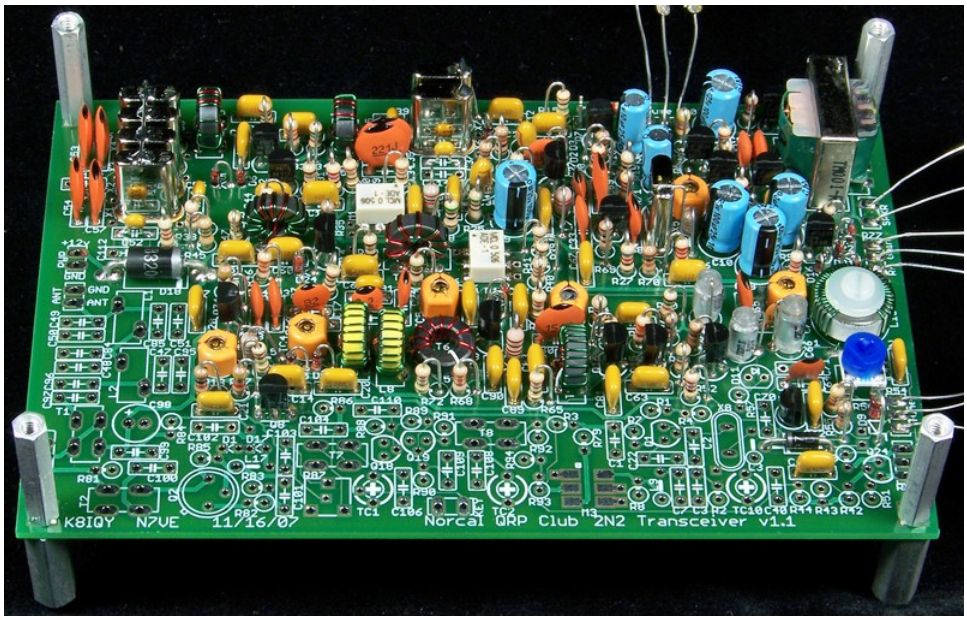
[ ] Install diodes D13, D14, D15, D16, D19, D20, D21, and D22. Note cathode ends (bar) so they are installed correctly.

[ ] Install resistors R73, R74, R75, and R76.

[ ] Install RF gain control R77 to the pads marked “RF Gain” using discarded leads from previously installed components

[ ] Install capacitors C93 and C94.

Your PCB should look like that shown in the next figure.



- Figure 32 -

Test – Connect a speaker or headphones to the “SPKR” jack. Apply power to the PCB. Connect an antenna to the lower pad where capacitor C95 will be mounted. Alternately peak trim capacitors TC3, TC4 and TC5 until the band noise or a received signal is the loudest. Adjust R77 to verify the RF gain can be reduced.

Your Measurements/Observations - _____

_____

Receive Incremental Tuning (RIT)

[ ] Install the **2N7000 MOSFET** at Q24.

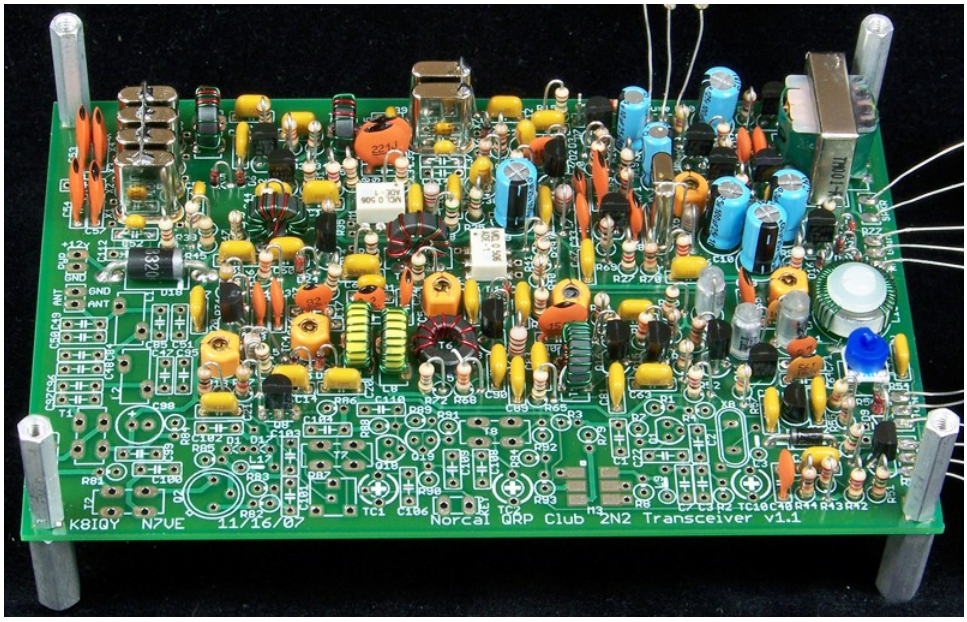
[ ] Install diode D11. This diode (a **MV209**) looks like a transistor with markings on it but with only two leads.

[ ] Install resistors R42, R43, R44, R50, R51 and R57.

[ ] Install RIT control R53 to the pads marked “RIT” using discarded leads from previously installed components

[ ] Install capacitors C40, C70, and C71.

Your PCB should look like that shown in the next figure.



- Figure 33 -

Test – Connect a speaker or headphones to the "SPKR" jack. Apply power to the PCB. Connect an antenna to the lower pad where capacitor C95 will be mounted. Adjust R53 in both directions to verify the receiver tuning changes approximately 3 KHz up and down in frequency from the center detent position.

Your Measurements/Observations - _____

_____

At this stage of the assembly, the receive strip is complete and fully functional. You might want to readjust the RxLO (trim capacitor TC9) to set the injection point so that cw stations are at a pleasing note, around 700 Hz, and the loudest you can make them. As you adjust the RxLO, you'll have to re-tune the station with tuning potentiometer R54 to keep it centered in the passband of the receiver.

<u>Transmit Local Oscillator (TxLO)</u>

[ ] Install inductors L3 and L9.

[ ] Install trim capacitor TC10. The rounded end is the grounded end.

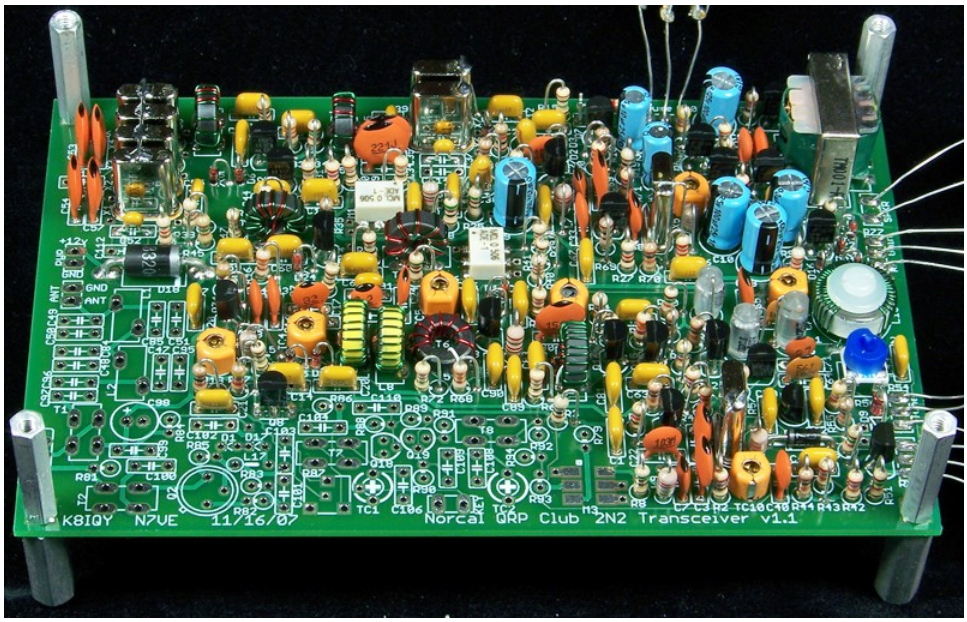
[ ] Install transistor Q1.

[ ] Install resistors R1, R2, R3, R4, R7 and R8.

[ ] Install capacitors C1, C2, C3, C7 and C22.

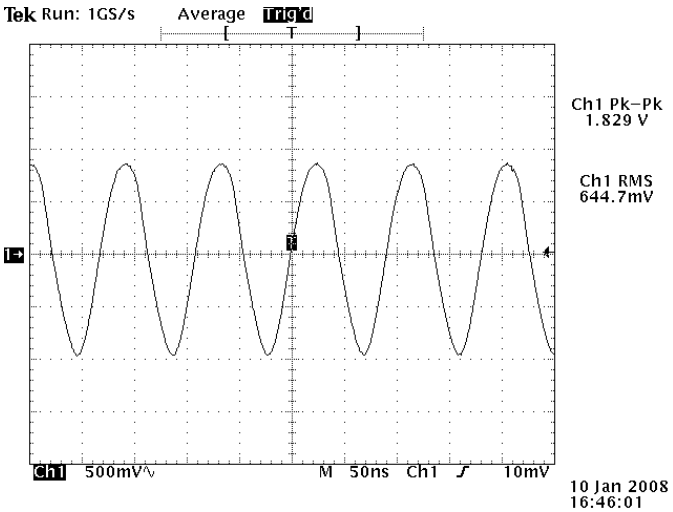
[ ] Install crystal X8; it will be the last one marked LO or XX. Place a spacer over the crystal leads before soldering it to the PCB. Ground the crystal case with a short piece of wire to the provided adjacent ground pad.

Your PCB should look like that shown in the next figure.



- Figure 34 -

Test – Apply power to the board. Measure the TxLO output at the top of resistor R8 with a suitable device. Either an oscilloscope or RF Probe with readout device can be used.. Jumper the "Key" pads together to key the transmitter. The RF probe should show an output level of approximately 0.7 volts. On the oscilloscope, the waveform should approximately match that shown in the next figure.



- Figure 35 -

Your Measurements/Observations - _____

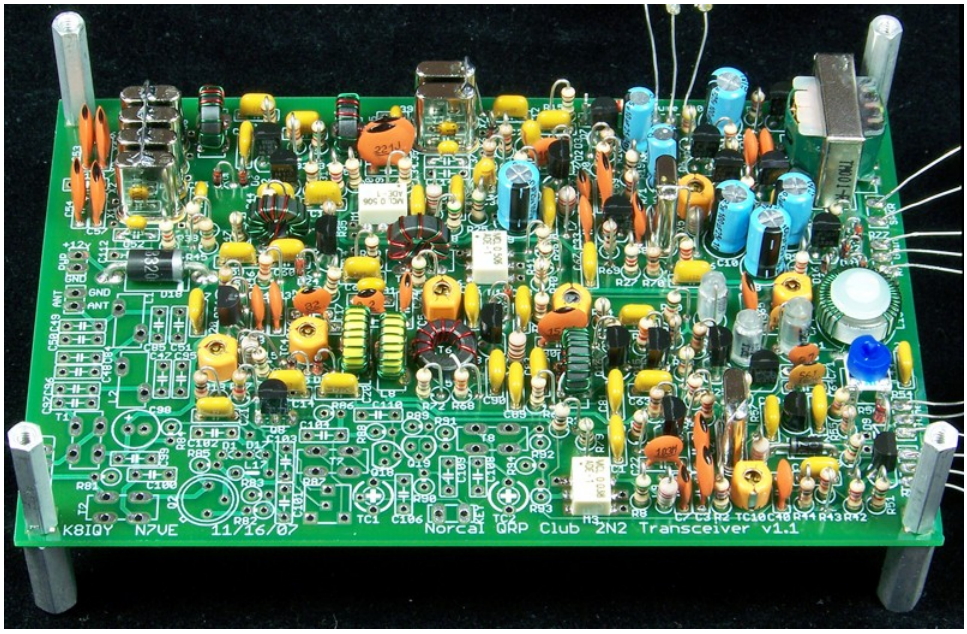
_____

Transmit Main Mixer

[ ] Install mixer M3. ***Before soldering all of the leads, make sure it it oriented correctly.*** A dot on the part and on the PCB denote the location of Pin 1.

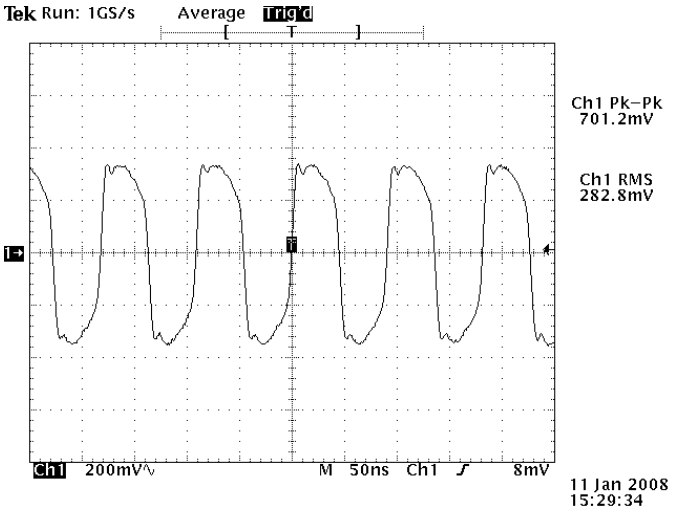
[ ] Install resistor R79.

Your PCB should look like that shown in the next figure.



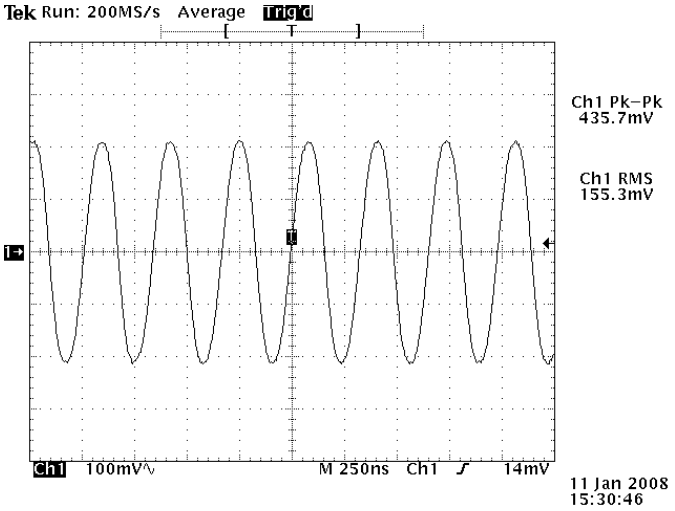
- Figure 36 -

Test – Connect a speaker or headphones to the "SPKR" jack. Apply power to the PCB. Connect an RF probe or oscilloscope to the top of resistor R8. Jumper the "Key" pads together to key the transmitter. The RF probe should show an output level of approximately 0.2 volts. On the oscilloscope, the waveform should approximately match that shown in the next figure.



- Figure 37 -

Connect an RF probe or oscilloscope to the top of resistor R79. The RF probe should show an output level of approximately 0.13 volts. On the oscilloscope, the waveform should approximately match that shown in the next figure.



- Figure 38 -

Adjust trim capacitor TC10 so that a cw tone can be heard from the receive strip.

Your Measurements/Observations - _____
_____

Transmit Cascode Amplifier

[ ] Wind and install transformers T7 and T8.

[ ] Install trim capacitors TC1 and TC2.

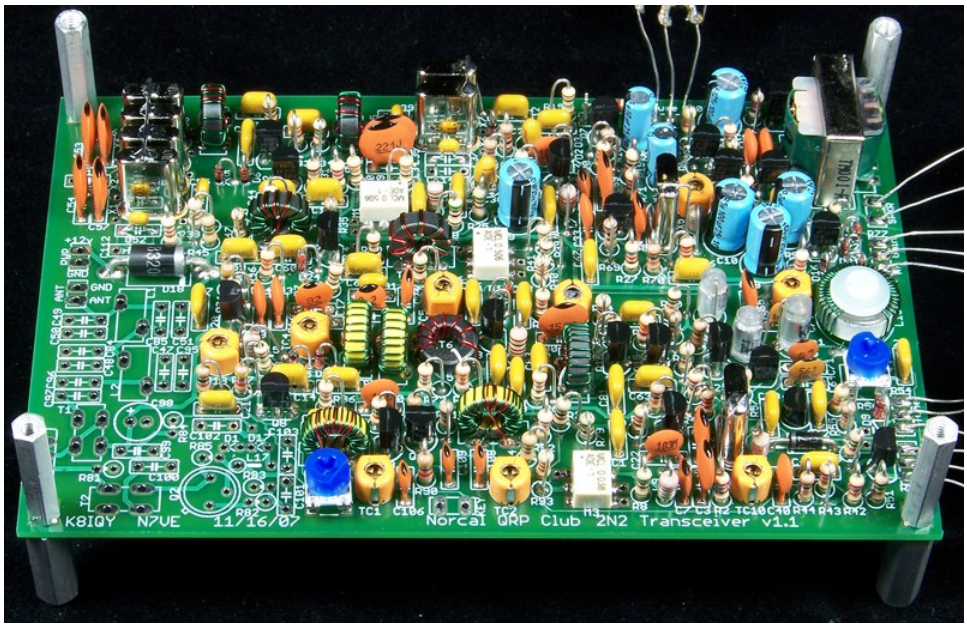
[ ] Install transistors Q18 and Q19.

