KN-Q7A

Single Band SSB Transceiver
Kit Manual

Rev. D
CRKITS.COM
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Qin Ling, BD4AHS
Ed Durrant, VK2ARE

Revision History

Oct 23, 2011: Rev. A, first formal release.
Nov 1, 2011: Rev. A1, modified a typo in step 5. Thanks JG1EAD for pointing out.
Nov 26, 2011: Rev. A2, removed an extra 104 capacitor near microphone input in schematics, and corrected the injected audio amplitude from 5 mV to 1.5 V peak-peak in TX alignment section. Also, changed microphone modulator to DSB modulator in step 3.
Apr 30, 2012: Rev. B, modified the manual to be compatible with both V2.1 and V2.1a PCB, and fixed the description of SET BIAS for final power transistor IRF640.
Sep 12, 2012: Rev. C, modified the manual to be compatible with both 40m and 20m versions.
Oct 16, 2012: Rev. C1, modified based on the feedback from VK2ARE.
Mar 4, 2014: Rev. D, rewritten for PCB V2.2 and 20m version

THANK YOU!

Thank you for purchasing your KN-Q7A Single Band SSB Transceiver Kit. The kit was designed by BA6BF, and is now supplied by CRKITS.COM and its worldwide distributors. The KN-Q7A kit is an ideal candidate for field operation, back pack and emergency use.

In this revision of manual, we have rewritten for PCB V2.2 and 20m version. 40m version will be also covered, but if you want to read the manual for PCB V2.1a or earlier which was written based on 40m version, please download from http://crkits.com/knq7amanual_old.pdf

Specifications

- Dimension: 153 mm x 97 mm x 40 mm, not including protruding features
- Weight: 500 grams or 1.1 lbs
- Power Supply: 12~13.8 V, 3 A
- Current consumption: about 40 mA in RX and about 2 A in TX @ 13.8 V
- RF output: about 10 W PEP @ 13.8 V (5 W PEP for the 20m version)
- Spur suppression: better than -43 dBc
- Sensitivity: better than 0.5 μV at 10 dB SNR
- IF filter: 6 pole crystal ladder filter + 1 pole post IF amplifier crystal filter
- IF bandwidth: about 2.0 kHz
- IF frequency: 8.467 MHz, 8.192 MHz, or 4.194 MHz, depending on the selected tuning range
- Frequency tuning range: about 20 kHz in VXO type. Options: 7.050~7.070 MHz, 7.080~7.100 MHz, 7.110~7.130 MHz, 7.145~7.165 MHz, 7.200~7.220 MHz, 7.280~7.300 MHz or 14.200~14.230 MHz
- Connectors:
  - Speaker output: 3.5 mm connector, mono output
  - Microphone input: 8-pin, can be configured to be compatible with electret microphones or speaker microphones
  - Antenna connector: BNC type
- Controls:
  - IF Gain Control: act as volume control
  - Tune Control

Disclaimer

We offer the kit as is and do not guarantee the assembled kit by yourself can meet your local regulatory requirements, including safety, RF, environmental or others. As some parts used in the kit are obsolete, we cannot guarantee that all the components in the kit are brand new, but we bear the responsibility of providing them as good as possible.

Tools Preparation

The tools needed for the kit building are solder iron, solder sucker, clipper, tweezers, pliers, screw drivers including Philips and slotted, and a multimeter of digital or analog type. Besides, you will need an electric drill and a 3 mm drill bit, a 50 Ω, 20 W or higher power dummy load, an HF band SWR/Power meter, a 13.8 V/ 3 A power supply, a personal computer running Windows, an amateur radio transceiver with a general coverage receiver and calibrated frequency display, and other ancillary instruments. It will be nice if you have access to a frequency counter, an audio signal generator, a RF signal generator, an oscilloscope and a spectrum analyzer, but they are not absolutely required.

Parts Inventory

Open the package and read the one-page quick guide thoroughly. Also, some volunteers have translated some manuals for you. To download your local language documents, you can search the CHINA_QRP group file section on Yahoo or go to the document archive section of http://crkits.com. There you will find a list of all documents (Thanks EA2SN for Spanish translations and JL1KRA for Japanese translations).

You need to download the complete part list and do the parts inventory carefully.
40 m version: http://crkits.com/knq7apartlist.pdf
20 m version: http://crkits.com/knq7a20mpartlist.pdf

We have put resistors, trimmers, potentiometers and 104 capacitors into one plastic bag so it will make your work much easier. You may find some extra parts, and it is fine to keep them as backup. It is okay to discard the original metal front panel, rear panel and the original 8x panel screws now, because they have replacements in the kit. If you find problems or missing parts, please contact your seller directly.

We offer several frequency ranges to meet different requirements (this list is subject to change without notice):

- **7.050~7.070**, LO 15.540 1 pcs (strong pulling capability), IF 8.467, for Asia, Canada, Australia
- **7.080~7.100**, LO 15.570 1 pcs (strong pulling capability), IF 8.467, for Europe, Asia, Australia, covering the 7.090 calling frequency
- **7.110~7.130**, LO 15.600 1 pcs (strong pulling capability), IF 8.467, for Europe, Asia
- **7.145~7.165**, LO 15.360 2 pcs, IF 8.192, for North America, Asia and Europe
- **7.200~7.220**, LO 15.418 1 pcs (strong pulling capability), IF 8.192, for North America (General Class)
- **7.280~7.300**, LO 15.500 1 pcs, IF 8.192, for North America (General Class), covering the 7.285 calling frequency
- **14.200~14.230**, LO 18.432 1pcs (strong pulling capability), IF 4.194, for 20m worldwide

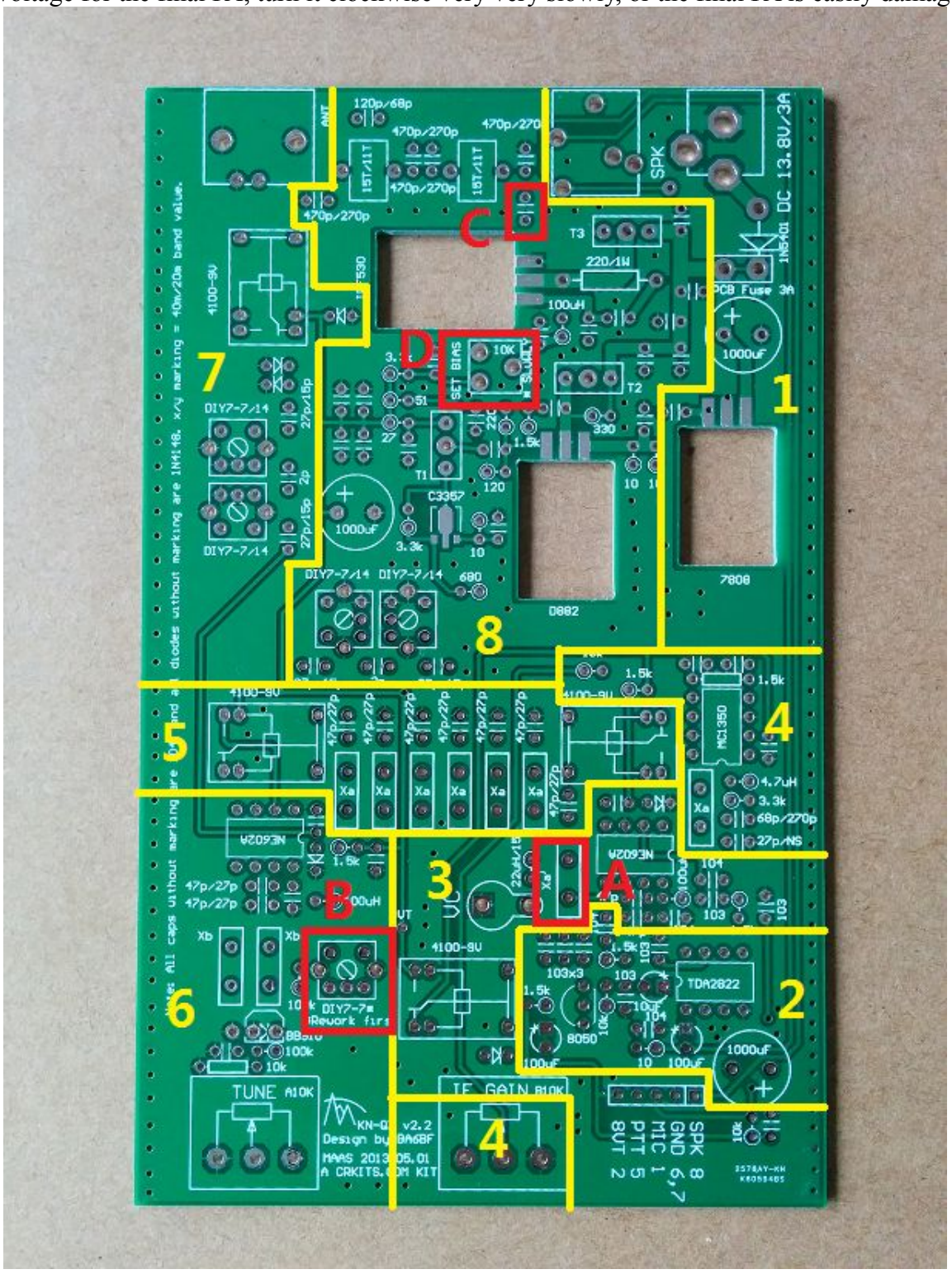
For the VXO crystal with strong pulling capability, the VXO range can be pulled much wider, up to 200 kHz by adjusting the VXO coil, but frequency stability gets worse and we don't officially claim support.