[ ] Install resistors R86, R88, R89, R90, R91, R92, R93, and R94

[ ] Install trim potentiometer R87.

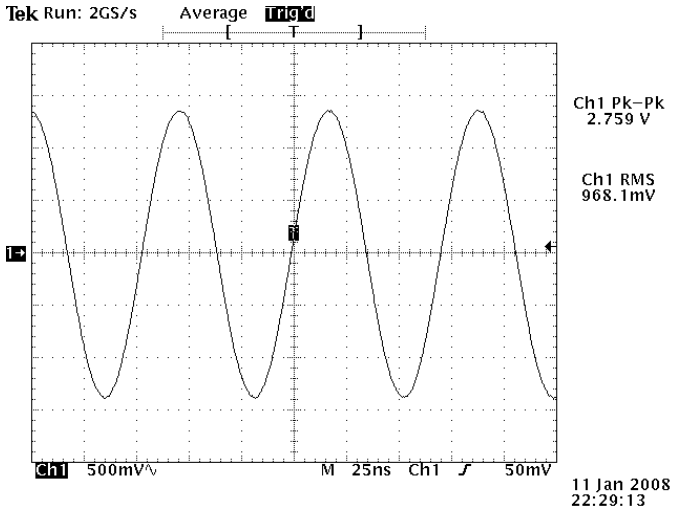
[ ] Install capacitors C104, C106, C108, C109, and C110.

Your PCB should look like that shown in the next figure.



- Figure 39 -

Test – Connect a speaker or headphones to the "SPKR" jack. Apply power to the PCB. Connect an RF probe or oscilloscope to the top pad of capacitor C103. Adjust trim resistor R87 CW to the end of its travel. Jumper the "Key" pads together to key the transmitter. Alternately adjust trim capacitors TC1 and TC2 for maximum output. The RF probe should show an output level of approximately 1 volt. On the oscilloscope, the waveform should approximately match that shown in the next figure.



- Figure 40 -

Your Measurements/Observations - _____

_____

Transmit Driver Amplifier

[ ] Wind and install transformer T2.

[ ] Install inductor L17.

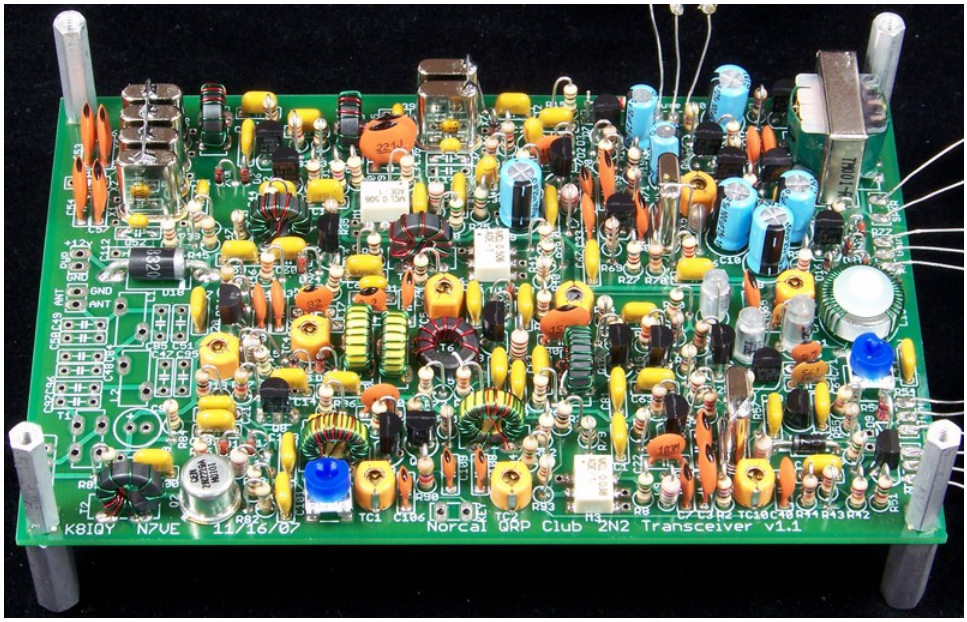
[ ] Install the **2N2219A** transistor at Q2. Make sure that the bottom of the case is not tight to the PCB; space it up about 1/32nd of an inch.

[ ] Install diodes D1 and D17.

[ ] Install resistors R81, R82, R83, R84, and R85.

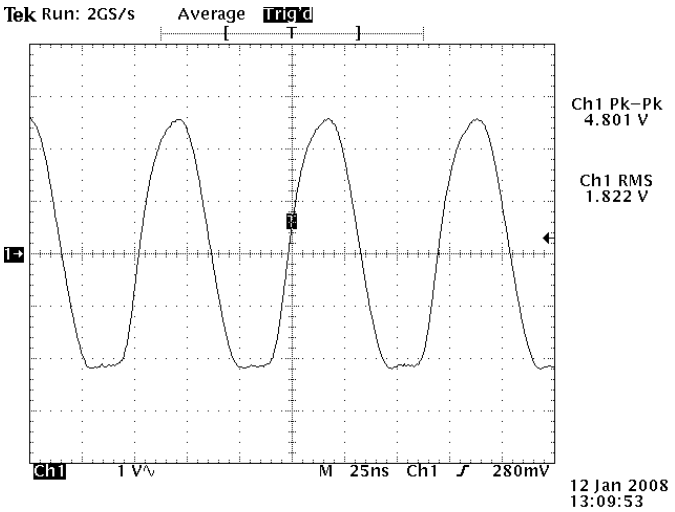
[ ] Install capacitors C100, C101, C102 and C103.

Your PCB should look like that shown in the next figure.



- Figure 41 -

Test – Connect a speaker or headphones to the "SPKR" jack. Apply power to the PCB. Connect an RF probe or oscilloscope to the top of resistor R81. Adjust trim resistor R87 to the middle of its travel. Jumper the "Key" pads together to key the transmitter. Alternately adjust trim capacitors TC1 and TC2 for maximum output. The RF probe should show an output level of approximately 1.7 volts. On the oscilloscope, the waveform should approximately match that shown in the next figure.



- Figure 42 -

Your Measurements/Observations - _____

_____

Transmit Final Amplifier

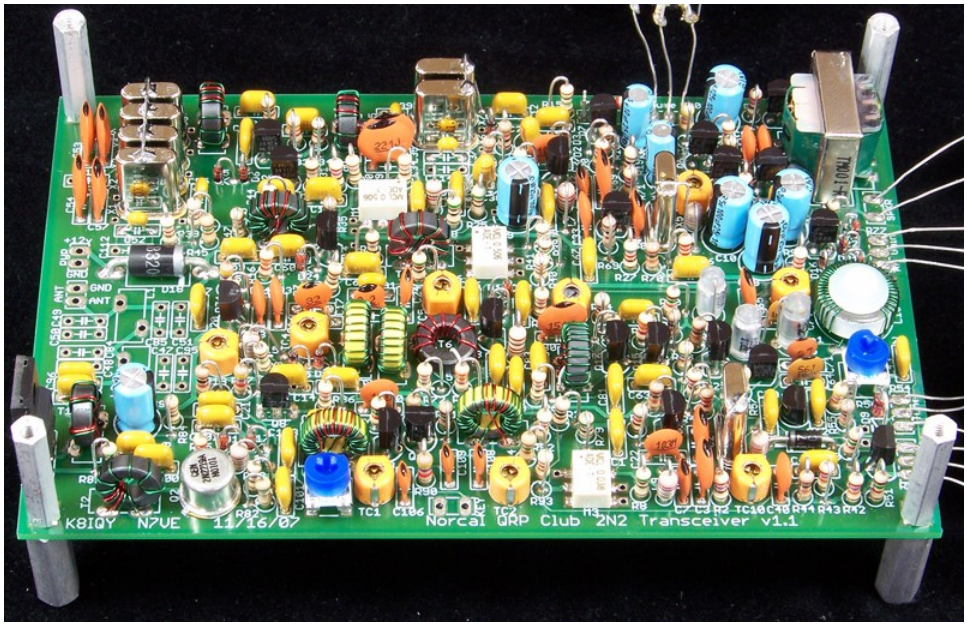
[ ] Wind and install transformer T1. This transformer can be wound with either a pair of wires twisted together at 8-10 turns per inch and then wound on the core, or with the pair of wires wound in parallel. Either method will yield a suitable transformer. An example of each method was shown earlier in this manual.

[ ] Install the **2SC5739** transistor at Q25. Make sure the longer side of the TO-220 case is toward the outside edge of the PCB before soldering the leads.

[ ] Install capacitors C96, C97 and C99.

[ ] Install electrolytic capacitor C98 matching the polarity markings on the case with those on the PCB.

Your PCB should look like that shown in the next figure.



- Figure 43 -

Test – No test will be performed at this step because we do not have a load on the final amplifier. We will add the output low pass filter in the next step and then test the final amplifier with a resistive dummy load attached to absorb the RF output power.

Transmit Output Low Pass Filter

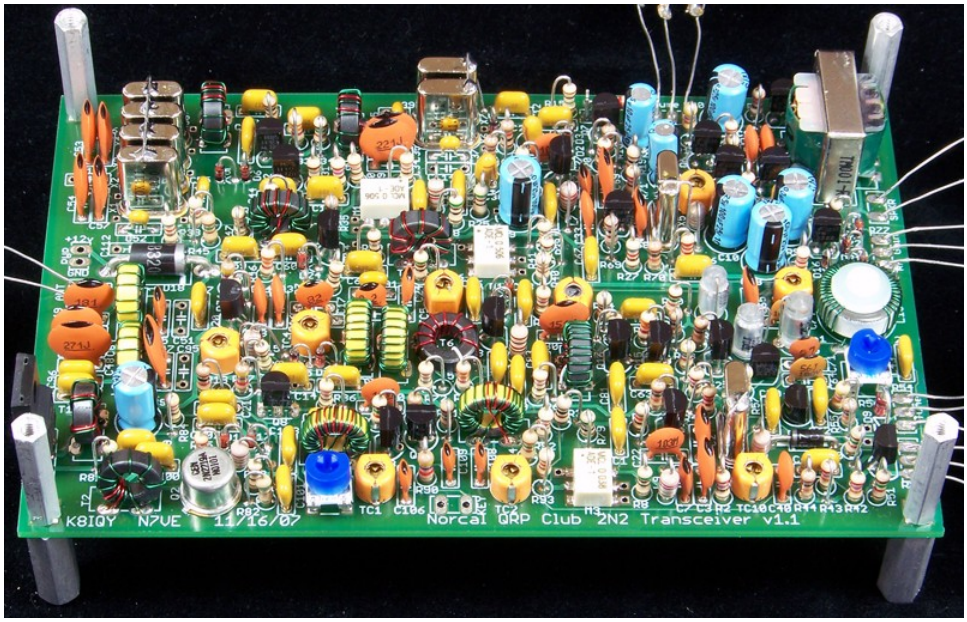
[ ] Wind and install inductors L1 and L2.

[ ] Install capacitor pairs C47/C95, C48/C84, C51/C85, and C49/C50. Some of these capacitors may not be used in your rig, depending on the band it is on. ***Unused capacitors are shown on the schematic with a value of 0 pF.***

[ ] Install the BNC output connector to the pads marked "ANT" using discarded leads from

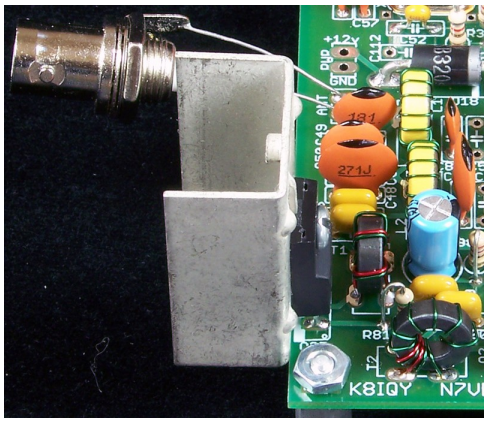
previously installed components. The center of the BNC is wired to the "ANT" pad and the BNC ground to the "GND" pad.

Your PCB should look like that shown in the next figure.



- Figure 44 -

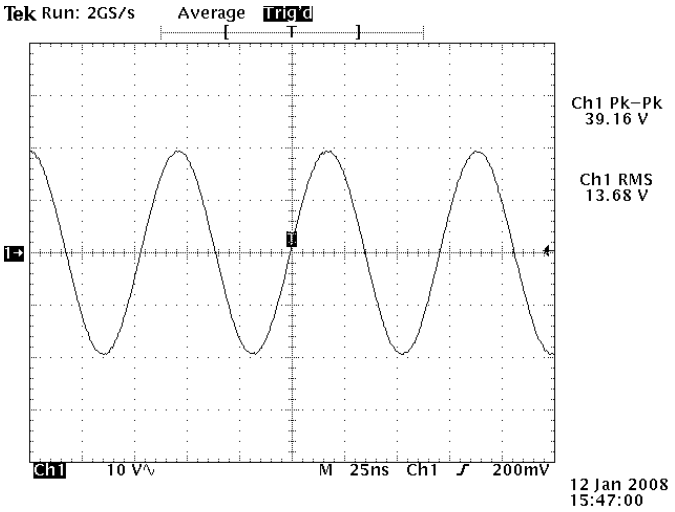
Test – Attach a TO-220 style heat sink (or fabricate something similar) to final transistor Q25 as shown in the next figure.



- Figure 45 -

Connect a speaker or headphones to the "SPKR" jack. Connect a 50 Ohm dummy load/watt meter to the output BNC connector. Connect an RF probe or oscilloscope to the "ANT" side of the BNC connector and the ground of the probe or scope to the "GND" side of the BNC connector. Adjust trim resistor R87 fully counter clockwise. Apply power to the PCB. Jumper the "Key" pads together to key the transmitter. ***Do not keep the transmitter keyed for more than 30 seconds at a time while performing these tests, to prevent the final transistor from overheating.*** Begin turning R87 in a clockwise direction while alternately adjusting trim

capacitors TC1 and TC2 for maximum output. Keep turning R87 until an output level of 4-watts is obtained. The receiver should be hearing the transmitted signal. The RF probe should show an output level of approximately 16 volts under these conditions. On the oscilloscope, the waveform should approximately match that shown in the next figure.



- Figure 46 -

Your Measurements/Observations - _____

_____

Final Adjustments

Now that the construction of your 2N2/XX PCB is complete, we can go back and do some final tune-up work to optimize the performance of the rig. We'll do it once here and again after the rig is installed in the case.

VFO

This step sets up the VFO to 100 KHz of band coverage (50 KHz for 30 Meters) and sets the low end of the VFO to match the low end of the band. This calibration step requires either a frequency counter or another receiver capable of receiving the VFO across its tuning range.

[ ] Connect a speaker or headphones to the "SPKR" jack. Apply power to the PCB. Connect the frequency counter probe to the top of resistor R40. Let the rig and the counter warm up for ½ hour before proceeding. If using another receiver for this calibration, turn it on and let it also warm up.

[ ] Center the RIT potentiometer, R53. Adjust trim potentiometer R78 fully counter clockwise. Turn the VFO frequency 10-turn potentiometer fully clockwise. Adjust trim capacitor TC6 so that the upper VFO frequency matches the frequency shown in the table on page 56 for the band your rig is on. A frequency tolerance of +/- 200 Hz is close enough.

[ ] Turn the VFO frequency 10-turn potentiometer fully counter clockwise. Adjust trim potentiometer R78 until the lower VFO frequency matches the frequency shown in the page 56

table for the band your rig is on. A frequency tolerance of +/- 200 Hz is close enough.

[ ] Since there is some interaction between these two settings, repeat these two adjustments until both ends of the band are set to your satisfaction.

Receiver Front-End

This procedure will optimize the receive sensitivity. With the receiver operating, apply a mid-band signal to the antenna connector using a signal generator (the NORCAL S1-S9 generator is recommended) set for 50 uV or less. As an alternate, attach an antenna and find a moderately strong signal. The VFO should be tuned to the center the signal in the receive passband. Beginning with trim capacitor TC3, peak TC3, TC4, and TC5. Repeat this step a few times to obtain the loudest signal under these contitions. Reduce the signal level to approximately 1 uV and repeat the peaking process.

TxLO

In this step, we will match the transmit frequency to the received frequency With the rig transmitting into a dummy load, adjust the transmit LO trim capacitor, TC10, to match the tone that is heard in the receiver when a cw signal is being received.

Transmit Strip

This step will maximize the RF power output from the rig.

[ ] Set the VFO to the middle of its tuning range, 5-turns from full CCW on potentiometer R54.

[ ] With the rig transmitting into a dummy load/watt meter, peak the power output by adjusting trim capacitor TC7 in the VFO driver stage.