Board Assembly

We will do it step by step, finishing one part of assembly at a time, and testing it to ensure final success. We will provide partial schematic in each step to help you understand the theory of operation, and make sure you install all the parts required to do the final testing of the block.

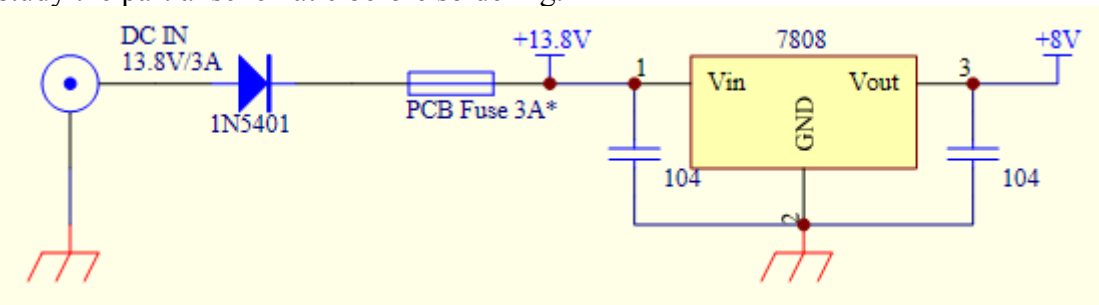
However, the partial schematic might not contain all the parts you should install in each step, so don't get confused when you are told to install a part not shown on the schematic. Note that PCB version is subject to change without prior notice and it may look slightly different from yours.

In the photo below, PCB version is printed on the PCB between two potentiometers. 1~8 means building steps and A~D means:
A – BFO crystal marked by Xa'. The red dotted crystal should be installed here if your kit has one.
B – Only this DIY7-7 coil should be reworked to remove built-in tubular capacitor before soldering.
C – Install the only one light green 104 monolithic capacitor here
D – Preset this trimmer fully counterclockwise before you apply power supply. When you adjust the bias voltage for the final PA, turn it clockwise very very slowly, or the final PA is easily damaged.

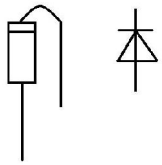


Step 1: Power Supply Circuit

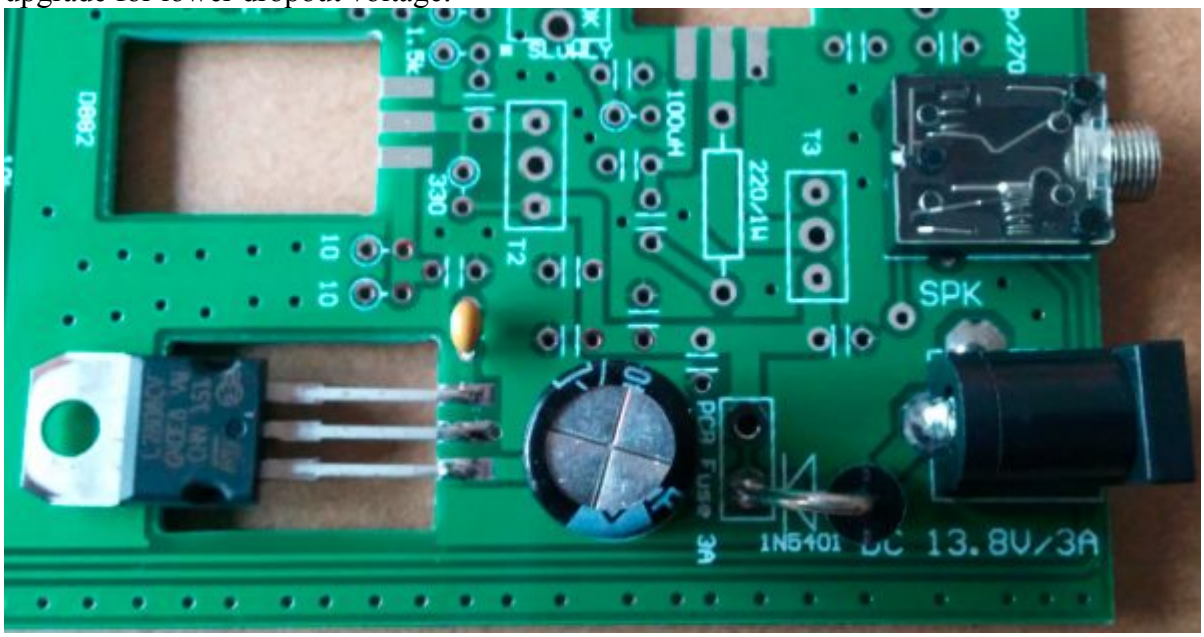
Let's start with the power supply circuit. Should you want to study the whole schematic prior to the building to have better understanding, you may find a copy of the circuit at the end of this manual. Please study the partial schematic before soldering.



[ ] Solder 1x DC IN socket, and trim the pins flush to avoid shorts with chassis foot screws
[ ] Solder 1x speaker connector near the DC IN power connector; make sure you install it in place
[ ] Bend the pins of 1x 1N5401 diodes as shown, and solder. For other diodes, always bend the pins like this. If you kit comes with 1N5820~1N5822, it is an upgrade for lower dropout voltage.



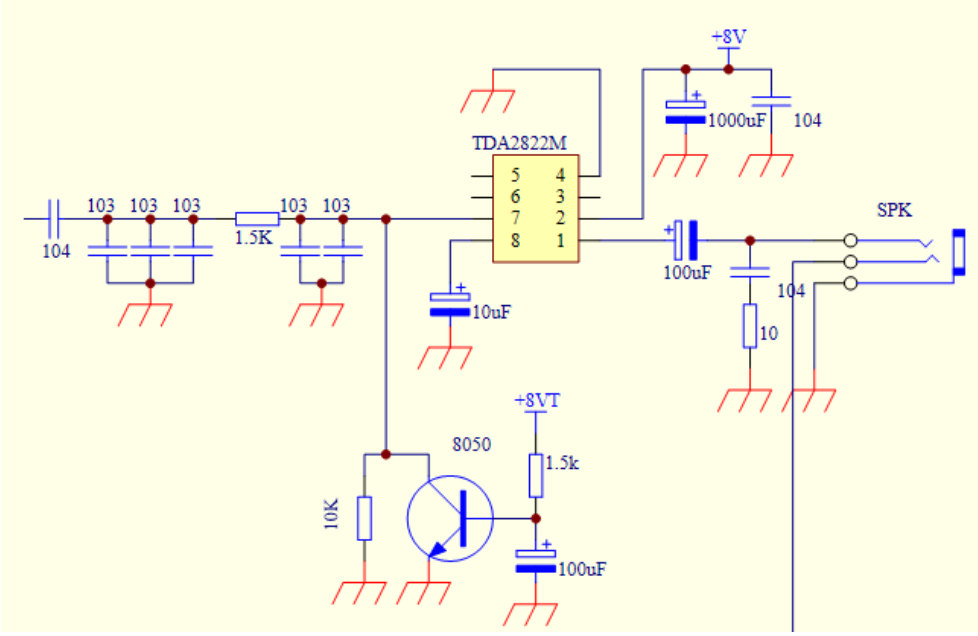
[ ] Solder 1x 1000 µF capacitors; check polarity
[ ] Solder 1x 0.1 µF (104) monolithic capacitor near 7808. Remember that all capacitors without marking are 104 ones.
[ ] Solder 1x 7808 as shown for test purposes now. If your kit comes with LM2940-8.0, it is an upgrade for lower dropout voltage.



[ ] Plug in a 12~13.8 V power supply to the DC IN connector (center positive) and measure the voltage on pin 3 of 7808 near to the 104 capacitor to see if it is within +/-5 % of 8 V; if not, check power supply polarity and your soldering
[ ] Disconnect the power supply and proceed to the next step.

Step 2: Audio Amplifier

The core component of the audio amplifier is a TDA2822M. It is a dual channel amplifier but we only use one channel here. Please study the schematic before soldering.



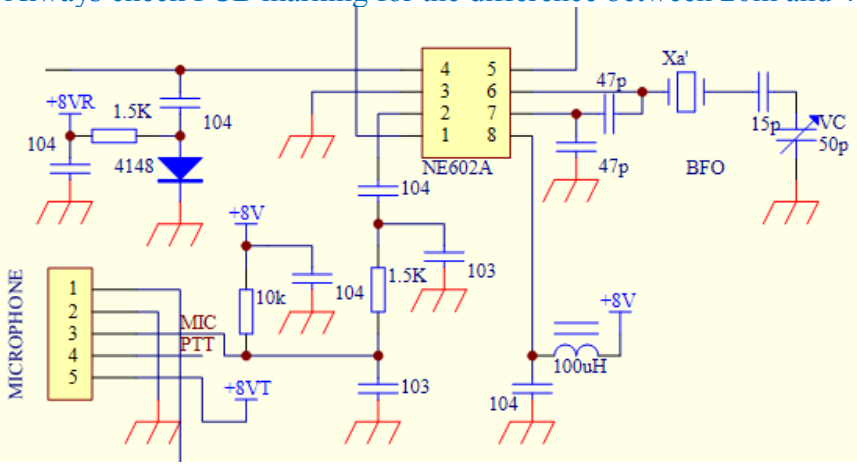
[ ] Place 1x 8 pin IC socket, paying close attention to the notch, and solder, then insert a TDA2822M with correct orientation as shown on the photo
[ ] Solder 1x 1000 µF capacitors; check polarity
[ ] Solder 2x 100 µF electrolytic capacitor; check polarity
[ ] Solder 1x 10 µF electrolytic capacitor; check polarity
[ ] Solder 1x 8050 transistor; check PCB outline
[ ] Solder the remaining capacitors and resistors; when finished, it will look like the photo below

[ ] Plug in a 12~13.8 V power supply and connect an external speaker of 8 Ω or higher impedance to the speaker connector. Touch pin 5 of the nearby NE602A using tweezers to inject some noise, and note if the audio amplifier works. If not, please check your soldering, and check the pin 2 of the TDA2822M for the presence of 8V. If all is okay, disconnect the power supply and the external speaker to proceed to the next step.