[ ] Alternately adjust trim capacitors TC1 and TC2 in the Cascode Amplifier stage for maximum power output as indicated on the watt meter.

[ ] Adjust trim resistor R87 in the Tx Driver stage to set the power output level you want.

[ ] Alternate between the previous two steps until you are satisfied with the settings.

[ ] Adjust the RF output power with trim resistor R87 to the desired power level. Four-watts is recommended.

Remove PCB Temporary Wiring

This step will remove the external controls and their temporary wiring.

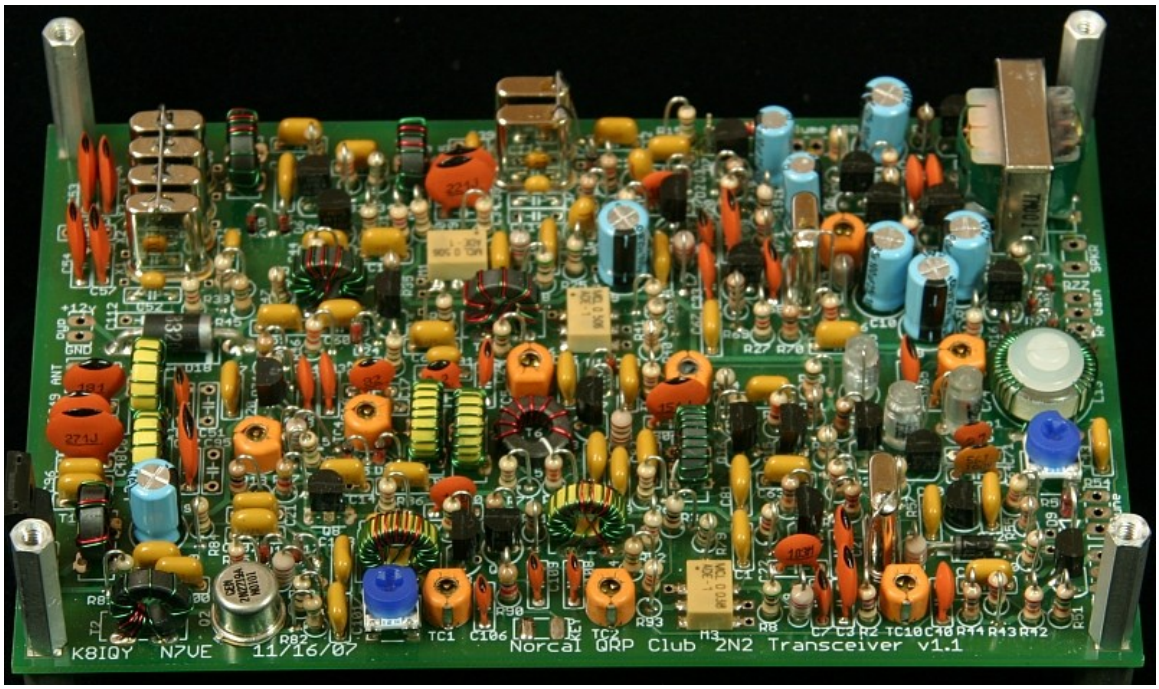
[ ] With the completed PCB still on the standoffs, carefully remove all of the external controls and their wiring. It is suggested that all wires between a control and the PCB be cut in the middle.

[ ] With the PCB inverted, ***so that the bottom side is up***, heat a connection point and pull the wire out from the top side, the side facing the workbench surface.

[ ] Using a solder sucker, carefully reheat that pad and suck the solder out so that the hole is open.

[ ] Repeat the process for all of the pads that still have wires soldered to them until the board is free of wires and all holes are open.

Your PCB should look like that shown in the next figure. (Ignore the fact that the Key pad holes still contain solder – it was a slight oversight by the author. :-o)



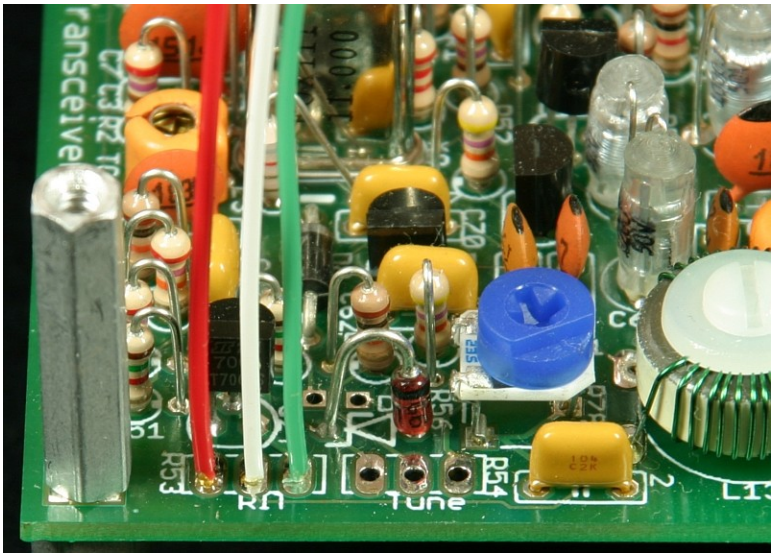
- Figure 47 -

Final PCB Wiring

This step will add the wires to the PCB that connect to the external controls.

[ ] RIT (R53) - Cut 8 1/2 inch pieces of wire in colors Red, White, and Green. Strip 1/8 inch of insulation from each end and carefully tin. Solder the Red wire to the RIT left pad, the White wire to the RIT center pad, and the Green wire to the RIT right pad.

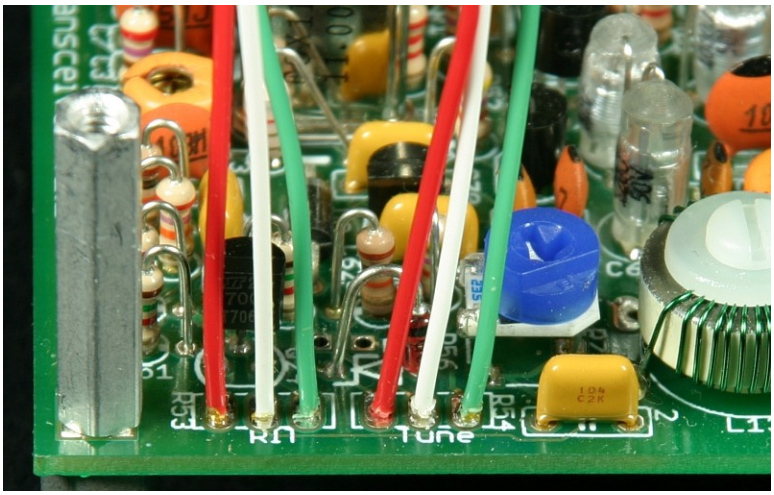
Your PCB should look like that shown in the next figure.



- Figure 48 -

[ ] TUNE (R54) - Cut 7 inch pieces of wire in colors Red, White, and Green. Strip 1/8 inch of insulation from each end and carefully tin. Solder the Red wire to the TUNE left pad, the White wire to the TUNE center pad, and the Green wire to the TUNE right pad.

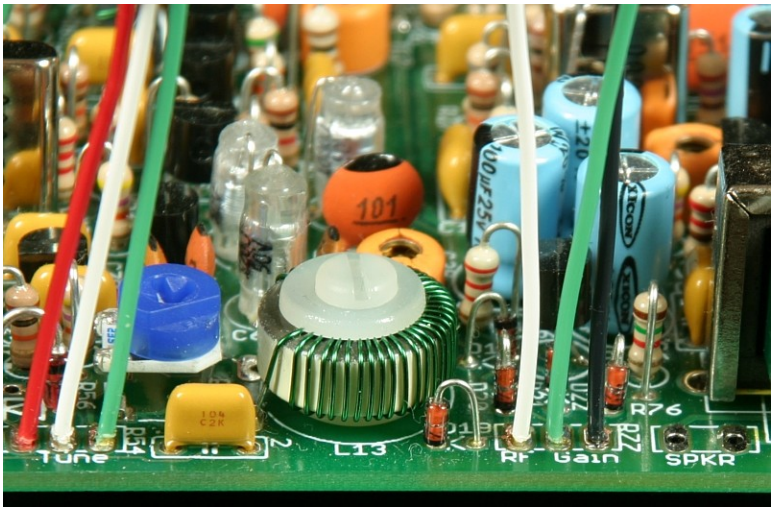
Your PCB should look like that shown in the next figure.



- Figure 49 -

[ ] RF Gain (R77) - Cut 4 1/2 inch pieces of wire in colors White, Green, and Black. Strip 1/8 inch of insulation from each end and carefully tin. Solder the White wire to the RF Gain left pad, the Green wire to the RF Gain center pad, and the Black wire to the RF Gain right pad.

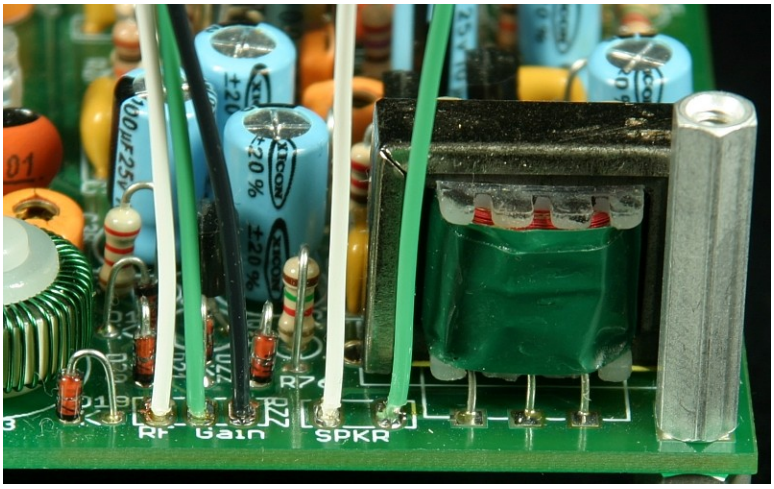
Your PCB should look like that shown in the next figure.



- Figure 50 -

[ ] SPKR (Speaker) - Cut 4 inch pieces of wire in colors White and Green. Strip 1/8 inch of insulation from each end and carefully tin. Solder the White wire to the SPKR left pad and the Green wire to the SPKR right pad.

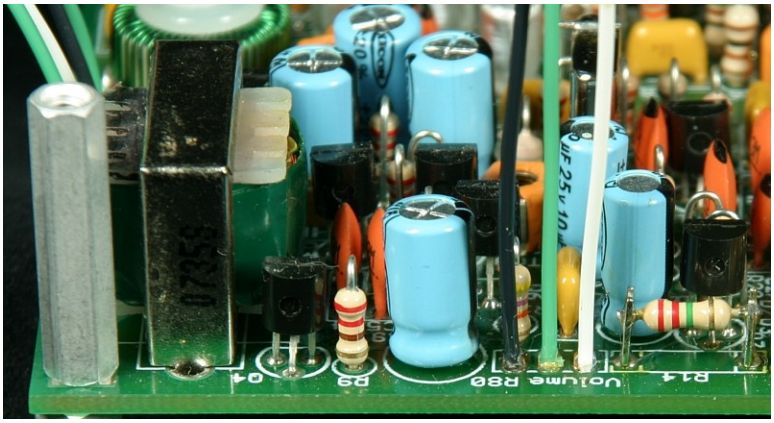
Your PCB should look like that shown in the next figure.



- Figure 51 -

[ ] Volume (R80) - Cut 1 1/2 inch pieces of wire in colors White, Green, and Black. Strip 1/8 inch of insulation from each end and carefully tin. Solder the Black wire to the Volume left pad, the Green wire to the Volume center pad, and the White wire to the Volume right pad ***as viewed from the closest PCB edge.***

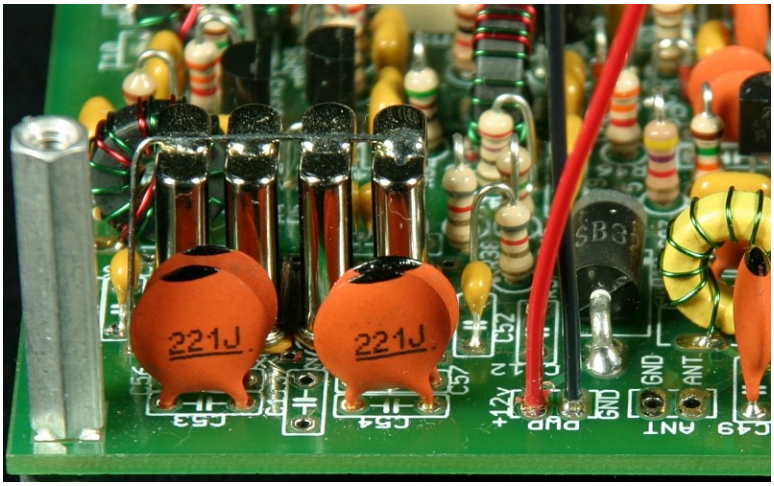
Your PCB should look like that shown in the next figure.



- Figure 52 -

[ ] PWR (+12/GND) - Cut 4 1/2 inch pieces of wire in colors Red and Black. Strip 1/8 inch of insulation from each end and carefully tin. Solder the Red wire to the PWR left pad and the Black wire to the PWR right pad ***as viewed from the closest PCB edge.***

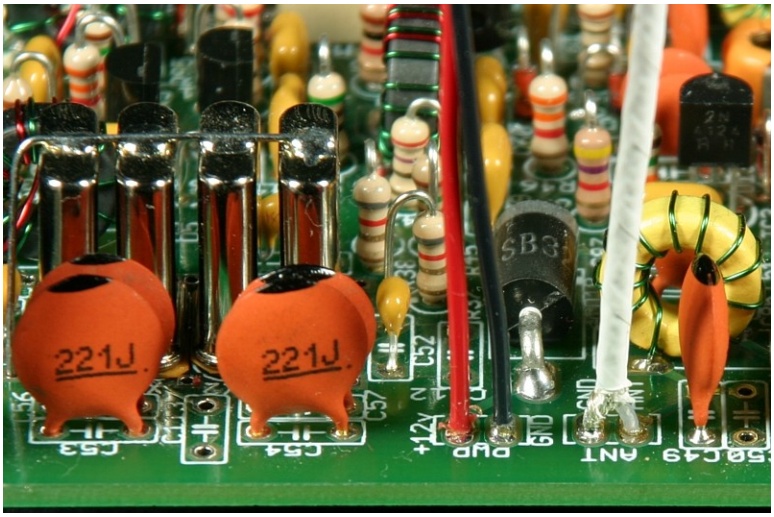
Your PCB should look like that shown in the next figure.



- Figure 53 -

[ ] ANT (ANR/GND) - Cut a 3 1/2 inch piece of RG-174 coaxial cable. Strip 5/16 inch of outer insulation from each end. Carefully unbraid the outer shield using a pointed tool such as a scribe and twist the strands tightly. Carefully tin the first 1/16 inch of the shield on either end. Strip 1/8 inch of insulation from the inner conductor on each end and carefully tin. Solder the outer shield to the ANT left pad and the inner conductor to the ANT right pad ***as viewed from the closest PCB edge.***

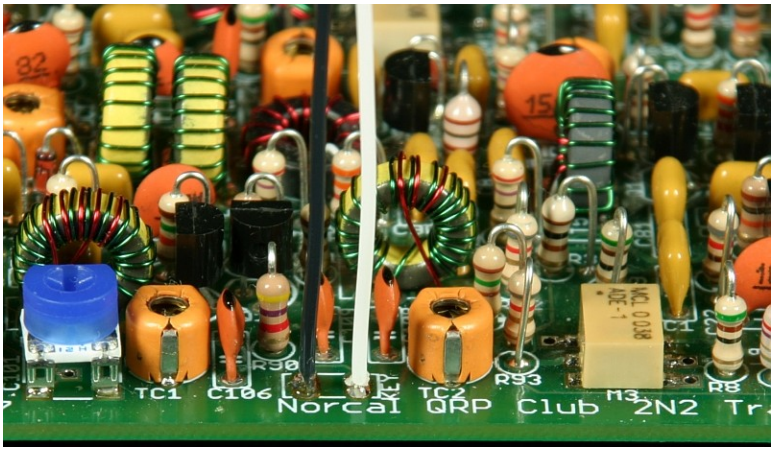
Your PCB should look like that shown in the next figure.



- Figure 54 -

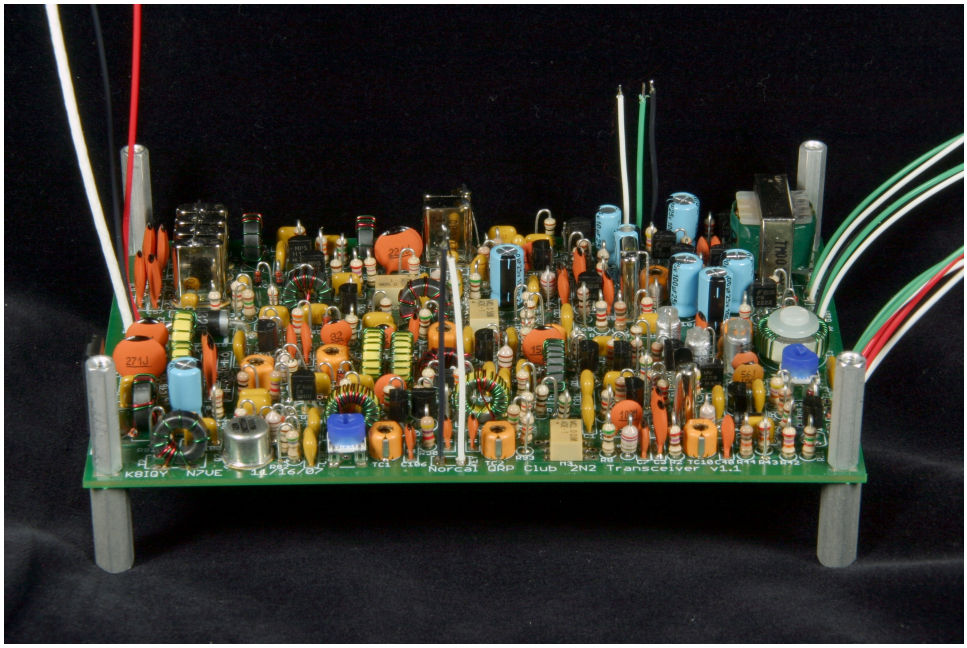
[ ] KEY (Key/Gnd) - Cut 2 inch pieces of wire in colors White and Black. Strip 1/8 inch of insulation from each end and carefully tin. Solder the Black wire to the KEY left pad and the White wire to the KEY right pad ***as viewed from the closest PCB edge.***

Your PCB should look like that shown in the next figure.



- Figure 55 -

Once all of the wires are installed on the PCB, it should look like that shown in the next figure.



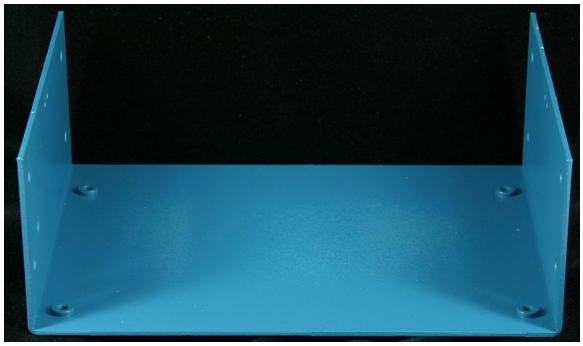
- Figure 56 -

Set the wired PCB aside for the moment while the case components are assembled.

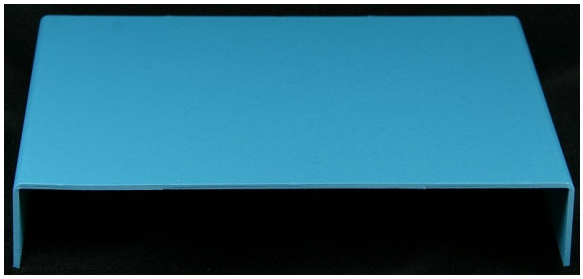
Case Component Assembly

The case is comprised of a bottom shell, top shell, front panel, and rear panel. The top and bottom shells are held together by a plastic latch system, allowing the top shell to be easily removed for access to the inside of the 2N2/XX rig. The front and rear panels contain all of the controls and connectors for the rig. Pem nuts are used to hold the PCB in the bottom shell and the front and rear panels to the bottom shell.

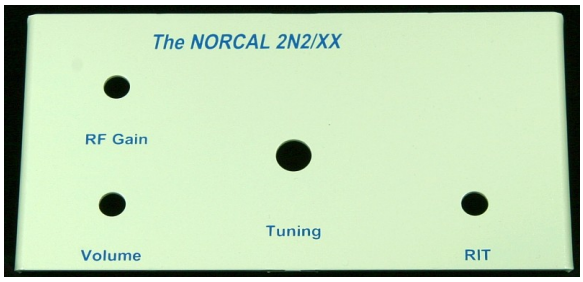
The case components are shown in this collection of photos.



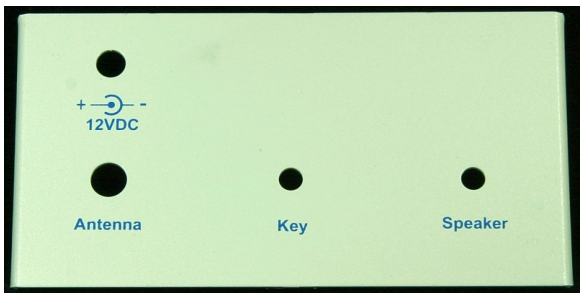
- Figure 57 -



- Figure 58 -

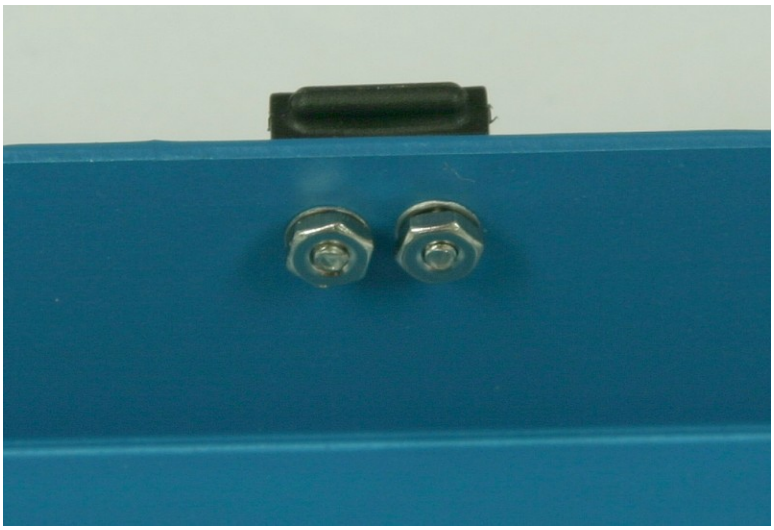


- Figure 59 -



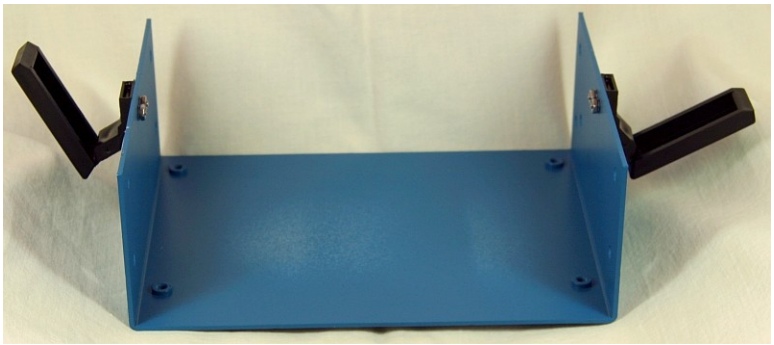
- Figure 60 -

[ ] Using 2-56 X 5/16 flat head screws, #2 internal tooth lock washers, and 2-56 hex nuts, secure the tab part of the latch assembly to each side of the top shell. The tab goes on the outside and with the protrusion on the tab extending beyond the top shell edge as shown in the detailed photo.



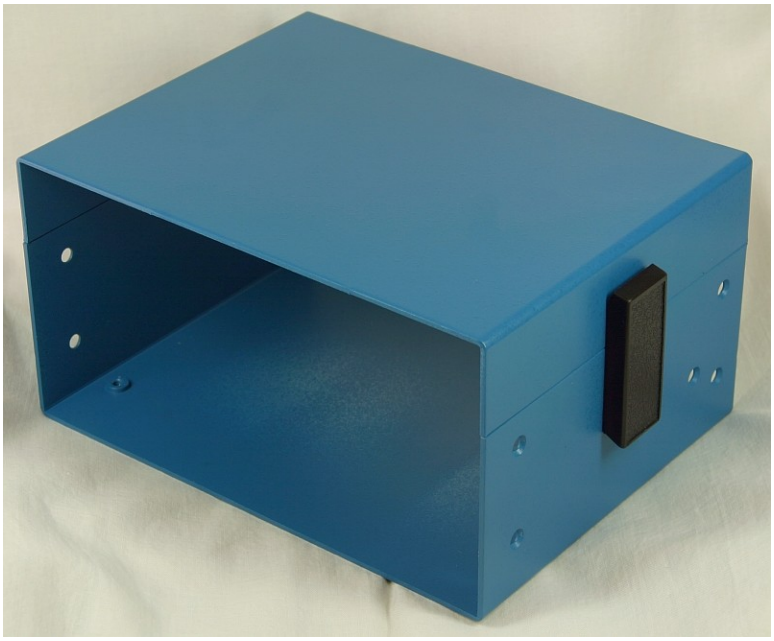
- Figure 61 -

[ ] Using 2-56 X 5/16 flat head screws, #2 internal tooth lock washers, and 2-56 hex nuts, secure the latch part of the latch assembly to each side of the bottom shell as shown in the photo.



- Figure 62 -

[ ] With the latch components installed on the bottom and top shell pieces, place the top on the bottom and test the latches to assure they are working properly. The next photo shows how the case will look if the latches are installed correctly.



- Figure 63 -

Put the completed case aside for now. It will be used again shortly, but next, the front panel will receive its controls and then be wired to the PCB. After that, the PCB will be installed in the case and the front panel screwed into place.

Front Panel Assembly

In the next steps, the controls for the front panel will be installed, the front panel controls wired, and the PCB and front panel installed into the bottom shell.

[ ] Before the Volume control (R80-marked as A10K) and RF Gain control (R77-marked as A1K) potentiometers are installed into the front panel, their shafts need to be shortened by 7/32 inch. Mark the shaft on each, hold the shaft in a vise, and cut the shaft to length with a fine-tooth hack saw. After making the cut, clean up the end of the shaft with a small mill file.

The next photo shows a modified potentiometer (lower) compared to one that is unaltered (upper).

- Figure 64 -

[ ] Install Volume control potentiometer R80 (marked A10K) into the front panel from the back side, put on the washer, and then the hex nut. Tighten the control finger tight, as it needs to be able to rotate for ease of wiring later on.

[ ] Repeat the above process with RF Gain control potentiometer R77 (marked A1K)

[ ] Repeat the above process with RIT control potentiometer R53 (marked B1K)

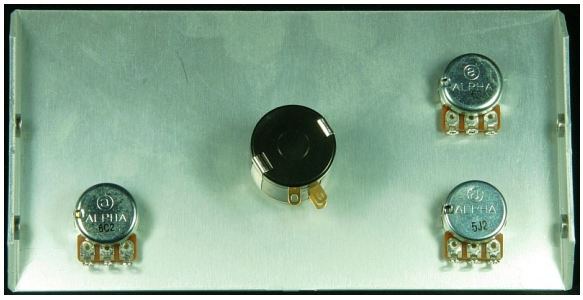
[ ] Install the 10-turn Tuning potentiometer R54 by putting the internal tooth lock washer on the shaft, inserting into the panel from the back side, and then adding the hex nut on the panel front side . As before, tighten only finger tight so that the control can be rotated for ease of wiring.

The front panel should look like the next two photos.

Front View

- Figure 65 -

Rear View



- Figure 66 -

Front Panel Wiring

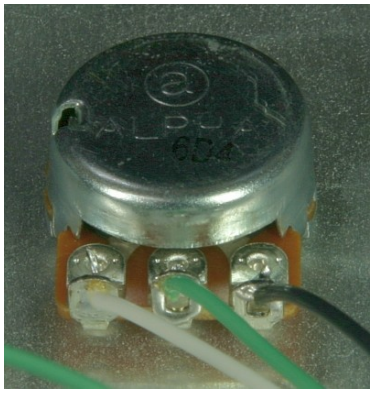
In the next steps, the front panel will be wired to the PCB.

[ ] With the PCB and front panel laying face down and aligned side to side with the PCB, begin by soldering the wires from the Volume pads to the Volume control potentiometer. Use a pair of the small supplied knobs under the top edge of the front panel to stabilize it. The Volume

control potentiometer should be rotated so that the wires reach it equally. Use the photographs as a reference in soldering the correctly colored wire to each potentiometer terminal.

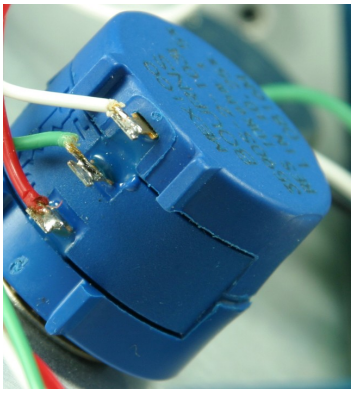
- Figure 67 -

[ ] Next, solder the wires from the RF Gain pads to the RF Gain control potentiometer. Use the photograph as a reference in soldering the correctly colored wire to each potentiometer terminal.



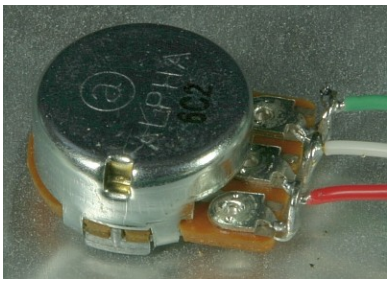
- Figure 68 -

[ ] Solder the wires from the Tuning pads to the 10-turn Tuning potentiometer. Use the photograph as a reference in soldering the correctly colored wire to each potentiometer terminal.



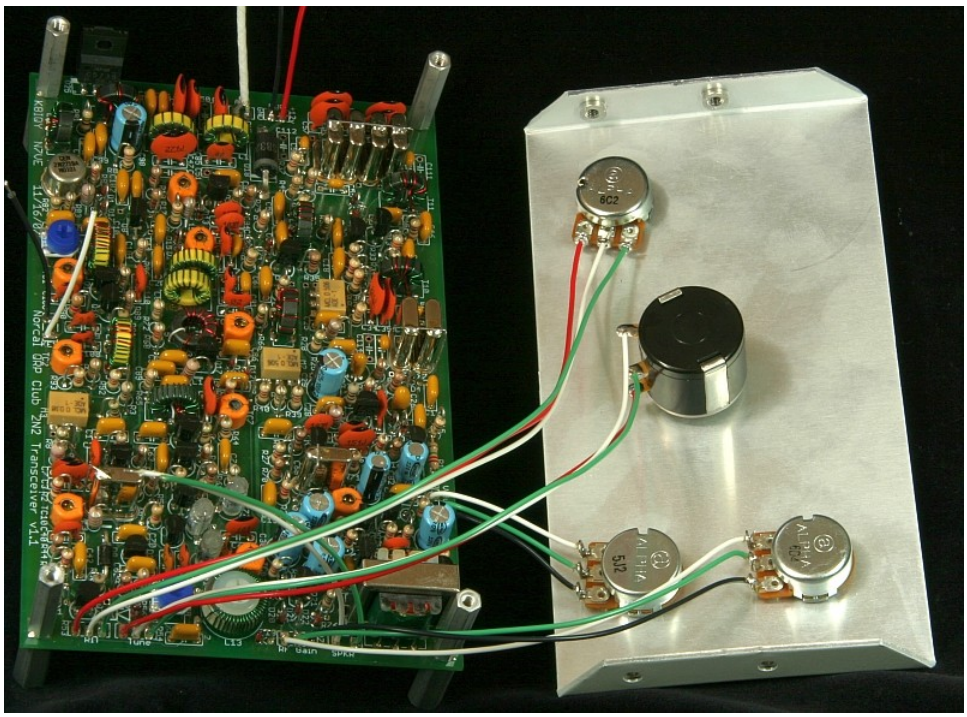
- Figure 69 -

[ ] Next, solder the wires from the RIT pads to the RIT control potentiometer. Use the photograph as a reference in soldering the correctly colored wire to each potentiometer terminal.



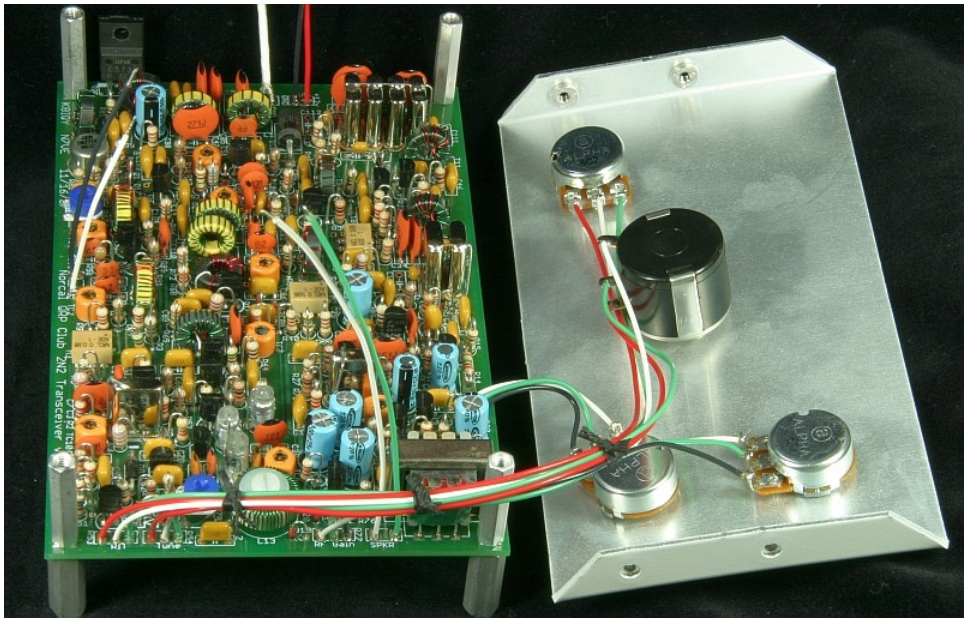
- Figure 70 -

With all of the wire sets correctly soldered to their respective potentiometers, the PCB-Front Panel assembly should look like the next photo.