WARNING: It is not a good choice to plug in a headphone to the speaker connector, as the radio does not have an AGC circuit and an abrupt strong signal or noise may cause hearing impairment.

Step 3: Detector/ Double Sided Band Modulator

The core component is a double-balanced mixer and oscillator NE602A. It acts as the detector in the RX path and also as a DSB modulator in TX. Please study the schematic before soldering. Xa' is a marking for BFO crystal. It is red dotted on the top for 20m version, but same as other IF crystals for 40m version. Always check PCB marking for the difference between 20m and 40m versions.



[ ] Place 1x 8 pin IC socket, paying close attention to the notch, and solder, then insert a NE602A with correct orientation as shown on the photo

[ ] Pick 1x BFO crystal and solder. You don't have to place an insulator under the crystal or ground the crystal case

[ ] Solder 1x 15 pF capacitor near VC. Remember the marking 22 uH/ 15 pF means for 40m version install 22 uH inductor or for 20m version install 15 pF capacitor

[ ] Solder 1x trimmer capacitor VC as shown on the photo

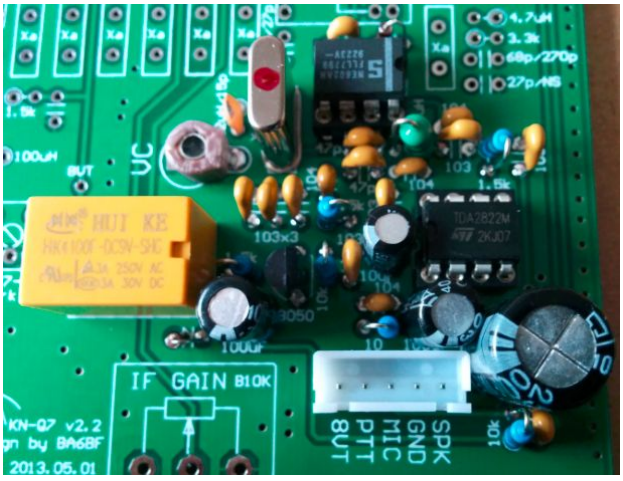
[ ] Solder 1x SIP5 socket as on-board microphone connector as shown on the photo

[ ] Solder 1x relay. This relay is controlled by the PTT and switches 8 V RX/ TX power

[ ] Solder 1x 104 monolithic capacitor near 1000 µF capacitor. Remember that all capacitors without marking are 104

[ ] Solder 1x 1N4148 near the relay. Remember that all diodes without marking are 1N4148 and bend the pin near the bar marking on the body

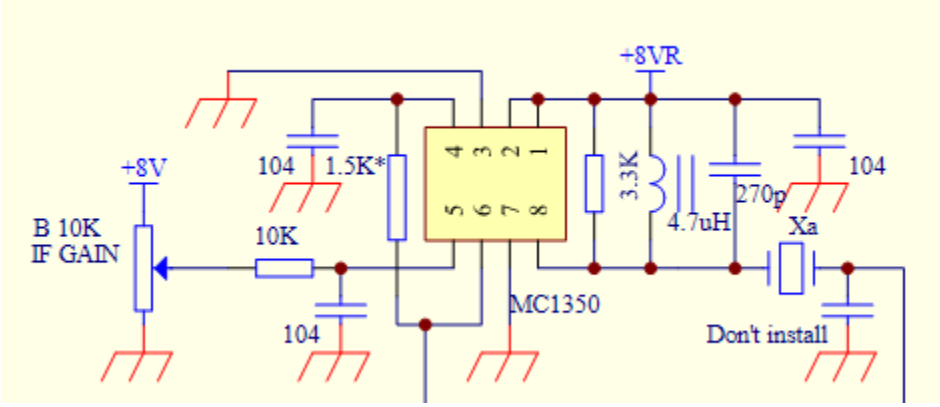
[ ] Solder the remaining inductors, resistors, diodes and capacitors. When finished, it will look like the photo below.



[ ] Plug in a 12~13.8 V power supply. Short the PTT pin to GND to see if the relay works. Use a nearby general coverage SSB/CW receiver to hear the leakage of the BFO within +/-2 kHz range of the marked frequency. Connect an external speaker to the speaker connector and touch pin 1 of the NE602A using tweezers to note if the noise coming out of the speaker increases. Check your soldering and the presence of 8 V on pin 8 of NE602A if it is not normal. If all is okay, disconnect the power supply and the external speaker to proceed to the next step.

Step 4: RX IF Amplifier

The core component is an MC1350. There is no AGC circuit designed, and the IF gain is controlled by a potentiometer (IF GAIN) and also used as volume control. A crystal filter is added after the output network of the MC1350. Please study the schematic before soldering. Xa is a marking for IF crystals. Don't install means the capacitor is not required for 20m version. Always check PCB marking for the difference between 20m and 40m versions.

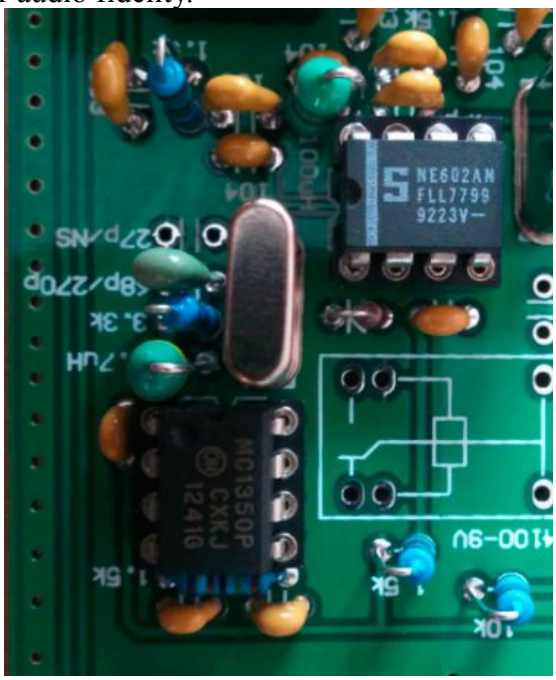


[ ] Place 1x 8 pin IC socket, paying close attention to the notch, and solder, then insert a MC1350 with correct orientation as shown on the photo

[ ] Pick 1x IF crystal and solder. You don't have to place an insulator under the crystal or ground the crystal case

[ ] Pick the potentiometer marked B10K and solder it as IF GAIN control, making sure that the shaft is vertical to the PCB side

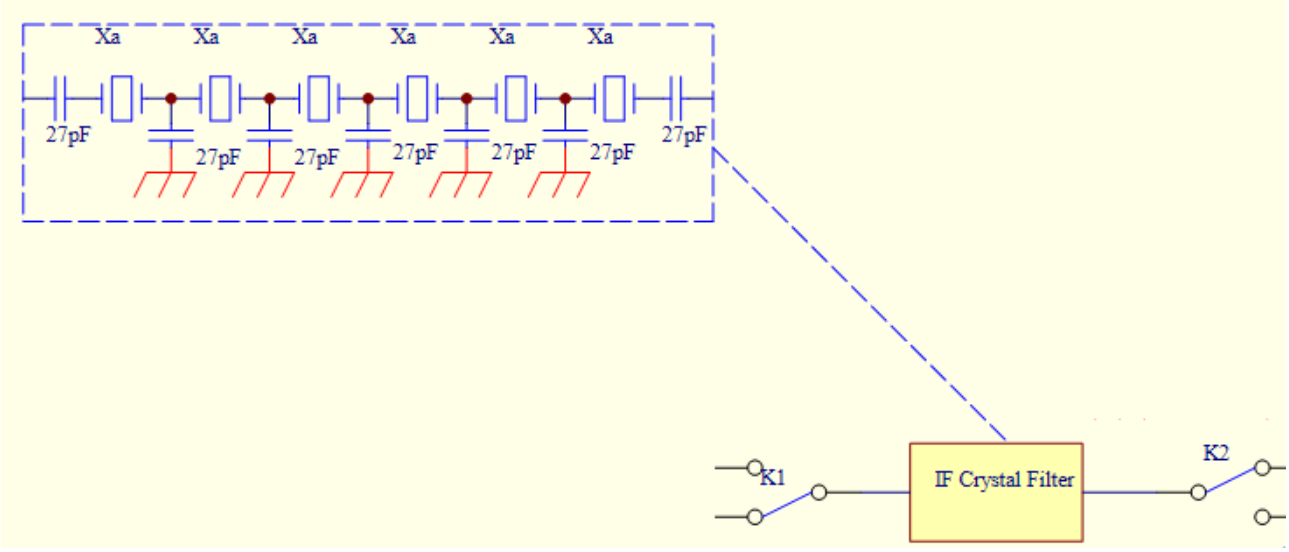
[ ] Solder the remaining inductors, resistors and capacitors. When finished, it will look like the photo below. Note that from PCB V2.1a, a resistor of 1.5k is added between pin 4 and pin 6 of MC1350 to improve receiver audio fidelity.



[ ] Plug in a 12~13.8 V power supply and connect an external speaker to the speaker connector. Turn the potentiometer to fully clockwise, touch pin 6 of MC1350 using tweezers and note if the noise coming out of the speaker increases. Turn the potentiometer counter clockwise to note if the noise decreases. If it is not normal, please check your soldering, and check the pin 1, 2 and 8 of the MC1350 for the presence of 8 V. If all is okay, turn the potentiometer fully clockwise again, and disconnect the power supply and the external speaker to proceed to the next step.

Step 5: IF Crystal Filter

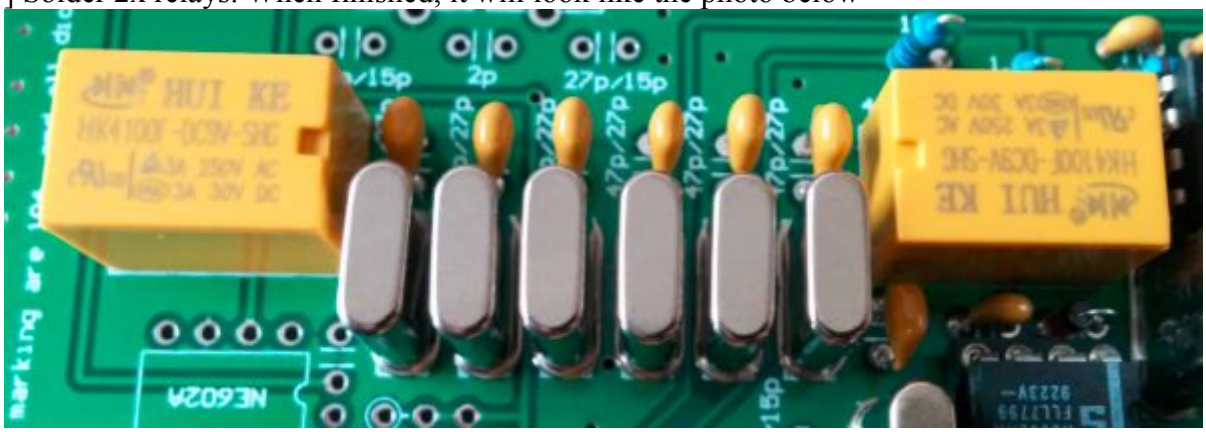
This part includes 6x IF crystals, 7x capacitors and 2x relays. Please study the schematic before soldering. Xa is a marking for IF crystals. Always check PCB marking for the difference between 20m and 40m versions.



[ ] Pick 6x IF crystals and solder. You don't need to place insulators under the crystals or ground the crystal cases

[ ] Solder 7x 27 pF capacitors (for the 40m version, they are 7x 47 pF)

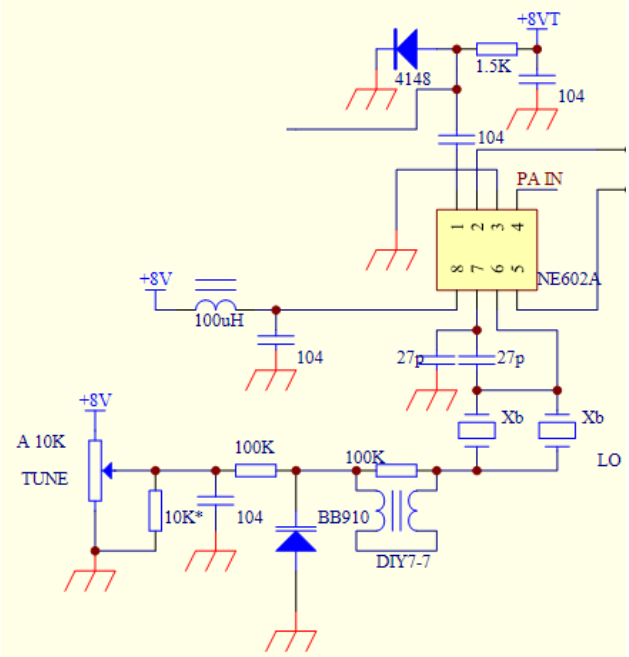
[ ] Solder 2x relays. When finished, it will look like the photo below



[ ] Plug in a 12~13.8 V power supply and connect an external speaker to the speaker connector. Touch pin 5 of the uninstalled NE602A using tweezers to note a little noise from the speaker. If it is not normal, please check your soldering. If it is okay, disconnect the power supply and the external speaker to proceed to the next step.

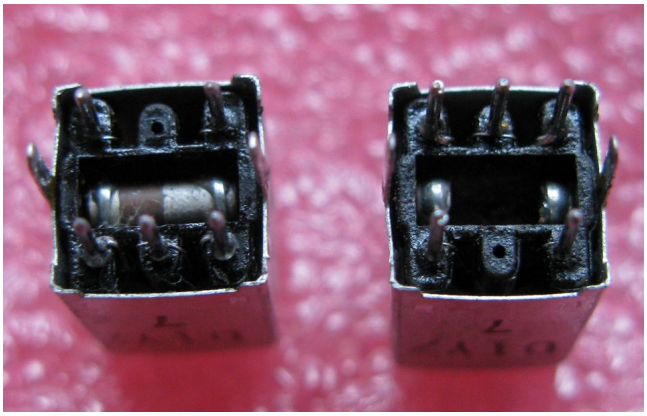
Step 6: Mixer and VXO Local Oscillator

The core component is another double-balanced mixer and oscillator NE602A. It acts as the RX/TX mixer and the local oscillator (LO). Please study the schematic before soldering. Xb is a marking for VXO crystal(s). Always check PCB marking for the difference between 20m and 40m versions.



[ ] Place 1x 8 pin IC socket, paying close attention to the notch, and solder, then insert a NE602A with correct orientation as shown on the photo

[ ] Pick 1x IFT DIY7-7, and use a small slotted screw driver to press and break the built-in tubular capacitor, and remove all the loose fragments. The photo shows the original IFT on the left, and the reworked IFT on the right. Place it on the PCB and solder



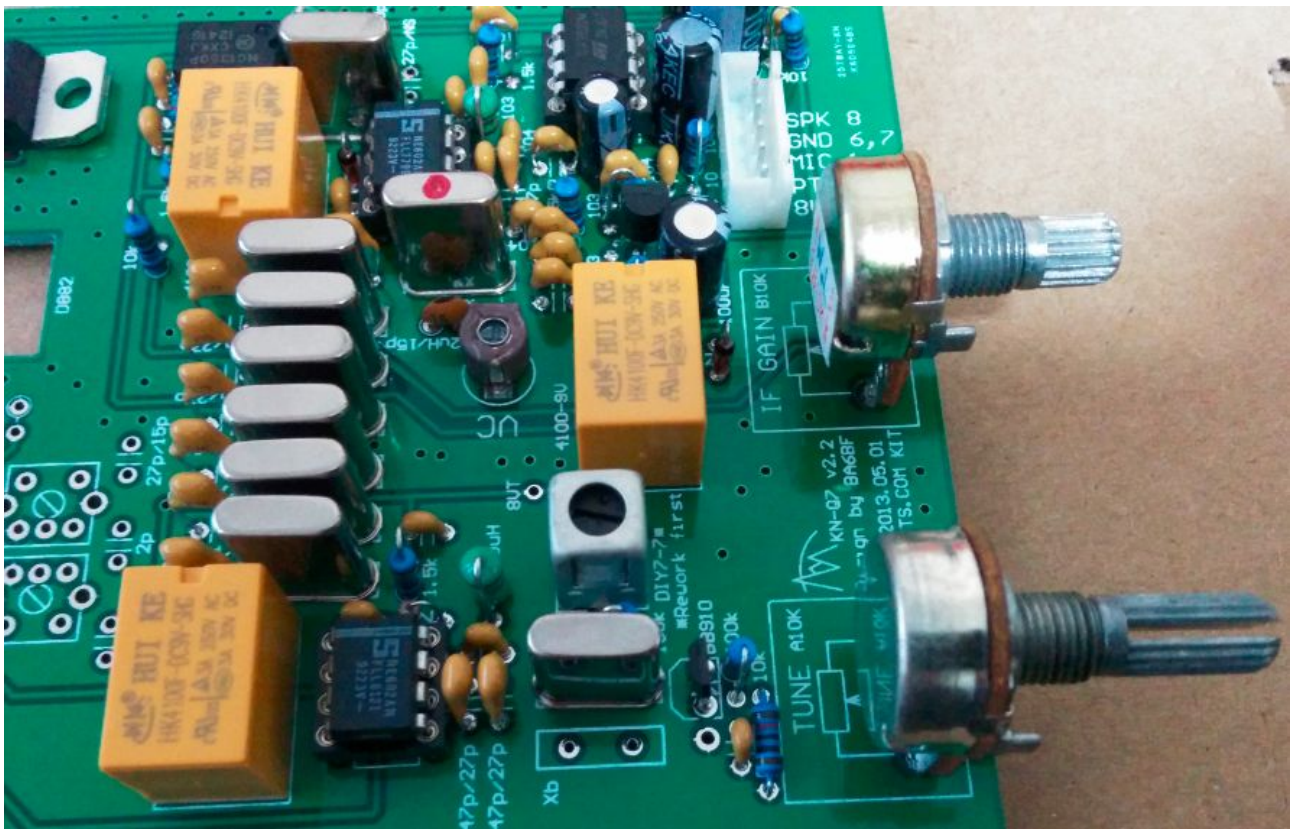
[ ] Solder the VXO crystal(s). You don't need to place insulator under the crystal or ground the crystal case. You may need to solder 1x or 2x crystals, depending on the frequency range you have selected for your kit. If you just need to solder 1x crystal, either slot will be okay

[ ] Solder the diode BB910. Place BB910's marking side to face the TUNE potentiometer and away from the VXO crystal(s), and solder

[ ] Pick the potentiometer marked A10K and solder it as the TUNE control, making sure the shaft is parallel to the PCB and vertical to the PCB side. Turning the potentiometer clockwise will increase the frequency of the LO

[ ] Solder 2x 27 pF capacitors (for the 40 meter version, they are 2x 47 pF)

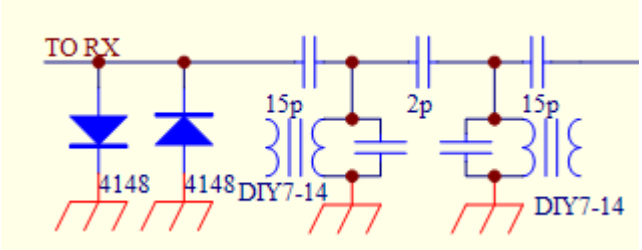
[ ] Solder the remaining parts. When finished, it will look like the photo below. Note that from PCB V2.1a, a 10k resistor is added between the center pin of potentiometer and ground to help improve the tuning linearity of high end frequency range.