- Figure 71 -

[ ] This next step is optional, but one that will improve the assembly appearance of the finished rig. If done at this stage of the assembly, it will be easier. Using wide waxed nylon dental tape or preferably lacing cable, do some lacing together of the control wires from the various potentiometers back to the PCB. The arrangement is not critical, except for the Volume control potentiometer. The lacing should not include this control as there are audio signals on the wires; the remaining controls only have DC voltages on them. The next photo shows an example of a suggested lacing method.



- Figure 72 -

Installing the PCB and Front Panel into Case Bottom Shell

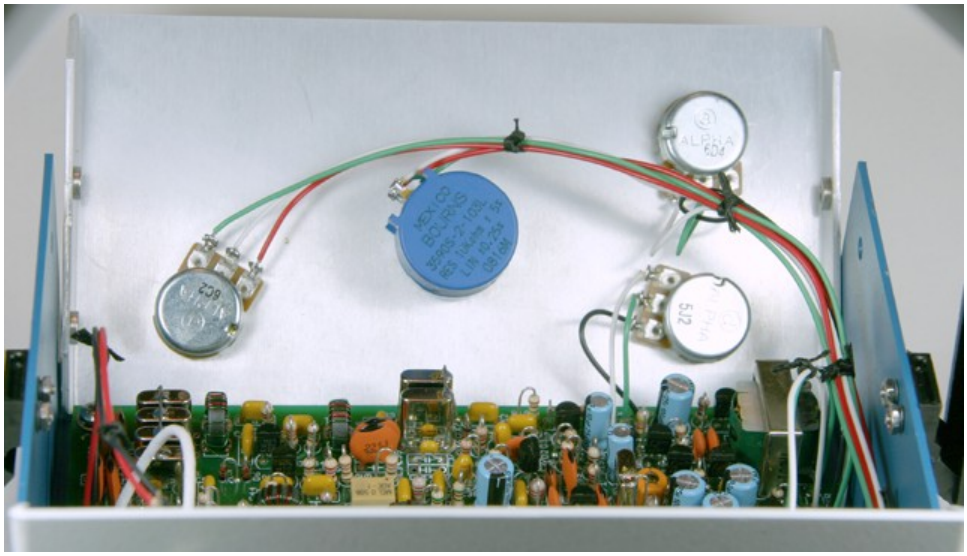
The next several steps will result in the PCB being mounted to the bottom case shell and the front panel being screwed into place on the front of the bottom case shell.

[ ] Begin by removing all of the standoffs from the four corners of the PCB

[ ] Using four 4-40 X 5/16 inch pan head screws, #4 internal tooth lock washers, and 1/8 X 3/16 inch spacers, mount the PCB to the bottom of the case. The PCB is oriented such that the final transistor is on the side of the case bottom where it will be secured in a later step. Place the spacers on top of the pem nuts, then place the PCB down on the spacers, and carefully insert a screw with a lock washer through a PCB mounting hole and into the pem nut. Tighten each screw only finger tight at this point so that small adjustments can still be made.

[ ] Place the 1/8 X 1/2 X 1 inch spacer between the final transistor tab and the case wall. Using a 4-40 X 1/2 inch flat head screw, #4 internal tooth lock washer, and 4-40 hex nut, secure the final transistor to the case wall.

[ ] Once the transistor mounting screw is tight, tighten the PCB corner mounting screws. The assembly should look like the next photo.

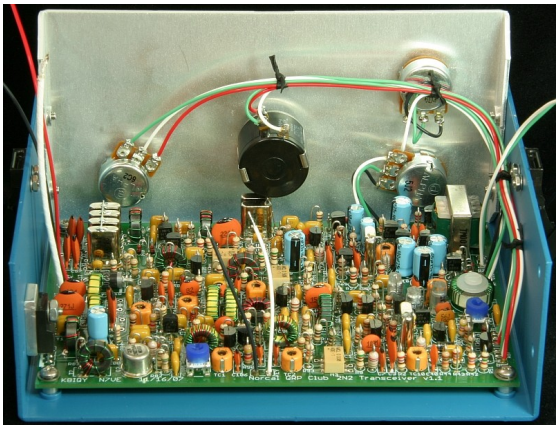


- Figure 73 -

[ ] Using four 4-40 X 1/4 inch flat head screws, mount the front panel to the bottom case shell.

[ ] When the front panel is in place, rotate the potentiometers to optimize the layout of the wiring going to them. Then, tighten the nuts that hold the potentiometers so that they are snug. Additional cable lacing can be done at this point to hold the front panel wiring in place. The assembly should look like the next photos.

Front Panel from Inside



- Figure 74 -

Front Panel from Front

- Figure 75 -

Rear Panel Assembly

In the section, the rear panel connectors will be installed.

[ ] Install a 1/8 inch stereo jack in the hole marked "Speaker". When viewed from the back side of the panel, orient the lug on the side of the jack toward the right.

[ ] Install another 1/8 inch stereo jack in the hole marked "Key". When viewed from the back side of the panel, also orient the lug on the side of this jack toward the right.

[ ] Install a BNC connector in the hole marked "Antenna". To install this connector, push the connector through the panel hole, place the wire lug over the back of the connector, put on the internal tooth lock washer, and follow this with the hex nut. Tighten the assembly with the wire lug pointing to the left when viewed from the back of the panel. Pry the wire lug up so that it is oriented at about 60 degrees to the panel surface.

[ ] Finally, install the coaxial power connector in the hole marked "12VDC". The lugs on this connector should be oriented so that they are left, down, and right when viewed from the back of the panel.

When all of the connectors are installed, the rear panel should look like the next two photos.

Rear Panel from Rear

- Figure 76 -

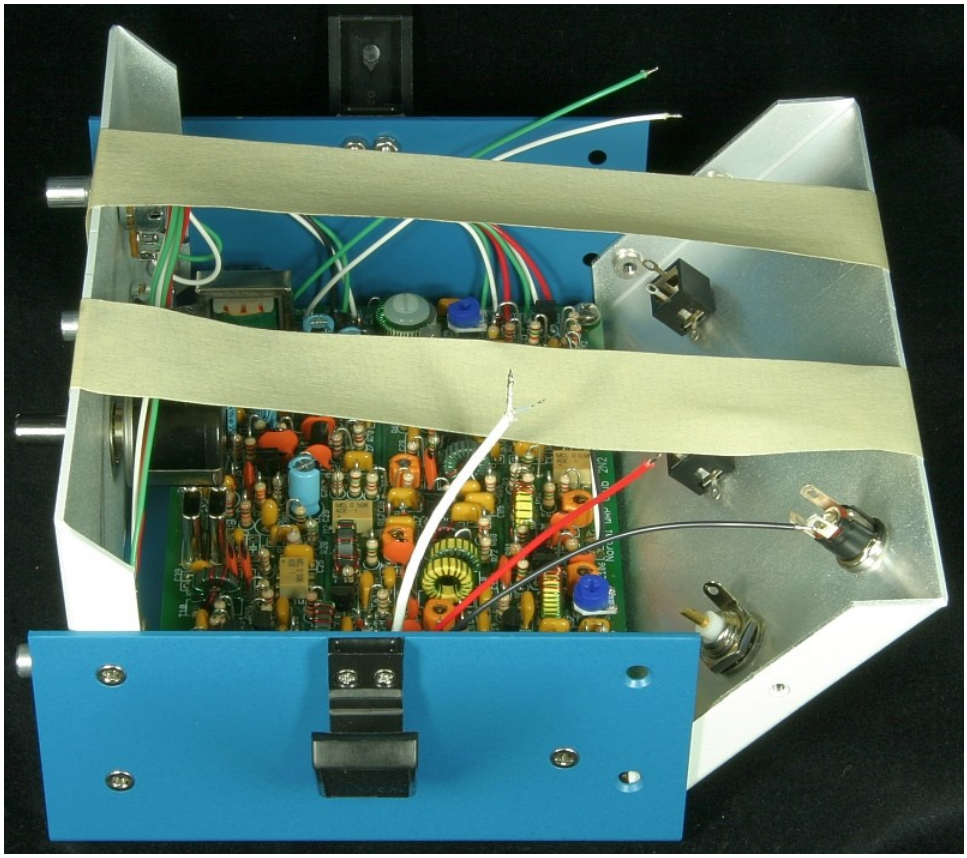
Rear Panel from Front

- Figure 77 -

Installing the Rear Panel into Case Bottom Shell

The next several steps will result in the rear panel being wired and screwed into place on the rear of the bottom case shell.

[ ] Place the rear panel against the PCB at an angle of about 45 degrees. With the panel held in this position, tape in place with two strips of masking tape to hold it so that the wires to the rear panel can be soldered more easily. The next photo shows this setup.



- Figure 78 -

[ ] Following the details shown in the next photograph, solder the green and white wires coming from the "SPKR" pads to the "Speaker" stereo connector. The white wire is soldered to the left lug and the green wire to the right lug as viewed from the front.

[ ] Next, solder the black and white wires coming from the "Key" pads to the "Key" stereo connector. The white wire is soldered to the left lug and the black wire to the right lug as viewed from the front.

[ ] Solder the center conductor of the coax coming from the "ANT" pads to the center pin of the "Antenna" BNC connector. Solder a short length of solid wire (a discarded component lead) to the ground lug of the BNC connector. Position this wire to be parallel to the coax shield lead and cut it to an appropriate length so that it overlaps the shield lead. Solder the coax shield lead and the ground extension lead together.

[ ] Finally, solder the red and black wires coming from the "PWR" pads to the "12VDC" coaxial power connector. The black lead is soldered to the center lug and the red lead is soldered to the right lug.

[ ] If you did some lacing of the component leads on the front panel, do the same on the rear panel.

[ ] Remove the masking tape supports. The rear panel should look as shown in the next photo.

- Figure 79 -

[ ] Screw the rear panel to the case using 4-40 X 1/4 inch flat head screws. As the panel is being moved into position, route the wires so they are not close to components that have RF signals on them, such as coils or trimmers, as shown in the next photo.

- Figure 80 -

Final Assembly

These steps complete the assembly of the 2N2/XX.

[ ] Install small knobs on the RF Gain, Volume, and RIT control potentiometers and the large knob on the Tuning potentiometer.

[ ] Install the 4 rubber feet on the bottom of the case near the corners.

[ ] Set the case top on the bottom case assembly, engage the latch tabs, and latch the top to the bottom. Your 2N2/XX should look like the one in this last photo!

- Figure 81 -

Congratulation on the successful built of your NORCAL 2N2/XX. We hope you have enjoyed the building experience, will use the rig often, and enjoy it for many years.

2N2/XX Appendix

This part of the assembly manual contains specifications, a parts placement diagram, and the schematic diagrams for each of the available bands. **Make sure you are using the correct schematic for the band you are building.** There are significant part value differences among the three bands, therefore, you must use the correct schematic to successfully complete your 2N2/XX rig.

2N2/XX Features

All discrete component, through-hole (except mixers) design.

Analog through-out; very low noise.

100 KHz band coverage (50 KHz on 30-meters).

10-turn potentiometer for tuning ease.

500 Hz, 6-pole, non-ringing crystal filter.

"Thumpless" QSK keying.

Receiver Incremental Tuning (RIT).

5-watt output on all bands.

2N2/XX Specifications

Sensitivity (MDS): > -120 dBm (-128 dBm on 20 meters, typical).

Opposite Sideband Rejection: > 80 dB.

IF Rejection: > 50 dB.

Image Rejection: > 70 dB.

Intermodulation Dynamic Range (IMDR): > 90 dB.

Input 3rd Order Intercept (IP3): > 8 dB.

Blocking Dynamic Range (BDR): > 105 dB.

Receive current ~ 180 milliamperes.

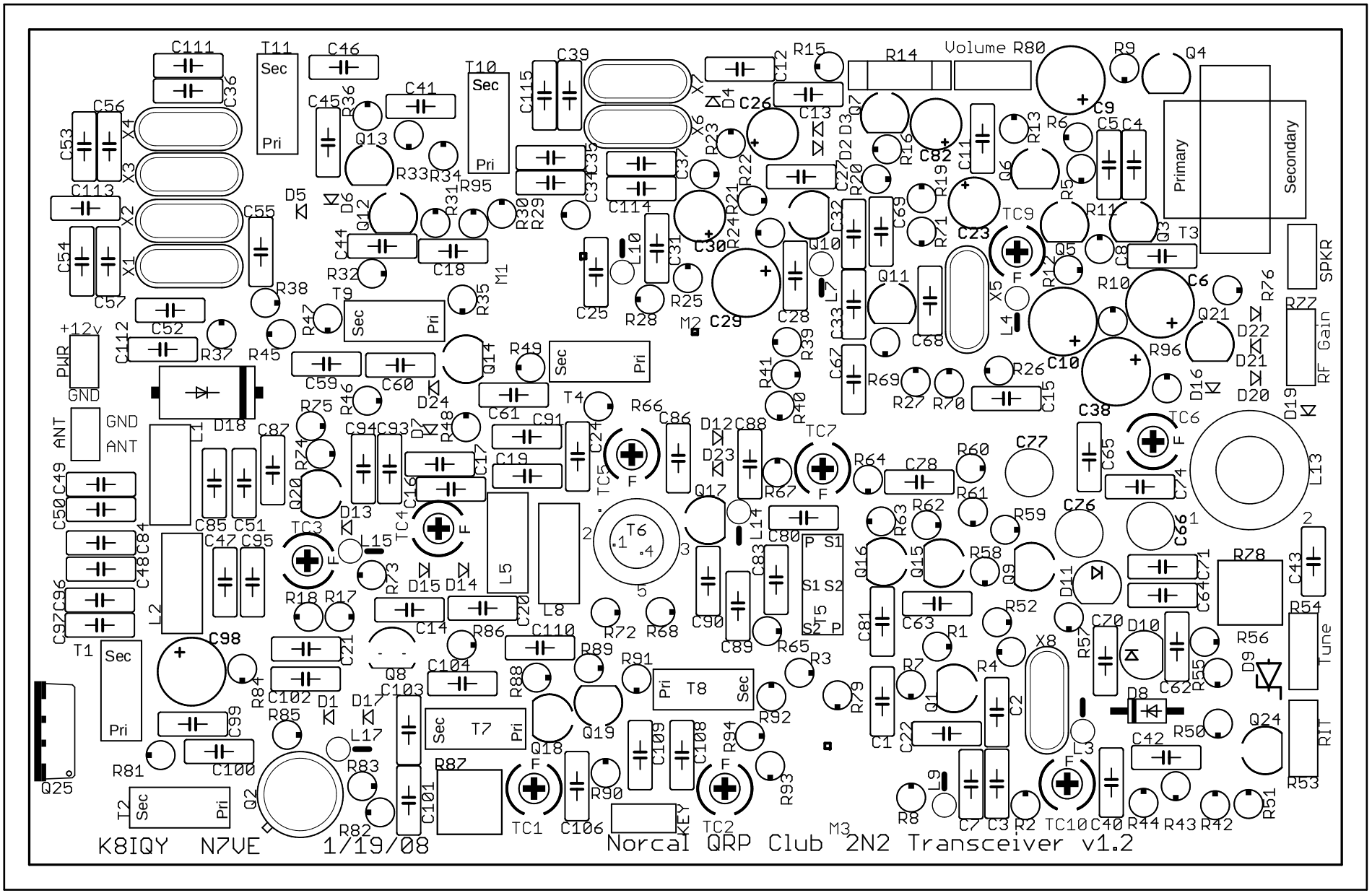
Transmit current ~ 800 milliamperes (5-watts output).

Design Tuning Range for Each Band

Band	VFO Low	VFO High	IF Frequency	Band Low	Band High
20 Meters	3.0000 MHz	3.1000 MHz	11.0000 MHz	14.000 MHz	14.100 MHz
30 Meters	2.7272 MHz	2.7772 MHz	7.3728 MHz	10.100 MHz	10.150 MHz
40 Meters	2.0848 MHz	2.1848 MHz	4.9152 MHz	7.000 MHz	7.100 MHz

The above chart shows the nominal VFO tuning ranges and IF frequencies for each band. However, the IF filter passband center in the 2N2/XX rigs actually fall just a bit higher than the IF frequencies shown, typically 500 to 600 Hz higher. What that means is that the VFO frequencies shown may have to be increased by a small amount to achieve the correct band operating frequencies as shown in the chart.