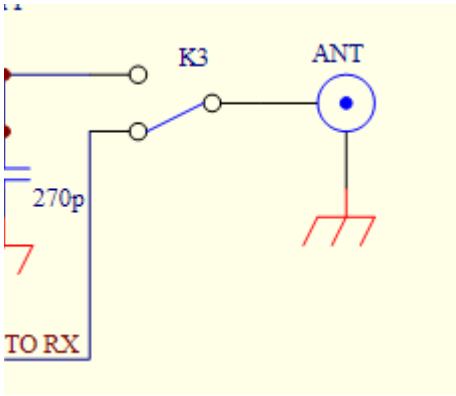


[ ] Plug in a 12~13.8 V power supply and connect an external speaker to the speaker connector. Touch pin 1 of the NE602A using tweezers or even with an antenna cable tip to note if strong band noise comes out of the speaker. Turn the TUNE control to check if VXO frequency changes thus the noise tone changes. The VXO frequency change can be detected by a general coverage SSB/CW receiver nearby. Check soldering and the presence of 8 V on pin 8 of the NE602A if it is not normal. If all is okay, disconnect the power supply and the external speaker to proceed to the next step.

Step 7: RX Front End

This part of circuit includes an antenna connector, a relay, two 1N4148 diodes as a level limiter for protection purposes and two DIY7-14 IFT's (or DIY7-7 for the 40m version) as RX band-pass filters (BPF). By completing this step, you will have a fully working receiver, so you will be able to align it and hear some signals. Please study the schematic before soldering. Always check PCB marking for the difference between 20m and 40m versions.



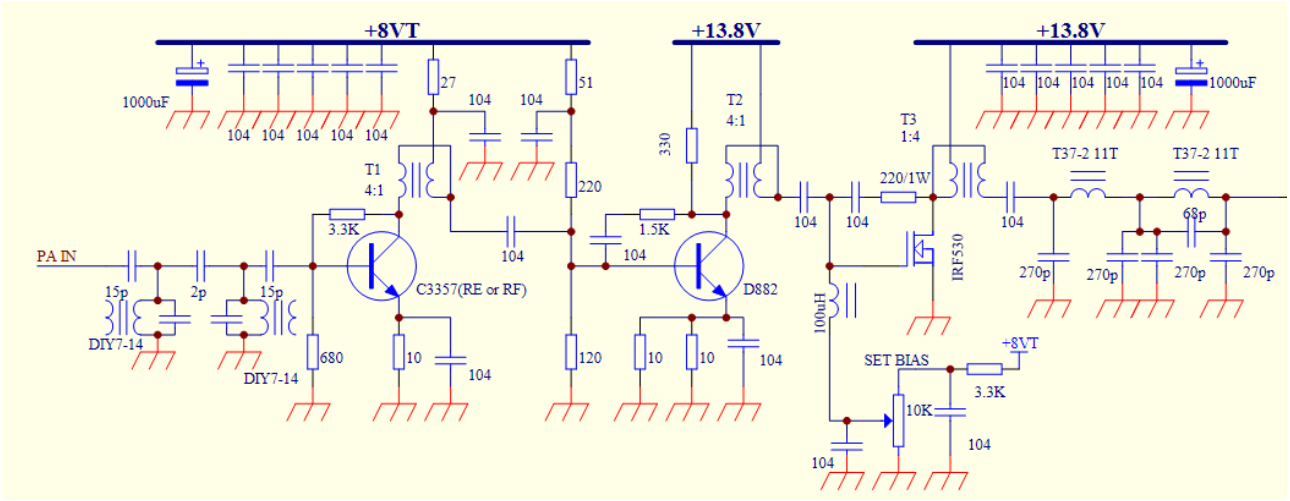


[ ] Solder 2x IFT's DIY7-14 (or DIY7-7 for the 40m version); no rework is required
[ ] Solder 3x 1N4148 diodes; check polarity
[ ] Solder 1x relay
[ ] Solder the remaining capacitors. When finished, it will look like the photo below. And it also completes the RX part

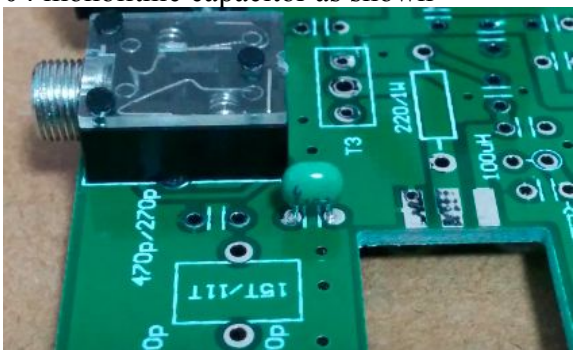
[ ] Now let's do a brief alignment and enjoy receiving on-air signals. Plug in a 12~13.8V power supply and connect an external speaker to the speaker connector. Touch ANT pin using an antenna cable tip to note strong band noises or signals coming out of the speaker. Turn the TUNE control slowly to see if you can hear any on-going QSO. If not, you may need to turn down the core of the IFT near VXO crystal to extend the tuning range. Note that the cores are very crisp, so turn it mildly. While hearing the band noise or a QSO signal, peak the RX BPF by turning the cores of the two IFT's. Fine tune the signal by slowly turning TUNE control and if you feel the audio spectrum is not normal and you can only hear vague voices, you may need to turn trimmer capacitor marked VC to change the BFO frequency a little bit until you can hear loud and clear signals from the speaker. Check your soldering if it is not normal. If all is okay, disconnect the power supply and the external speaker to proceed to the next step.

Step 8: TX Amplifiers and Low-Pass Filters (LPF)

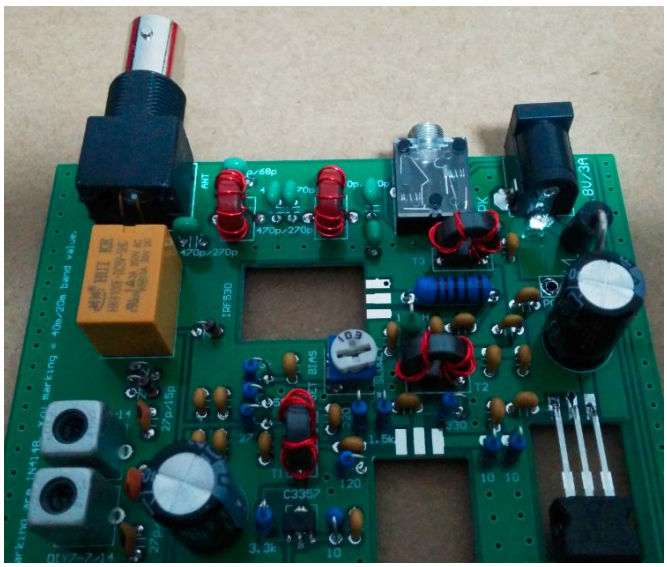
This part of the circuit includes a BPF composed of two DIY7-14 IFT's (or two DIY7-7 for the 40m version), three amplifier stages using a C3357, a D882 and an IRF530 respectively, and a two stage LPF. Please study the schematic before soldering. Always check PCB marking for the difference between 20m and 40m versions.



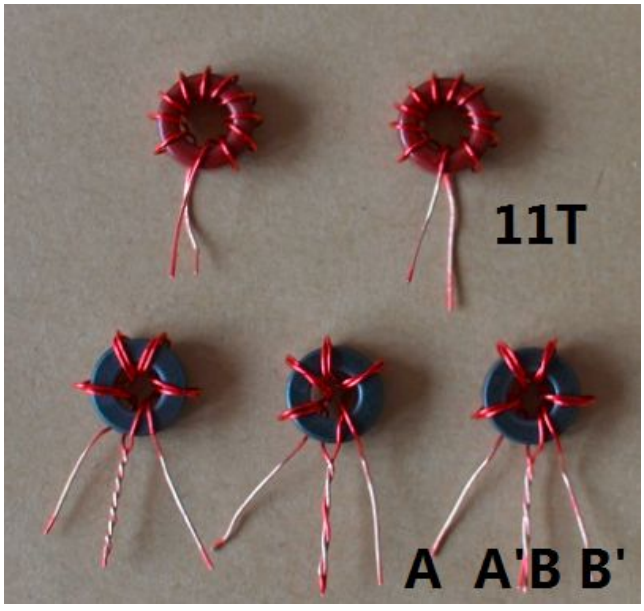
[ ] Solder the SMD transistor C3357 first. It comes with an RE or RF marking on the body
[ ] Solder 2x DIY7-14 IFT's (or 2x DIY7-7 for the 40m version), no rework is required
[ ] Solder 1x 10 k Ω trimmer, and preset it to fully counter clockwise to preset 0 V to the gate of IRF530
[ ] Install the big size 220 Ω 1 W resistor horizontally and solder
[ ] Install the light green 104 monolithic capacitor as shown



[ ] Solder the remaining parts, with the exception of all toroid coils, and the D882 and IRF530 transistors, which will be installed later in final assembly stages. When finished, it will look like the photo below.



[ ] Desolder the 7808 voltage regulator, and clean the solder from the pads and pins
[ ] We will use two kinds of toroid coils as shown. LPF coils (2x) are on the top. They require 11 turns (15 turns for the 40m version) windings on the toroids T37-2 (red) using about 25 cm of enamel wire. The wide-band transformers (3x) are on the bottom. They require 5 turns of a bifilar winding on the toroids FT37-43 (black) using about 20 cm of bifilar enamel wire, and connecting different windings in the middle. Make the bifilar wire about 4 twists per inch (25 mm). Once twisted, you should wind 5 turns, and prepare the central tap by connecting two ends from different windings. If the winding start wires are A and B, and the end wires are A' and B', you should join B with A' for the central tap. You will find continuity between A and the central tap, between the central tap and B', and between A and B'. In all cases, you should scrape carefully the enamel from the wire, and tin it prior to use. It is very important to effectively clean the enamel to get good soldered connections. Follow the same procedure to prepare the second LPF coil and the other two wide-band transformers, and solder in place. That ends the board assembly. Let's move on to the final assembly.



Final Assembly

Now you have the completed board ready to start the final assembly.

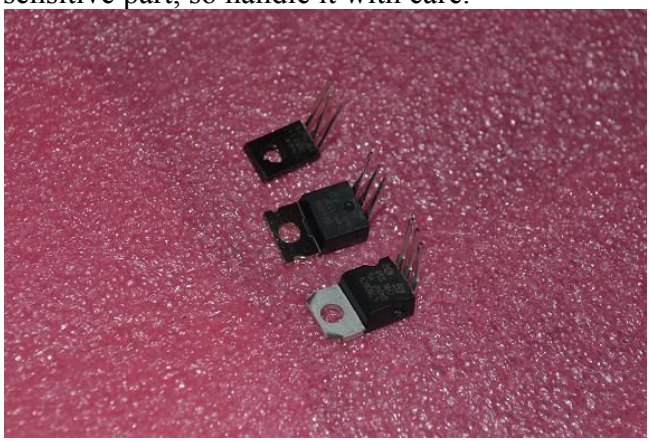
[ ] You will need to drill 7x M3 holes on any one of the two chassis pieces, since they are identical, but only on one, please :-). Download the drilling template from http://crkits.com/knq7atemplate.pdf. Print it on a piece of A4 size paper with 100% scale (the default scale is not necessarily 100%). Cut off the outline and fit it into the chassis bottom.

[ ] Drill 7x M3 holes. The locations for the 4x chassis feet holes are not very important, but you have to be very careful with the locations of the holes for the three semiconductors. Please pay close attention while you are drilling. After you are done with the drilling, please make sure you remove the blurs from the holes.

[ ] Install the 4x rubber feet with 4 pairs of M3x10 screws and M3 nuts. The nuts should be placed in the holes of the rubber feet, otherwise the screws will be too long to interfere with the PCB. You can press the rubber feet by your fingers so you can drive screws easily to the nuts and tighten them.

[ ] Slide in the board through the slot, make sure that you may see the three holes from the rectangular holes on the PCB, and also observe that there are no short circuit or interference

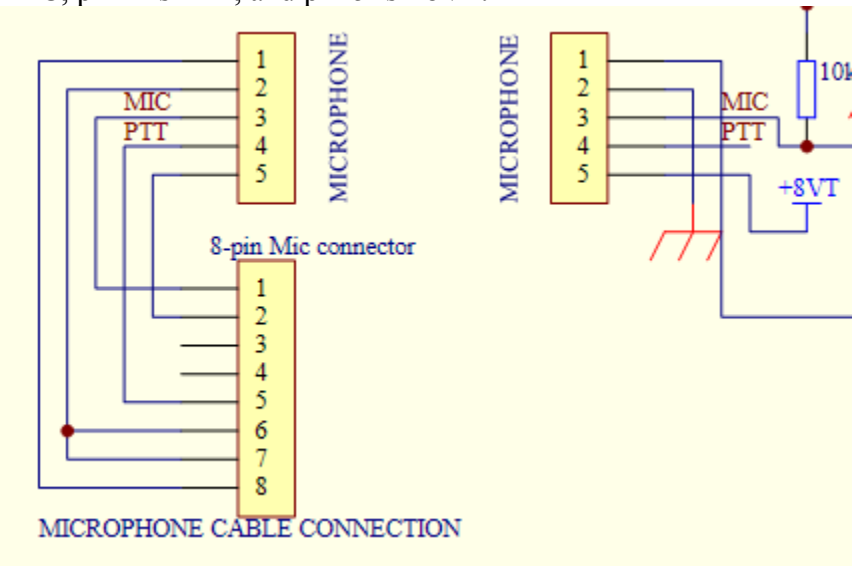
whatsoever between the board and the chassis. Review carefully the screw head areas.
[ ] Bend the pins of the 7808, IRF530, and D882 semiconductors as shown. Please note that IRF530 is a electrostatic sensitive part, so handle it with care.



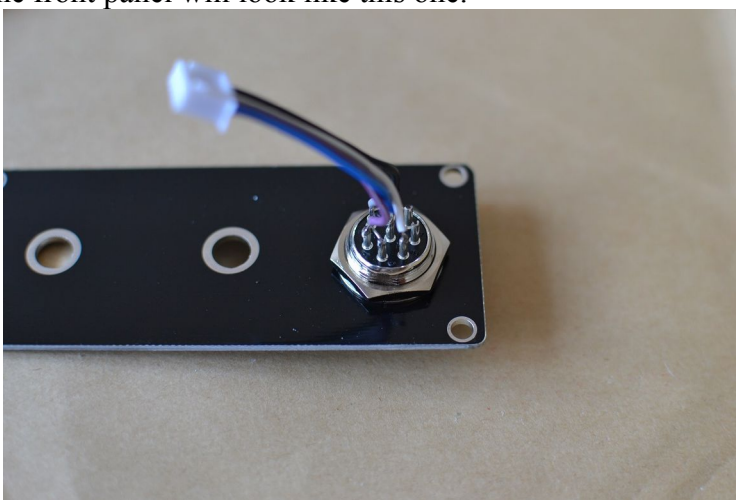
[ ] Place insulator pads on the places where the body of the D882 and IRF530 transistors will lie. Place the semiconductors on each position and insert M3x10 screws from the bottom. The 7808 may be secured directly with a M3 nut, as well as the D882 (which already has an insulator pad below). The IRF530 needs also a small white insulator washer to isolate the metal tab from the chassis. (You may check with a tester that there is no continuity between the screw -or chassis- and the tab). Once all three semiconductors are in position and secured, bend the pins, trim any extra portions and solder.

[ ] Prepare the front panel by installing the 8-pin microphone connector.

[ ] Solder the microphone cable, based on the schematic below. This connection is compatible with ICOM HM-series and the supplied optional microphone. To use a different brand microphone, please identify the pinout and wire it accordingly. On the SIP5 connector pin 1 is SPEAKER, pin 2 is GND, pin 3 is MIC, pin 4 is PTT, and pin 5 is +8VT.



After you are done, the front panel will look like this one.



[ ] Make sure both potentiometers have a nut on first. Plug in the microphone cable into the SIP5 socket on board, install the front panel using two black chassis screws, then put a washer and another nut on each potentiometers, and finally install the knobs.

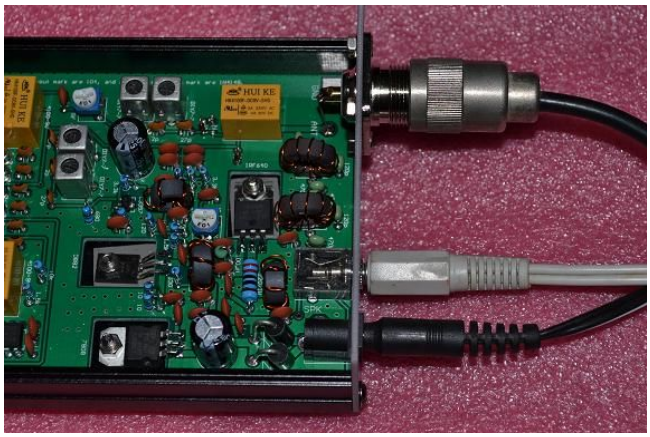
[ ] Preset the IF GAIN control to mid-way and you are ready to start alignment. After alignment, remember to install the top chassis using another 4x black chassis screws.