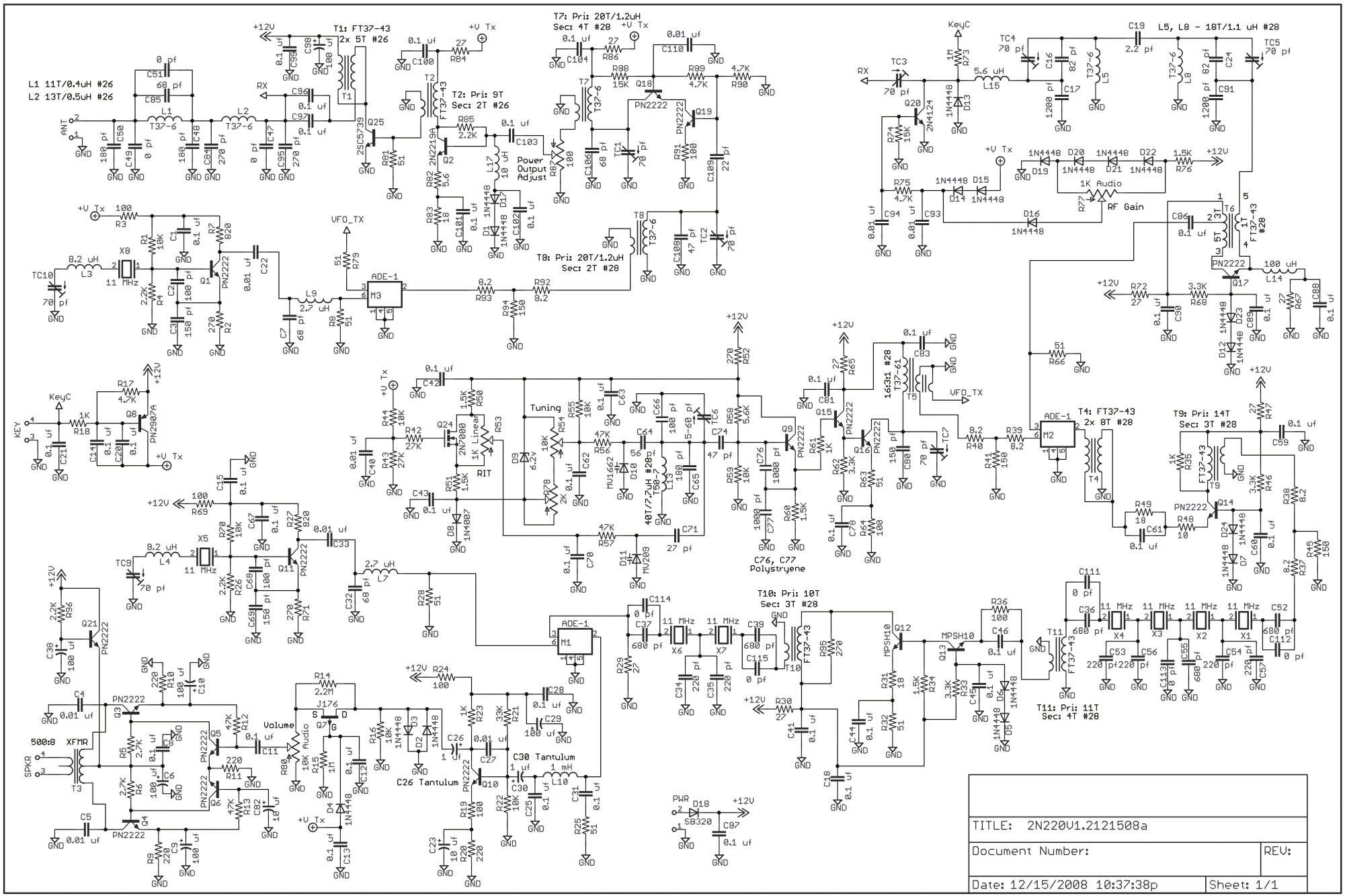
2N2/XX V1.2
PCB Overlay



21 Jan 2008

NorCal 2N2/XX V1.2.10 20 Meter Parts List

Sort	Qty	Part Value	Part Name	Part Type	Part Number	Part Supplier
1	8	0 pf	C47, C49, C51, C111, C112, C113, C114, C115	Ceramic Capacitor NPO	Not Used	
2	1	2.2 pf	C19	Ceramic Capacitor NPO	140-50N5-2R2C-TB-RC	Mouser
3	1	22 pf	C109	Ceramic Capacitor NPO	140-50N5-220J-TB-RC	Mouser
4	1	27 pf	C71	Ceramic Capacitor NPO	140-50N5-270J-TB-RC	Mouser
5	2	47 pf	C74, C108	Ceramic Capacitor NPO	140-50N5-470J-TB-RC	Mouser
6	1	56 pf	C64	Ceramic Capacitor NPO	140-50N5-560J-TB-RC	Mouser
7	4	68 pf	C7, C32, C85, C106	Ceramic Capacitor NPO	140-50N5-680J-TB-RC	Mouser
8	2	82 pf	C16, C24	Ceramic Capacitor NPO	140-50N5-820J-TB-RC	Mouser
9	3	100 pf	C2, C66, C68	Ceramic Capacitor NPO	140-50N5-101J-TB-RC	Mouser
10	3	150 pf	C3, C69, C80	Ceramic Capacitor NPO	140-50N5-151J-TB-RC	Mouser
11	3	180 pf	C48, C50, C65	Ceramic Capacitor NPO	140-50N5-181J-TB-RC	Mouser
12	6	220 pf	C34, C35, C53, C54, C56, C57	Ceramic Capacitor NPO	140-50N5-221J-TB-RC	Mouser
13	2	270 pf	C84, C95	Ceramic Capacitor NPO	140-50N5-271J-TB-RC	Mouser
14	5	680 pf	C36, C37, C39, C52, C55	Ceramic Capacitor NPO	80C322C681J2G	Mouser
15	2	1000 pf	C76, C77	Polystyrene Capacitor	23PS210	Mouser
16	2	1200 pf	C17, C91	Ceramic Capacitor NPO	80C322C122J2G	Mouser
17	9	0.01 uf	C4, C5, C22, C27, C33, C40, C93, C94, C110	Ceramic Capacitor X7R	80-C317C103K5R	Mouser
18	42	0.1 uf	C1, C8, C11, C12, C13, C14, C15, C18, C20, C21, C25, C28, C31, C41, C42, C43, C44, C45, C46, C59, C60, C61, C62, C63, C67, C70, C78, C81, C83, C86, C87, C88, C89, C90, C96, C97, C99, C100, C101, C102, C103, C104	Ceramic Capacitor X7R	80-C322C104K5R	Mouser
19	2	1 uf	C26, C30	Tantalum Capacitor	80-T350A105K035AT	Mouser
20	2	10 uf	C23, C82	Electrolytic Capacitor	140-XRL25V10-RC	Mouser
21	6	100 uf	C6, C9, C10, C29, C38, C98	Electrolytic Capacitor	140-XRL25V100-RC	Mouser
22						
23	19	1N4448	D1, D2, D3, D4, D5, D6, D7, D12, D13, D14, D15, D16, D17, D19, D20, D21, D22, D23, D24	Signal Diode	512-1N4448TR	Mouser
24	1	MV1662	D10	Tuning Diode	MV1662	Hosfelt Electronics
25	1	MV209	D11	Tuning Diode	863-MV209G	Mouser
26	1	SB320	D18	Power Diode	625-SB320	Mouser
27	1	1N4007	D8	Power Diode	625-1N4007-E3	Mouser
28	1	1N4735A	D9	Zener Diode 6.2V	512-1N4735A	Mouser
29						
30	4	T37-6	L1, L2, L5, L8	Toroid Core (Yellow)		Micro Metals
31	1	T50-7	L13	Toroid Core (White)		Micro Metals
32	2	2.7 uH	L7, L9	Molded Inductor	434-22-2R7	Mouser
33	1	5.6 uH	L15	Molded Inductor	434-22-5R6	Mouser
34	2	8.2 uH	L3, L4	Molded Inductor	434-22-8R2	Mouser
35	1	10 uH	L17	Molded Inductor	434-22-100	Mouser
36	1	100 uH	L14	Molded Inductor	434-22-101	Mouser
37	1	1 mH	L10	Molded Inductor	434-22-102	Mouser
38						
39	3	ADE-1	M1, M2, M3	Mixer	ADE-1	MiniCircuits
40						
41	15	PN2222	Q1, Q3, Q4, Q5, Q6, Q9, Q10, Q11, Q14, Q15, Q16, Q17, Q18, Q19, Q21	NPN TO92	512-PN2222ABU	Mouser
42	2	MPSH10	Q12, Q13	NPN TO92	863-MPSH10G	Mouser
43	1	2N2219A	Q2	NPN TO39	511-2N2219A	Mouser
44	1	2N4124	Q20	NPN TO92	512-2N4124BU	Mouser
45	1	2N7000	Q24	MOSFET TO92	512-2N7000	Mouser
46	1	2SC5739	Q25	NPN TO220	2SC57390P-ND	DigiKey
47	1	J176	Q7	JFET TO92	512-J176	Mouser
48	1	PN2907A	Q8	PNP TO92	512-PN2907ABU	Mouser
49						
50	1	5.6	R82	Resistor ¼ watt	660-CF1/4C5R6J	Mouser
51	6	8.2	R37, R38, R39, R40, R92, R93	Resistor ¼ watt	660-CF1/4C8R2J	Mouser
52	1	10	R48	Resistor ¼ watt	660-CF1/4C100J	Mouser
53	3	18	R31, R49, R83	Resistor ¼ watt	660-CF1/4C180J	Mouser
54	8	27	R29, R30, R47, R65, R67, R72, R84, R86	Resistor ¼ watt	660-CF1/4C270J	Mouser
55	8	51	R8, R25, R28, R32, R63, R66, R79, R81	Resistor ¼ watt	660-CF1/4C510J	Mouser
56	7	100	R3, R19, R24, R36, R64, R69, R91	Resistor ¼ watt	660-CF1/4C101J	Mouser
57	3	150	R41, R45, R94	Resistor ¼ watt	660-CF1/4C151J	Mouser
58	4	220	R9, R10, R11, R20	Resistor ¼ watt	660-CF1/4C221J	Mouser
59	4	270	R2, R52, R71, R95	Resistor ¼ watt	660-CF1/4C271J	Mouser
60	2	820	R7, R27	Resistor ¼ watt	660-CF1/4C821J	Mouser
61	4	1K	R18, R23, R35, R61	Resistor ¼ watt	660-CF1/4C102J	Mouser
62	5	1.5K	R34, R50, R51, R60, R76	Resistor ¼ watt	660-CF1/4C152J	Mouser
63	4	2.2K	R4, R26, R85, R96	Resistor ¼ watt	660-CF1/4C222J	Mouser
64	2	2.7K	R5, R6	Resistor ¼ watt	660-CF1/4C272J	Mouser
65	4	3.3K	R33, R46, R62, R68	Resistor ¼ watt	660-CF1/4C332J	Mouser
66	4	4.7K	R17, R75, R89, R90	Resistor ¼ watt	660-CF1/4C472J	Mouser
67	1	5.6K	R58	Resistor ¼ watt	660-CF1/4C562J	Mouser
68	7	10K	R1, R16, R22, R44, R55, R59, R70	Resistor ¼ watt	660-CF1/4C103J	Mouser
69	2	15K	R74, R88	Resistor ¼ watt	660-CF1/4C153J	Mouser
70	2	27K	R42, R43	Resistor ¼ watt	660-CF1/4C273J	Mouser
71	1	33K	R21	Resistor ¼ watt	660-CF1/4C333J	Mouser
72	4	47K	R12, R13, R56, R57	Resistor ¼ watt	660-CF1/4C473J	Mouser
73	2	1M	R15, R73	Resistor ¼ watt	660-CF1/4C105J	Mouser
74	1	2.2M	R14	Resistor ¼ watt	660-CF1/4C225J	Mouser
75						
76	1	1K	R53	Potentiometer Linear Ctr Detent	313-2000F-1K	Mouser
77	1	1K	R77	Potentiometer Audio	31JA301-F	Mouser
78	1	10K	R80	Potentiometer Audio	31JA401-F	Mouser
79	1	10K	R54	Potentiometer Linear 10-turn	652-3590S-2-103L	Mouser
80						
81	1	100	R87	Trimmer Potentiometer	652-3318F-1-101	Mouser
82	1	2K	R78	Trimmer Potentiometer	652-3318F-1-202	Mouser
83						
84	2	T37-6	T7, T8	Toroid Core (Yellow)		Micro Metals
85	7	FT37-43	T1, T2, T4, T6, T9, T10, T11	Toroid Core (Shiny Gray)		Micro Metals
86	1	FT37-61	T5	Toroid Core (Dull Gray)		Micro Metals
87	1	Audio Transformer	T3	500CT:8 Ohm	42TM001-RC	Mouser
88						
89	1	5-60 pf NPO	TC6	Trimmer Capacitor	81-TZ03Z500F169B00	Mouser
90	8	70 pf	TC1, TC2, TC3, TC4, TC5, TC7, TC9, TC10	Trimmer Capacitor	659-GKG70015	Mouser
91						
92	8	11.0000 MHz	X1, X2, X3, X4, X5, X6, X7, X8	Crystal	559-FOX111-LF	Mouser
93						
94	2	Connector	3.5 mm (1/8 inch)	Stereo Phone Jack	161-3402-E	Mouser
95	1	Connector	2.1 mm center pin	Power Jack	163-4304-E	Mouser
96	1	Connector	With ground lug	BNC Panel Mount	161-9323	Mouser
97			Note: BNC Panel Mount from Hosfelt Electronics		952	Hosfelt Electronics
98						
99	2	Hardware		Test Point Terminal	534-1035	Mouser
100	1	Hardware	4-40 thread, 1 inch length	Nylon Screw	561-P440-1	Mouser
101	1	Hardware	4-40 thread	Nylon Nut	561-G440	Mouser
102	2	Hardware	8-32 thread	Shoulder Washer	561-SW8	Mouser
103	4	Hardware	½ inch X ¼ inch	Square Tapered Bumper	517-SJ-5023BK	Mouser
104	1	Hardware	1.39" inch diameter	Black Knob	450-2039-GRX	Mouser
105	3	Hardware	0.77 inch diameter	Black Knob	450-2035-GRX	Mouser
106	4	Hardware	4-40 thread, 1 inch length	Female Threaded Standoff	91780A167	McMaster-Carr
107	4	Hardware	4-40 thread, 1 inch length	Male-Female Threaded Standoff	93505A436	McMaster-Carr
108	2	Hardware	Note: 10 units/package	Polypropylene Draw Latch	1891A48	McMaster-Carr
109	8	Hardware	2-56 thread, 5/16 inch length, Note: 100/package	Flat Head Machine Screw	91771A078	McMaster-Carr
110	8	Hardware	#2 internal tooth lock washer, Note: 100/package	Lock Washer	98449A500	McMaster-Carr
111	8	Hardware	2-56 thread, Note: 100/package	Hex Nut	91841A003	McMaster-Carr
112	1	Hardware	4-40 thread, ½ inch length, Note: 100/package	Flat Head Machine Screw	91771A110	McMaster-Carr
113	5	Hardware	#4 internal-tooth lock washer, Note: 100/package	Lock Washer	98449A510	McMaster-Carr
114	1	Hardware	4-40 thread, Note: 100/package	Hex Nut	91841A005	McMaster-Carr
115	8	Hardware	4-40 thread, ¼ inch length, Note: 100/package	Flat Head Machine Screw	91771A106	McMaster-Carr
116	4	Hardware	4-40 thread, 5/16 inch length, Note: 100/package	Pan Head Machine Screw	91772A107	McMaster-Carr
117	4	Hardware	#4, 1/8 inch length, unthreaded round spacer, Note: 10/package	Aluminum Spacer	92510A688	McMaster-Carr
118	1	Hardware		Case	NorCal 2N2/XX	TenTec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L2 13T/0.5uH #26
T1: FT37-43
2x 5T #26
T2: Pri: 9T
Sec: 2T #26
T7: Pri: 20T/1.2uH
Sec: 4T #28
T8: Pri: 20T/1.2uH
Sec: 2T #28
Power Output Adjust
1K Audio
RF Gain
T4: FT37-43
2x 8T #28
T9: Pri: 14T
Sec: 3T #28
T10: Pri: 10T
Sec: 3T #28
T11: Pri: 11T
Sec: 4T #28
C76, C77 Polystryene
C26 Tantulum
C30 Tantulum
Volume
RIT
Tuning
500:8 XFMR
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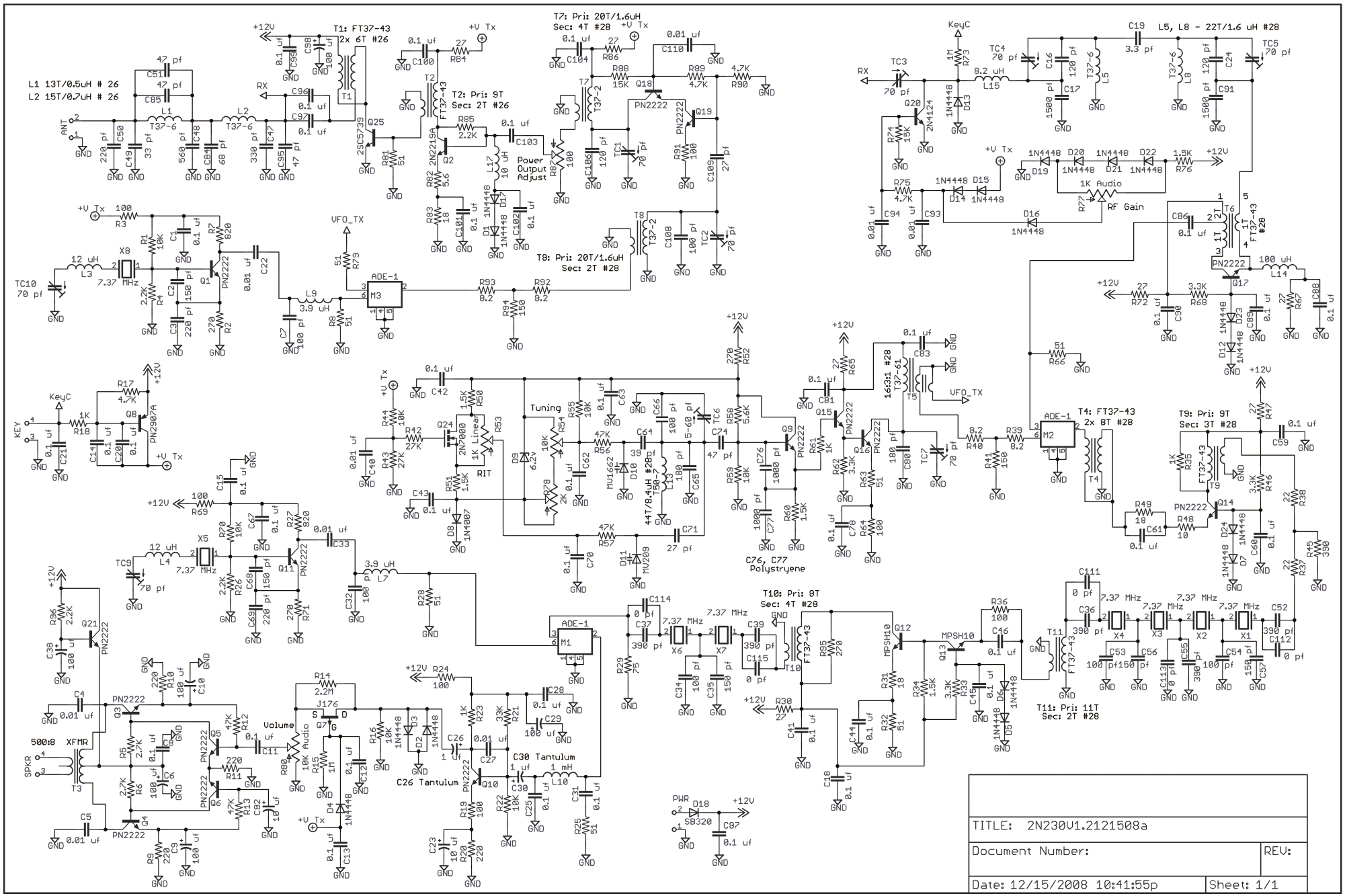
Sheet: 1/1