Alignment

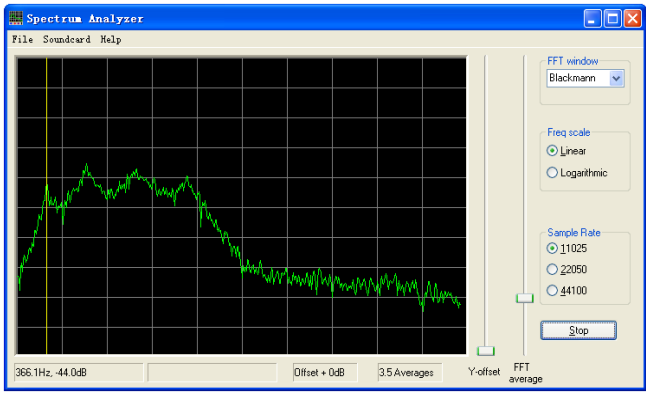
RX Alignment

In previous steps we have done most of the RX alignment. Now we are going to use an audio spectrum analyzer software (on a PC running Windows) to fine tune the BFO frequency, so the RX voice can be very clear, and more importantly, the carrier and the opposite sideband are well suppressed. In the one-page quick guide, we mentioned briefly that we should tune the audio spectrum to lie between 350 Hz and 2200 Hz. Here we provide some details on how to do it easily.

There are many audio spectrum analyzer programs available. Here we recommend for our purpose the free software by Con, ZL2AFP. You may download it from http://www.qsl.net/zl1an/Software/Spectrum3.zip. Unzip and double click the spectrum2.exe file to run. The photo below shows the hardware setup. You will need to connect the speaker out to the microphone input of the sound card on PC, as the white audio cable does. You will also need to connect a noise generator or simply an antenna to the antenna connector, and apply a power supply of 12~13.8 V.



Follow the setup on the screen capture below, and click start, you will see a similar audio spectrum. If not, you may need to turn clockwise or counter clockwise the IF GAIN control. Now fine tune the trimmer capacitor in the BFO to move the pass-band to the left or to the right. You can use the cursor to read the frequency and level of the signal (on the left bottom corner) to identify the low and high end of the pass-band, so you can get about 350 Hz~2200 Hz range. If you have wider or narrower range, please make sure you still set the lower end of 350 Hz. Please note that, if you are using an antenna to do this, you should tune away from any signal to use the band noise as a random noise source, or the spectrum will jump up and down making the measurement very difficult.



Remove the audio cable and connect an external speaker. Use band noise or a signal to peak again the RX BPF.

Then, tune the IFT in the LO to your favorite frequency coverage. Turning it deeper means that you can get a wider frequency coverage range with a lower range end. Normally, the upper end of the range changes a little, but the lower end of the range changes much more. You can use a calibrated radio to receive the same signal and know where you are on the band, or you can use a signal generator to inject a specific frequency so you can get the range that you want quickly.

By the way, you may want to measure the overall current in RX, and it should be about 40 mA. If not, please check your soldering.

TX Alignment

PTT Test: Connect a dummy load to the antenna connector, the power supply of 12~13.8 V/ 3 A to DC IN connector, and a microphone to the front panel connector. Press PTT to see if it causes relay clicks. If not, you should check the wiring of the microphone connector.

Setting bias voltage for the final amplifier IRF530: Make sure that the SET BIAS trimmer is preset to fully counter clockwise first. Connect an ampere meter in series with the power cable (set to measure 1A or more), press PTT but **do not talk to the microphone**, the current will likely be 0.48 A. Then turn SET BIAS trimmer clockwise SLOWLY until the current increases 60mA to about 0.54 A. Note that, if you turn the trimmer too quickly, or the preset position is not in the middle, the IRF530 might conduct completely and it may cause an over current failure. From PCB V2.1a, a fuse is designed on PCB near 1N5401 diode. Over current failure will most likely blow the PCB fuse, and you can short it with a wire.

Peaking the TX BPF and measuring the RF power output: Connect a power meter between the antenna connector and the dummy load, press PTT while speaking into the microphone loudly, turn the cores of the TX BPF IFT's up a few turns and the RF power output will increase rapidly from about 1 W to about 10 W (5 W for the 20m version). If you are serious into getting as much power

as possible, you may need to inject a stable audio signal of about 1.0V peak-peak to the microphone input, so you can easily peak the TX BPF to get max power output. EA2SN recommended that you may download a sound card audio generator to do the same job from DL6IAK at http://dl6iak.etonlein.de/projects/2000-07-01.htm. Another way to generate stable RF power for peaking TX BPF is to break the balance of BFO NE602A by shorting its pin 2 and pin 3 after PTT is pressed. You may need to adjust capacitor trimmer VC to get a bigger power for TX BPF peaking, but after it, you should adjust the capacitor trimmer back, or the receiver audio will be bad.

Theory of Operation

We have explained the theory of operation in each functional block. Here it may be beneficial to go through the signal flow so it will help to understand the whole schematic diagram on the last page.

The KN-Q7A is a simple design with two NE602A chips which are used both for RX and TX. When in RX, one NE602A works as first mixer plus LO to convert the received RF signal to IF, and the other works as detector plus BFO to convert the IF signal to AF. When in TX, the detector NE602A now works as a DSB modulator to modulate BFO signal with voice and convert it to an IF signal, and the first mixer NE602A still works as a mixer to convert the IF signal to the RF. Some signal switch diodes and relays are used here to multiplex the use of the NE602A chips.

RX signal flow: The RF signal from the antenna is switched by an antenna switch relay, and goes into the RX BPF to filter out the unwanted interference and signals, passes through a variable RF attenuator, goes into the mixer NE602A to convert it to IF signal, then passes through an IF crystal filter, a manually-controlled variable-gain IF amplifier composed of a MC1350, fitted with a post-IF-amplifier crystal filter, and later feeds to the detector NE602A to convert the signal to audio, and finally is amplified by a TDA2822M to drive a speaker.

TX signal flow: The voice picked up by the microphone goes directly into a NE602A to modulate the BFO signal to produce the dual sided-band (DSB) IF signal, then goes through the IF crystal filter to become a single sided-band (SSB) IF signal. It is mixed with the VXO LO to produce the RF signal at the operating frequency, and after filtering out unwanted mixer products and other signals with the TX BPF, goes into a three-stage TX amplifiers and the LPF which will filter out spurs and harmonics. The antenna selector relay gets the amplified signal to the antenna for transmission.

Troubleshooting

If you follow the manual step by step, the success rate of the kit should be very high. Should you have any trouble, the #1 rule of thumb you should remember is that you probably have soldering problems, either cold soldering, solder bridges or misplaced components. A careful double check will be always helpful.

Here, we list the voltage on each pin of the key semiconductors in RX and TX. It will help you to identify the problems. For example, if you find that the RF power output is too low, by checking IRF530 pin G, if you measure a voltage lower than 2 V, the problem could be that you forgot to adjust the bias voltage.

Note: Please be careful not to cause any accidental short circuit between pins during your test, or it may damage the components.

Voltages in RX @ 13.8 V, "var" means variable, * is for detector IC near BFO, and ** is for mixer IC near LO

NE602A*		MC1350		NE602A**		TDA2822		C3357		D882		IRF530		8050	
1	**1.4**	1	**7.9**	1	**1.4**	1	**3.6**	E	**0**	E	**0**	S	**0**	E	**0**
2	**1.4**	2	**7.9**	2	**1.4**	2	**7.9**	B	**0**	B	**0**	G	**0**	B	**0**
3	**0**	3	**0**	3	**0**	3	**7.2**	C	**0**	C	**13**	D	**13**	C	**0**
4	**6.7**	4	**2.4**	4	**6.7**	4	**0**								
5	**6.7**	5	**var**	5	**6.7**	5	**4.2**								
6	**7.8**	6	**2.4**	6	**7.8**	6	**0.3**								
7	**7.3**	7	**0**	7	**7.1**	7	**0**								
8	**7.9**	8	**7.9**	8	**7.9**	8	**0.6**								

Voltages in TX with PTT on but no modulation @ 13.8 V, "var" means variable, * is for detector IC near BFO, and ** is for mixer IC near LO

NE602A*		MC1350		NE602A**		TDA2822		C3357		D882		IRF530		8050	
1	**1.4**	1	**0.5**	1	**1.4**	1	**3.6**	E	**0.3**	E	**1.7**	S	**0**	E	**0**
2	**1.4**	2	**0.5**	2	**1.4**	2	**7.9**	B	**1**	B	**2.3**	G	**2-4.3V**	B	**0.7**
3	**0**	3	**0**	3	**0**	3	**7.2**	C	**7.1**	C	**12.9**	D	**12.9**	C	**0**
4	**6.7**	4	**0**	4	**6.7**	4	**0**								
5	**6.7**	5	**var**	5	**6.7**	5	**4.2**								
6	**7.8**	6	**0**	6	**7.8**	6	**0.3**								
7	**7.3**	7	**0**	7	**7.1**	7	**0**								
8	**7.9**	8	**0**	8	**7.9**	8	**0.6**								

See full schematic for 20m version, 40m version and PCB silkscreen on the next 3 page. This is the end of the document.

KN-Q7A 80m/75m Supplementary Manual

CRKITS.COM
Dec 7, 2014

The KN-Q7A kit was initially introduced as a 40m band only SSB transceiver. Later, 20m band is supported, and recently 80m/75m band is supported too. Since the full manual and PCB markings are only good for 40m/20m, this supplementary manual will guide you through the building of the 80m/75m kits.

If you haven't read the full manual yet, you are encouraged to download and review it now, BEFORE you actually start the soldering. The manual locates at http://crkits.com/knq7amanual.zip.

Step 1~5

- Same as 40m kit with IF crystal 8.4672 MHz.

Step 6: Mixer and VXO Local Oscillator.

- Change 2x Xb to 80m/75m VXO crystal.
- Change 1x DIY7-7* to DIY7-3.8 and remove built-in tubular capacitor. Turn the core up until it is stopped by the shielding case to ensure VXO can oscillate first.

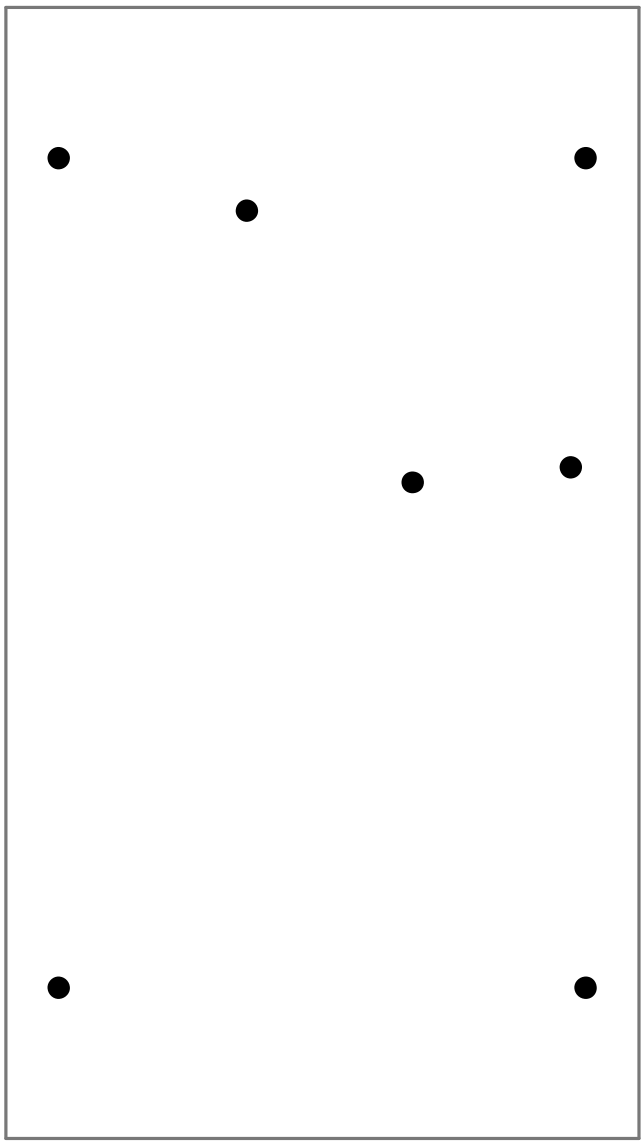
Step 7: RX Front End.

- Change 2x DIY7-7/14 to 2x DIY7-3.8 shielded coils.

Step 8: TX Amplifiers and Low-Pass Filters (LPF).

- Change 2x DIY7-7/14 to 2x DIY7-3.8 shielded coils.
- Change 4x 470p/270pF to 4x 820pF capacitors.
- Change 1x 120p/68pF to 220pF capacitor.
- Change 15T/11T to 22 turns winding on T37-2 (red) toroids.
- Change T1/T2/T3 from 5 turns bi-filar to 8 turns bi-filar winding on FT37-43 (black) toroids.

The rest of the building and alignment should be the same as the 40m kit. When you adjust the frequency range by turning the core down, you might stop the oscillation of the VXO. Make sure you leave some buffer as long as the frequency coverage is enough.



Common Parts

Part	Qty	Comments
Resistors		
10 Ω	4	BRN-BLK-BLK-GLD-BRN
27 Ω	1	RED-VIO-BLK-GLD-BRN
51 Ω	1	GRN-BRN-BLK-GLD-BRN
120 Ω	1	BRN-RED-BLK-BLK-BRN
220 Ω	1	RED-RED-BLK-BLK-BRN
220 Ω 1W	1	RED-RED-BLK-BLK-BRN, Big Size
330 Ω	1	ORG-ORG-BLK-BLK-BRN
680 Ω	1	BLU-GRY-BLK-BLK-BRN
1.5 kΩ	7	BRN-GRN-BLK-BRN-BRN
3.3 kΩ	3	ORG-ORG-BLK-BRN-BRN
10 kΩ	4	BRN-BLK-BLK-RED-BRN
100 kΩ	2	BRN-BLK-BLK-ORG-BRN
10 kΩ trimmer	1	103. Blue and White. 3-pin
10 kΩ potentiometer	2	A10K marking for TUNE, B10K marking for IF GAIN.
Capacitors		
2 pF NPO	2	2. Ceramic or monolithic.
68 pF NPO	1	68 or 680. Ceramic or monolithic.
0.01 µF	7	103. Ceramic or monolithic.
0.1 µF	34	104. Ceramic or monolithic.
10 µF 25 V or higher	1	Electrolytic capacitor
100 µF 25 V or higher	2	Electrolytic capacitor
1000 µF 25 V or higher	3	Electrolytic capacitor
50 pF trimmer capacitor	1	9~50 pF range, for BFO tuning
Diodes, Transistors and IC's		
1N4148	6	Glass body. Band is cathode.
1N5401 or 1N5820	1	Black body. Band is cathode. PCB marking: 1N5401.
BB910	1	Black body, similar to TO-92 transistor. 2-pin. Varicap diode.
C8050 or S8050	1	TO-92 transistor. 3-pin. RX muting.
C3357	1	RE or RF marking. SMD 3-pin. First TX amplifier.
D882	1	TO-126 transistor. 3-pin. TX driver amplifier.
IRF530 or IRF510	1	TO-220 MOSFET. 3-pin. Final TX amplifier. PCB marking: IRF530
7808	1	TO-220 IC. 3-pin. 8V voltage regulator.
NE602A	2	DIP-8 IC. Balanced mixer.
MC1350	1	DIP-8 IC. IF amplifier.
TDA2822M	1	DIP-8 IC. Audio amplifier.
IC Socket	4	DIP-8.
Inductors		
4.7 µH Solenoidal	1	YEL-VIO-GLD-SLV
100 µH Solenoidal	3	BRN-BLK-BRN-SLV
FT37-43 Toroid	3	Black, for RF wide-band transformers
T37-2 Toroid	2	Red, for low-pass filters
Magnet Wire	2m	For toroid winding instruction, see band dependent sections below
Others		
Black chassis screw	8	For front and rear panels.
Chassis Feet	4	14 mm tall.
TO-220 thermal insulator	2	For IRFxxx and D882, as insulator between chassis and plate
TO-220 washer	1	Small and white, for IRFxxx, as insulator between plate and nut
Silver M3x10 Screw	7	For chassis feet and semiconductors.
Silver M3 Nut	7	For chassis feet and semiconductors.

Phone Jack	1	3.5mm, for speaker output
DC IN Connector	1	2.1mm type. Center positive.
Mic Connector	1	8-pin type socket.
SIP5 Connector	1	One pair with cable, for mic connector to PCB connection.
Black plastic knob	1	Smaller, for IF GAIN control
Silver and black knob	1	Bigger, for TUNE control
9V Relay	4	HK4100F-DC9V-SHG. Yellow body
Antenna Connector	1	BNC type, PCB mount.
Chassis	1	Black, aluminum alloy material
PCB set of 3 pcs	1	Including main board, black front panel and rear panel.
Quick Guide	1	Printed one-page guide.

75/80-meter Band Dependent Parts

Part	Qty	Comments
27 pF NPO	5	27 or 270. Ceramic or monolithic.
47 pF NPO	11	47 or 470. Ceramic or monolithic.
220 pF NPO	1	221. Ceramic or monolithic.
820 pF NPO	4	821. Ceramic or monolithic.
22 µH Solenoidal	1	RED-RED-BLK-SLV. Inductor.
3.8M IFT/ shielded coil	5	DIY7-3.8, one needs rework to remove built-in tubular capacitor.
IF Crystals	8	8.4672 M
VXO Crystals	1	12.040 MHz, 12.140 MHz, or 12.288 MHz, depending on operating frequency range

Toroids winding: 8 bi-filar turns on 3 pcs of FT37-43 black toroids, and 22 turns on 2 pcs T37-2 red toroids.

40-meter Band Dependent Parts

Part	Qty	Comments
27 pF NPO	5	27 or 270. Ceramic or monolithic.
47 pF NPO	11	47 or 470. Ceramic or monolithic.
120 pF NPO	1	121. Ceramic or monolithic.
470 pF NPO	4	471. Ceramic or monolithic.
22 µH Solenoidal	1	RED-RED-BLK-SLV. Inductor.
7M IFT/ shielded coil	5	DIY7-7, one needs rework to remove built-in tubular capacitor.
IF Crystals	8	8.4672 M or 8.192 M, depending on operating frequency range
VXO Crystals	1 or 2	15.360 MHz, 15.418 MHz, 15.500 MHz, 15.540 MHz, 15.570 MHz or 15.600 MHz, depending on operating frequency range

Toroids winding: 5 bi-filar turns on 3 pcs of FT37-43 black toroids, and 15 turns on 2 pcs T37-2 red toroids.

20-meter Band Dependent Parts

Part	Qty	Comments
15 pF NPO	5	15 or 150. Ceramic or monolithic.
27 pF NPO	9	27 or 270. Ceramic or monolithic.
47 pF NPO	2	47 or 470. Ceramic or monolithic.
270 pF NPO	5	271. Ceramic or monolithic.
7M IFT/ shielded coil	1	DIY7-7, needs rework to remove built-in tubular capacitor.
14M IFT/ shielded coil	4	DIY7-14
IF Crystals	8	4.194304 MHz or 4.096 MHz, depending on operation frequency range
VXO Crystals	1	18.432 MHz

Toroids winding: 5 bi-filar turns on 3 pcs of FT37-43 black toroids, and 11 turns on 2 pcs T37-2 red toroids.