NorCal 2N2/XX V1.2.10 30 Meter Parts List

Sort	Qty	Part Value	Part Name	Part Type	Part Number	Part Supplier
1	5	0 pf	C111, C112, C113, C114, C115	Ceramic Capacitor NPO	Not Used	
2	1	3.3 pf	C19	Ceramic Capacitor NPO	81-RPE5C2A3R3C2P1B03	Mouser
3	2	27 pf	C71, C109	Ceramic Capacitor NPO	140-50N5-270J-TB-RC	Mouser
4	1	33 pf	C49	Ceramic Capacitor NPO	140-50N5-330J-TB-RC	Mouser
5	1	39 pf	C64	Ceramic Capacitor NPO	140-50N5-390J-TB-RC	Mouser
6	4	47 pf	C51, C74, C85, C95	Ceramic Capacitor NPO	140-50N5-470J-TB-RC	Mouser
7	1	68 pf	C84	Ceramic Capacitor NPO	140-50N5-680J-TB-RC	Mouser
8	7	100 pf	C7, C32, C34, C53, C54, C66, C108	Ceramic Capacitor NPO	140-50N5-101J-TB-RC	Mouser
9	3	120 pf	C16, C24, C106	Ceramic Capacitor NPO	140-50N5-121J-TB-RC	Mouser
10	5	150 pf	C2, C35, C56, C57, C68	Ceramic Capacitor NPO	140-50N5-151J-TB-RC	Mouser
11	2	180 pf	C65, C80	Ceramic Capacitor NPO	140-50N5-181J-TB-RC	Mouser
12	3	220 pf	C3, C50, C69	Ceramic Capacitor NPO	140-50N5-221J-TB-RC	Mouser
13	1	330 pf	C47	Ceramic Capacitor NPO	80-C322C331J2G	Mouser
14	5	390 pf	C36, C37, C39, C52, C55	Ceramic Capacitor NPO	80-C322C391J2G	Mouser
15	1	560 pf	C48	Ceramic Capacitor NPO	80-C322C561J2G	Mouser
16	2	1000 pf	C76, C77	Polystyrene Capacitor	23PS210	Mouser
17	2	1500 pf	C17, C91	Ceramic Capacitor NPO	80-C322C152J2G	Mouser
18	9	0.01 uf	C4, C5, C22, C27, C33, C40, C93, C94, C110	Ceramic Capacitor X7R	80-C317C103K5R	Mouser
19	42	0.1 uf	C1, C8, C11, C12, C13, C14, C15, C18, C20, C21, C25, C28, C31, C41, C42, C43, C44, C45, C46, C59, C60, C61, C62, C63, C67, C70, C78, C81, C83, C86, C87, C88, C89, C90, C96, C97, C99, C100, C101, C102, C103, C104	Ceramic Capacitor X7R	80-C322C104K5R	Mouser
20	2	1 uf	C26, C30	Tantalum Capacitor	80-T350A105K035AT	Mouser
21	2	10 uf	C23, C82	Electrolytic Capacitor	140-XRL25V10-RC	Mouser
22	6	100 uf	C6, C9, C10, C29, C38, C98	Electrolytic Capacitor	140-XRL25V100-RC	Mouser
23						
24	19	1N4448	D1, D2, D3, D4, D5, D6, D7, D12, D13, D14, D15, D16, D17, D19, D20, D21, D22, D23, D24	Signal Diode	512-1N4448TR	Mouser
25	1	MV1662	D10	Tuning Diode	MV1662	Hosfelt Electronics
26	1	MV209	D11	Tuning Diode	863-MV209G	Mouser
27	1	SB320	D18	Power Diode	625-SB320	Mouser
28	1	1N4007	D8	Power Diode	625-1N4007-E3	Mouser
29	1	1N4735A	D9	Zener Diode 6.2V	512-1N4735A	Mouser
30						
31	4	T37-6	L1, L2, L5, L8	Toroid Core (Yellow)		Micro Metals
32	1	T50-7	L13	Toroid Core (White)		Micro Metals
33	2	3.9 uH	L7, L9	Molded Inductor	434-22-3R9	Mouser
34	1	8.2 uH	L15	Molded Inductor	434-22-8R2	Mouser
35	1	10 uH	L17	Molded Inductor	434-22-100	Mouser
36	2	12 uH	L3, L4	Molded Inductor	434-22-120	Mouser
37	1	100 uH	L14	Molded Inductor	434-22-101	Mouser
38	1	1 mH	L10	Molded Inductor	434-22-102	Mouser
39						
40	3	ADE-1	M1, M2, M3	Mixer	ADE-1	MiniCircuits
41						
42	15	PN2222	Q1, Q3, Q4, Q5, Q6, Q9, Q10, Q11, Q14, Q15, Q16, Q17, Q18, Q19, Q21	NPN TO92	512-PN2222ABU	Mouser
43	2	MPSH10	Q12, Q13	NPN TO92	863-MPSH10G	Mouser
44	1	2N2219A	Q2	NPN TO39	511-2N2219A	Mouser
45	1	2N4124	Q20	NPN TO92	512-2N4124BU	Mouser
46	1	2N7000	Q24	MOSFET TO92	512-2N7000	Mouser
47	1	2SC5739	Q25	NPN TO220	2SC57390P-ND	DigiKey
48	1	J176	Q7	JFET TO92	512-J176	Mouser
49	1	PN2907A	Q8	PNP TO92	512-PN2907ABU	Mouser
50						
51	1	5.6	R82	Resistor ¼ watt	660-CF1/4C5R6J	Mouser
52	4	8.2	R39, R40, R92, R93	Resistor ¼ watt	660-CF1/4C8R2J	Mouser
53	1	10	R48	Resistor ¼ watt	660-CF1/4C100J	Mouser
54	3	18	R31, R49, R83	Resistor ¼ watt	660-CF1/4C180J	Mouser
55	2	22	R37, R38	Resistor ¼ watt	660-CF1/4C220J	Mouser
56	7	27	R30, R47, R65, R67, R72, R84, R86	Resistor ¼ watt	660-CF1/4C270J	Mouser
57	8	51	R8, R25, R28, R32, R63, R66, R79, R81	Resistor ¼ watt	660-CF1/4C510J	Mouser
58	1	75	R29	Resistor ¼ watt	660-CF1/4C750J	Mouser
59	7	100	R3, R19, R24, R36, R64, R69, R91	Resistor ¼ watt	660-CF1/4C101J	Mouser
60	2	150	R41, R94	Resistor ¼ watt	660-CF1/4C151J	Mouser
61	4	220	R9, R10, R11, R20	Resistor ¼ watt	660-CF1/4C221J	Mouser
62	4	270	R2, R52, R71, R95	Resistor ¼ watt	660-CF1/4C271J	Mouser
63	1	390	R45	Resistor ¼ watt	660-CF1/4C391J	Mouser
64	2	820	R7, R27	Resistor ¼ watt	660-CF1/4C821J	Mouser
65	4	1K	R18, R23, R35, R61	Resistor ¼ watt	660-CF1/4C102J	Mouser
66	5	1.5K	R34, R50, R51, R60, R76	Resistor ¼ watt	660-CF1/4C152J	Mouser
67	4	2.2K	R4, R26, R85, R96	Resistor ¼ watt	660-CF1/4C222J	Mouser
68	2	2.7K	R5, R6	Resistor ¼ watt	660-CF1/4C272J	Mouser
69	4	3.3K	R33, R46, R62, R68	Resistor ¼ watt	660-CF1/4C332J	Mouser
70	4	4.7K	R17, R75, R89, R90	Resistor ¼ watt	660-CF1/4C472J	Mouser
71	1	5.6K	R58	Resistor ¼ watt	660-CF1/4C562J	Mouser
72	7	10K	R1, R16, R22, R44, R55, R59, R70	Resistor ¼ watt	660-CF1/4C103J	Mouser
73	2	15K	R74, R88	Resistor ¼ watt	660-CF1/4C153J	Mouser
74	2	27K	R42, R43	Resistor ¼ watt	660-CF1/4C273J	Mouser
75	1	33K	R21	Resistor ¼ watt	660-CF1/4C333J	Mouser
76	4	47K	R12, R13, R56, R57	Resistor ¼ watt	660-CF1/4C473J	Mouser
77	2	1M	R15, R73	Resistor ¼ watt	660-CF1/4C105J	Mouser
78	1	2.2M	R14	Resistor ¼ watt	660-CF1/4C225J	Mouser
79						
80	1	1K Linear	R53	Potentiometer Linear Ctr Detent	313-2000F-1K	Mouser
81	1	1K Audio	R77	Potentiometer Audio	31JA301-F	Mouser
82	1	10K Audio	R80	Potentiometer Audio	31JA401-F	Mouser
83	1	10K	R54	Potentiometer Linear 10-turn	652-3590S-2-103L	Mouser
84						
85	1	100	R87	Trimmer Potentiometer	652-3318F-1-101	Mouser
86	1	2K	R78	Trimmer Potentiometer	652-3318F-1-202	Mouser
87						
88	2	T37-2	T7, T8	Toroid Core (Red)		Micro Metals
89	7	FT37-43	T1, T2, T4, T6, T9, T10, T11	Toroid Core (Shiny Gray)		Micro Metals
90	1	FT37-61	T5	Toroid Core (Dull Gray)		Micro Metals
91	1	Audio Transformer	T3	500CT:8 Ohm	42TM001-RC	Mouser
92						
93	1	5-60 pf NPO	TC6,	Trimmer Capacitor	81-TZ03Z500F169B00	Mouser
94	8	70 pf	TC1, TC2, TC3, TC4, TC5, TC7, TC9, TC10	Trimmer Capacitor	659-GKG70015	Mouser
95						
96	8	7.3728 MHz	X1, X2, X3, X4, X5, X6, X7, X8	Crystal	559-FOX073-LF	Mouser
97						
98	2	Connector	3.5 mm (1/8 inch)	Stereo Phone Jack	161-3402-E	Mouser
99	1	Connector	2.1 mm center pin	Power Jack	163-4304-E	Mouser
100	1	Connector	With ground lug	BNC Panel Mount	161-9323	Mouser
101			Note: BNC Panel Mount from Hosfelt Electronics		952	Hosfelt Electronics
102						
103	2	Hardware		Test Point Terminal	534-1035	Mouser
104	1	Hardware	4-40 thread, 1 inch length	Nylon Screw	561-P440-1	Mouser
105	1	Hardware	4-40 thread	Nylon Nut	561-G440	Mouser
106	2	Hardware	6-32 thread	Shoulder Washer	561-SW6	Mouser
107	4	Hardware	½ inch X ¼ inch	Square Tapered Bumper	517-SJ-5023BK	Mouser
108	1	Hardware	1.39" inch diameter	Black Knob	450-2039-GRX	Mouser
109	3	Hardware	0.77 inch diameter	Black Knob	450-2035-GRX	Mouser
110	4	Hardware	4-40 thread, 1 inch length	Female Threaded Standoff	91780A167	McMaster-Carr
111	4	Hardware	4-40 thread, 1 inch length	Male-Female Threaded Standoff	93505A436	McMaster-Carr
112	2	Hardware	Note: 10 units/package	Polypropylene Draw Latch	1891A48	McMaster-Carr
113	8	Hardware	2-56 thread, 5/16 inch length, Note: 100/package	Flat Head Machine Screw	91771A078	McMaster-Carr
114	8	Hardware	#2 internal tooth lock washer, Note: 100/package	Lock Washer	98449A500	McMaster-Carr
115	8	Hardware	2-56 thread, Note: 100/package	Hex Nut	91841A003	McMaster-Carr
116	1	Hardware	4-40 thread, ½ inch length, Note: 100/package	Flat Head Machine Screw	91771A110	McMaster-Carr
117	5	Hardware	#4 internal-tooth lock washer, Note: 100/package	Lock Washer	98449A510	McMaster-Carr
118	1	Hardware	4-40 thread, Note: 100/package	Hex Nut	91841A005	McMaster-Carr
119	8	Hardware	4-40 thread, ¼ inch length, Note: 100/package	Flat Head Machine Screw	91771A106	McMaster-Carr
120	4	Hardware	4-40 thread, 5/16 inch length, Note: 100/package	Pan Head Machine Screw	91772A107	McMaster-Carr
121	4	Hardware	#4, 1/8 inch length, unthreaded round spacer, Note: 10/package	Aluminum Spacer	92510A688	McMaster-Carr
122	1	Hardware		Case	NorCal 2N2/XX	TenTec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T2: Pri: 9T
Sec: 2T #26
T7: Pri: 20T/1.6uH
Sec: 4T #28
T8: Pri: 20T/1.6uH
Sec: 2T #28
Power Output Adjust
RIT
Tuning
1K Linear
1K Audio
Volume
RF Gain
C26 Tantulum
C30 Tantulum
C76, C77 Polystryene
T4: FT37-43
2x 8T #28
T5
16:1 #28
T9: Pri: 9T
Sec: 3T #28
T10: Pri: 8T
Sec: 4T #28
T11: Pri: 11T
Sec: 2T #28
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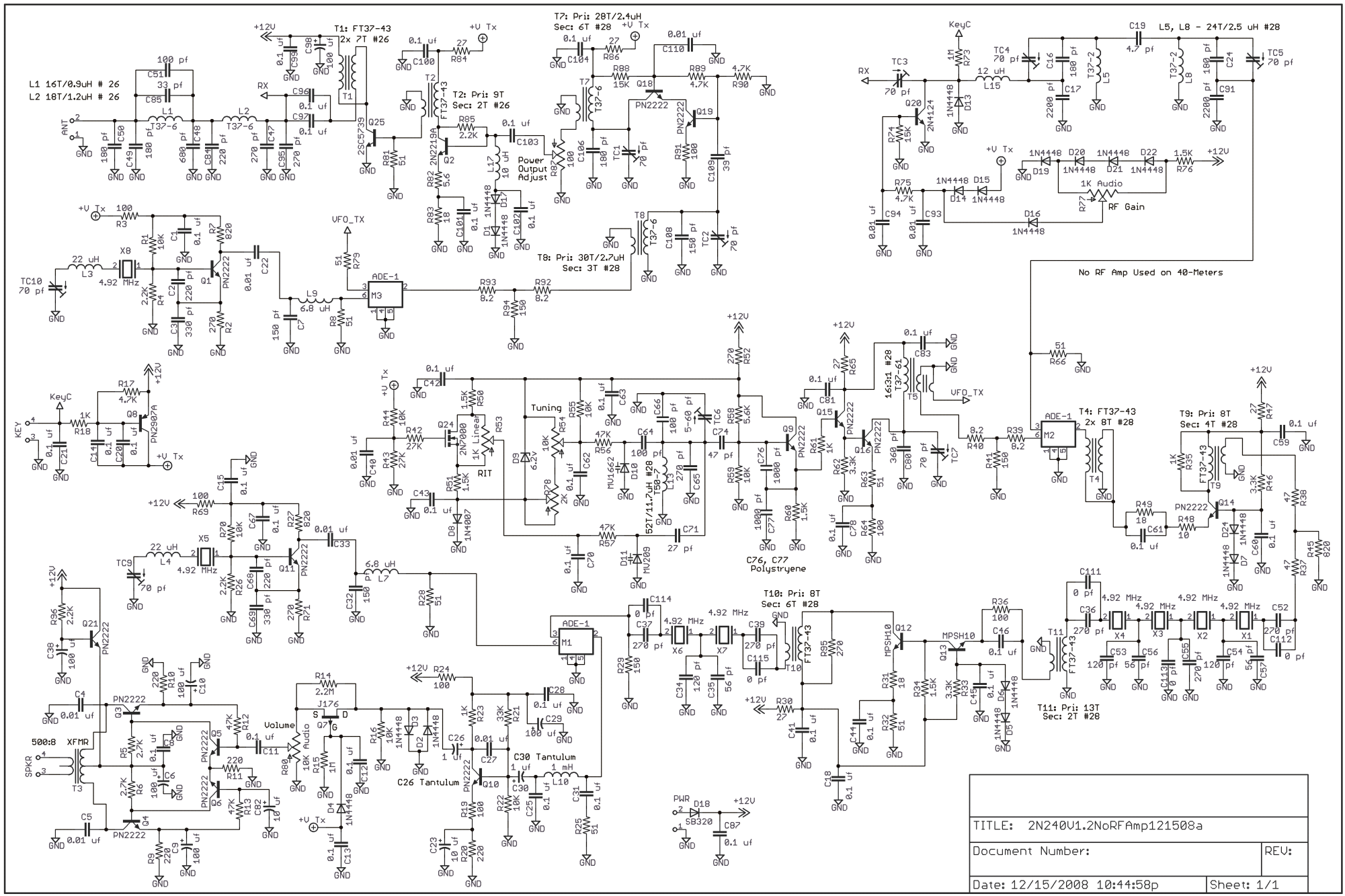
NorCal 2N2/XX V1.2.10 40 Meter Parts List

Sort	Qty	Part Value	Part Name	Part Type	Part Number	Part Supplier
1	5	0 pf	C111, C112, C113, C114, C115	Ceramic Capacitor NPO	Not Used	
2	1	4.7 pf	C19	Ceramic Capacitor NPO	140-50N5-4R7C-TB-RC	Mouser
3	1	27 pf	C71	Ceramic Capacitor NPO	140-50N5-270J-TB-RC	Mouser
4	1	33 pf	C85	Ceramic Capacitor NPO	140-50N5-330J-TB-RC	Mouser
5	1	39 pf	C109	Ceramic Capacitor NPO	140-50N5-390J-TB-RC	Mouser
6	1	47 pf	C74	Ceramic Capacitor NPO	140-50N5-470J-TB-RC	Mouser
7	3	56 pf	C35, C56, C57	Ceramic Capacitor NPO	140-50N5-560J-TB-RC	Mouser
8	3	100 pf	C51, C64, C66	Ceramic Capacitor NPO	140-50N5-101J-TB-RC	Mouser
9	3	120 pf	C34, C53, C54	Ceramic Capacitor NPO	140-50N5-121J-TB-RC	Mouser
10	3	150 pf	C7, C32, C108	Ceramic Capacitor NPO	140-50N5-151J-TB-RC	Mouser
11	5	180 pf	C16, C24, C49, C50, C106	Ceramic Capacitor NPO	140-50N5-181J-TB-RC	Mouser
12	3	220 pf	C2, C68, C84	Ceramic Capacitor NPO	140-50N5-221J-TB-RC	Mouser
13	8	270 pf	C36, C37, C39, C47, C52, C55, C65, C95	Ceramic Capacitor NPO	140-50N5-271J-TB-RC	Mouser
14	2	330 pf	C3, C69	Ceramic Capacitor NPO	80-C322C331J2G	Mouser
15	1	360 pf	C80	Ceramic Capacitor NPO	81-RPE5C1H361J2P1A03	Mouser
16	1	680 pf	C48	Ceramic Capacitor NPO	80-C322C681J2G	Mouser
17	2	1000 pf	C76, C77	Polystyrene Capacitor	23PS210	Mouser
18	2	2200 pf	C17, C91	Ceramic Capacitor NPO	80-C322C222J2G	Mouser
19	9	0.01 uf	C4, C5, C22, C27, C33, C40, C93, C94, C110	Ceramic Capacitor X7R	80-C317C103K5R	Mouser
20	38	0.1 uf	C1, C8, C11, C12, C13, C14, C15, C18, C20, C21, C25, C28, C31, C41, C42, C43, C44, C45, C46, C59, C60, C61, C62, C63, C67, C70, C78, C81, C83, C87, C96, C97, C99, C100, C101, C102, C103, C104	Ceramic Capacitor X7R	80-C322C104K5R	Mouser
21	2	1 uf	C26, C30	Tantalum Capacitor	80-T350A105K035AT	Mouser
22	2	10 uf	C23, C82	Electrolytic Capacitor	140-XRL25V10-RC	Mouser
23	6	100 uf	C6, C9, C10, C29, C38, C98	Electrolytic Capacitor	140-XRL25V100-RC	Mouser
24						
25	17	1N4448	D1, D2, D3, D4, D5, D6, D7, D13, D14, D15, D16, D17, D19, D20, D21, D22, D24	Signal Diode	512-1N4448TR	Mouser
26	1	MV1662	D10	Tuning Diode	MV1662	Hosfelt Electronics
27	1	MV209	D11	Tuning Diode	863-MV209G	Mouser
28	1	SB320	D18	Power Diode	625-SB320	Mouser
29	1	1N4007	D8	Power Diode	625-1N4007-E3	Mouser
30	1	1N4735A	D9	Zener Diode 6.2V	512-1N4735A	Mouser
31						
32	2	T37-6	L1, L2	Toroid Core (Yellow)		Micro Metals
33	2	T37-2	L5, L8	Toroid Core (Red)		Micro Metals
34	1	T50-7	L13	Toroid Core (White)		Micro Metals
35	2	6.8 uH	L7, L9	Molded Inductor	434-22-6R8	Mouser
36	1	10 uH	L17	Molded Inductor	434-22-100	Mouser
37	1	12 uH	L15	Molded Inductor	434-22-120	Mouser
38	2	22 uH	L3, L4	Molded Inductor	434-22-220	Mouser
39	0	100 uH		Molded Inductor	434-22-101	Mouser
40	1	1 mH	L10	Molded Inductor	434-22-102	Mouser
41						
42	3	ADE-1	M1, M2, M3	Mixer	ADE-1	MiniCircuits
43						
44	14	PN2222	Q1, Q3, Q4, Q5, Q6, Q9, Q10, Q11, Q14, Q15, Q16, Q18, Q19, Q21	NPN TO92	512-PN2222ABU	Mouser
45	2	MPSH10	Q12, Q13	NPN TO92	863-MPSH10G	Mouser
46	1	2N2219A	Q2	NPN TO39	511-2N2219A	Mouser
47	1	2N4124	Q20	NPN TO92	512-2N4124BU	Mouser
48	1	2N7000	Q24	MOSFET TO92	512-2N7000	Mouser
49	1	2SC5739	Q25	NPN TO220	2SC57390P-ND	DigiKey
50	1	J176	Q7	JFET TO92	512-J176	Mouser
51	1	PN2907A	Q8	PNP TO92	512-PN2907ABU	Mouser
52						
53	1	5.6	R82	Resistor ¼ watt	660-CF1/4C5R6J	Mouser
54	4	8.2	R39, R40, R92, R93	Resistor ¼ watt	660-CF1/4C8R2J	Mouser
55	1	10	R48	Resistor ¼ watt	660-CF1/4C100J	Mouser
56	3	18	R31, R49, R83	Resistor ¼ watt	660-CF1/4C180J	Mouser
57	5	27	R30, R47, R65, R84, R86	Resistor ¼ watt	660-CF1/4C270J	Mouser
58	2	47	R37, R38	Resistor ¼ watt	660-CF1/4C470J	Mouser
59	8	51	R8, R25, R28, R32, R63, R66, R79, R81	Resistor ¼ watt	660-CF1/4C510J	Mouser
60	7	100	R3, R19, R24, R36, R64, R69, R91	Resistor ¼ watt	660-CF1/4C101J	Mouser
61	3	150	R29, R41, R94	Resistor ¼ watt	660-CF1/4C151J	Mouser
62	4	220	R9, R10, R11, R20	Resistor ¼ watt	660-CF1/4C221J	Mouser
63	4	270	R2, R52, R71, R95	Resistor ¼ watt	660-CF1/4C271J	Mouser
64	3	820	R7, R27, R45	Resistor ¼ watt	660-CF1/4C821J	Mouser
65	4	1K	R18, R23, R35, R61	Resistor ¼ watt	660-CF1/4C102J	Mouser
66	5	1.5K	R34, R50, R51, R60, R76	Resistor ¼ watt	660-CF1/4C152J	Mouser
67	4	2.2K	R4, R26, R85, R96	Resistor ¼ watt	660-CF1/4C222J	Mouser
68	2	2.7K	R5, R6	Resistor ¼ watt	660-CF1/4C272J	Mouser
69	3	3.3K	R33, R46, R62	Resistor ¼ watt	660-CF1/4C332J	Mouser
70	4	4.7K	R17, R75, R89, R90	Resistor ¼ watt	660-CF1/4C472J	Mouser
71	1	5.6K	R58	Resistor ¼ watt	660-CF1/4C562J	Mouser
72	7	10K	R1, R16, R22, R44, R55, R59, R70	Resistor ¼ watt	660-CF1/4C103J	Mouser
73	2	15K	R74, R88	Resistor ¼ watt	660-CF1/4C153J	Mouser
74	2	27K	R42, R43	Resistor ¼ watt	660-CF1/4C273J	Mouser
75	1	33K	R21	Resistor ¼ watt	660-CF1/4C333J	Mouser
76	4	47K	R12, R13, R56, R57	Resistor ¼ watt	660-CF1/4C473J	Mouser
77	2	1M	R15, R73	Resistor ¼ watt	660-CF1/4C105J	Mouser
78	1	2.2M	R14	Resistor ¼ watt	660-CF1/4C225J	Mouser
79						
80	1	1K Linear	R53	Potentiometer Linear Ctr Detent	313-2000F-1K	Mouser
81	1	1K Audio	R77	Potentiometer Audio	31JA301-F	Mouser
82	1	10K Audio	R80	Potentiometer Audio	31JA401-F	Mouser
83	1	10K	R54	Potentiometer Linear 10-turn	652-3590S-2-103L	Mouser
84						
85	1	100	R87	Trimmer Potentiometer	652-3318F-1-101	Mouser
86	1	2K	R78	Trimmer Potentiometer	652-3318F-1-202	Mouser
87						
88	2	T37-6	T7, T8	Toroid Core (Yellow)		Micro Metals
89	6	FT37-43	T1, T2, T4, T9, T10, T11	Toroid Core (Shiny Gray)		Micro Metals
90	1	FT37-61	T5	Toroid Core (Dull Gray)		Micro Metals
91	1	Audio Transformer	T3	500CT:8 Ohm	42TM001-RC	Mouser
92						
93	1	5-60 pf NPO	TC6	Trimmer Capacitor	81-TZ03Z500F169B00	Mouser
94	8	70 pf	TC1, TC2, TC3, TC4, TC5, TC7, TC9, TC10	Trimmer Capacitor	659-GKG70015	Mouser
95						
96	8	4.9152 MHz	X1, X2, X3, X4, X5, X6, X7, X8	Crystal	559-FOX049-LF	Mouser
97						
98	2	Connector	3.5 mm (1/8 inch)	Stereo Phone Jack	161-3402-E	Mouser
99	1	Connector	2.1 mm center pin	Power Jack	163-4304-E	Mouser
100	1	Connector	With ground lug	BNC Panel Mount	161-9323	Mouser
101			Note: BNC Panel Mount from Hosfelt Electronics		952	Hosfelt Electronics
102						
103	2	Hardware		Test Point Terminal	534-1035	Mouser
104	1	Hardware	4-40 thread, 1 inch length	Nylon Screw	561-P440-1	Mouser
105	1	Hardware	4-40 thread	Nylon Nut	561-G440	Mouser
106	2	Hardware	6-32 thread	Shoulder Washer	561-SW6	Mouser
107	4	Hardware	½ inch X ¼ inch	Square Tapered Bumper	517-SJ-5023BK	Mouser
108	1	Hardware	1.39" inch diameter	Black Knob	450-2039-GRX	Mouser
109	3	Hardware	0.77 inch diameter	Black Knob	450-2035-GRX	Mouser
110	4	Hardware	4-40 thread, 1 inch length	Female Threaded Standoff	91780A167	McMaster-Carr
111	4	Hardware	4-40 thread, 1 inch length	Male-Female Threaded Standoff	93505A436	McMaster-Carr
112	2	Hardware	Note: 10 units/package	Polypropylene Draw Latch	1891A48	McMaster-Carr
113	8	Hardware	2-56 thread, 5/16 inch length, Note: 100/package	Flat Head Machine Screw	91771A078	McMaster-Carr
114	8	Hardware	#2 internal tooth lock washer, Note: 100/package	Lock Washer	98449A500	McMaster-Carr
115	8	Hardware	2-56 thread, Note: 100/package	Hex Nut	91841A003	McMaster-Carr
116	1	Hardware	4-40 thread, ½ inch length, Note: 100/package	Flat Head Machine Screw	91771A110	McMaster-Carr
117	5	Hardware	#4 internal-tooth lock washer, Note: 100/package	Lock Washer	98449A510	McMaster-Carr
118	1	Hardware	4-40 thread, Note: 100/package	Hex Nut	91841A005	McMaster-Carr
119	8	Hardware	4-40 thread, ¼ inch length, Note: 100/package	Flat Head Machine Screw	91771A106	McMaster-Carr
120	4	Hardware	4-40 thread, 5/16 inch length, Note: 100/package	Pan Head Machine Screw	91772A107	McMaster-Carr
121	4	Hardware	#4, 1/8 inch length, unthreaded round spacer, Note: 10/package	Aluminum Spacer	92510A688	McMaster-Carr
122	1	Hardware		Case	NorCal 2N2/XX	TenTec


L1 16T/0.9uH # 26
L2 18T/1.2uH # 26
T1: FT37-43
2x 7T #26
T2: Pri: 9T
Sec: 2T #26
T7: Pri: 28T/2.4uH
Sec: 6T #28
T8: Pri: 30T/2.7uH
Sec: 3T #28
Power Output Adjust
RIT
Tuning
C26 Tantulum
C30 Tantulum
C76, C77 Polystryene
No RF Amp Used on 40-Meters
1K Audio
RF Gain
Volume
T4: FT37-43
2x 8T #28
T5
T9: Pri: 8T
Sec: 4T #28
T10: Pri: 8T
Sec: 6T #28
T11: Pri: 13T
Sec: 2T #28
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2N2/XX Miscellaneous Information

Toroid Cores
Red core = T37-2 (Powdered Iron)
Yellow core = T37-6 (Powdered Iron)
White core (Used for VFO Inductor) = T50-7 (Powdered Iron)
Shiny gray core = FT37-43 (Ferrite)
Dull gray core (marked with green dot) = FT37-61 (Ferrite)

Toroid Winding Wire Supplied

Item	*Amount*
#28 Red	19 Feet
#28 Green	5 Feet
#26 Red	4 Feet
#26 Green	1 Foot

Hookup Wire Supplied

Item	*Amount*
RG174 Coax	6 inches
Black hookup	19 inches
Red hookup	30 inches
Green hookup	38 inches
White hookup	41 inches

All chassis-to-control hookup wire is #24, stranded, PVC insulated.