



Shown with optional Digital Dial



First, familiarize yourself with the parts and check for all the components. If a part is missing, please contact us and we will send one. You must use *qrpguys.parts@gmail.com* to request a part.

Please read all the instructions before starting to assemble the receiver or optional digital dial.

Parts List

- 1 QRPGuys Lidia Receiver PCB
- 1 U1, MC3361C DIP IC
- 1 U2, 78L08 voltage regulator
- 2 U3,U5 J310 FET
- 1 U4, LM386 DIP IC
- 4 C1,C4, C7,C8, 100pF capacitor, marked 101
- 2 C2,C5, 470pF capacitor, marked 471
- 3 C3,C13,C28 10pF NPO capacitor, marked 10 or 100
- 2 C6,C20, .001 capacitor, marked 102
- 7 C9,C10,C18,C21,C24,C25,C26, .1uF capacitor, marked 104
- 1 C11, 56pF NPO capacitor, marked 56
- 1 C12, 10pF trimmer capacitor (white)
- 2 C14, C15, .01uF capacitor, marked 103
- 3 C16,C17,C19, .047uF capacitor, marked 473
- 4 C22,C23,C27,C29, 100uF electrolytic capacitor

- 1 R1, 1K 9mm square vertical PCB pot
- 2 R2,R3, 47K 6mm PCB pot
- 1 R4, 10K, 10 turn pot
- 2 R5,R9, 100K resistor (brown-black-yellow-gold)
- 2 R6,R15, 1K ohm resistor (brown-black-red-gold)
- 2 R7,R16, 1M resistor (brown-black-green-gold)
- 1 R8, 7.5K resistor (violet-green-red-gold)
- 1 R10, 47 ohm resistor (yellow-violet-black-gold)
- 1 R11, 500 ohm 6mm PCB pot
- 1 R12, 50K panel mount audio pot
- 1 R13, 220 ohm resistor (red-red-brown-gold)
- 1 R14, 22 ohm resistor (red-red-black-gold)
- 2 L1,L2, 6.8uH axial inductor, marked blue-gray-gold-silver
- 1-L3, T37-2 (red) toroid core
- 1 L4, 100uH axial inductor, marked brown-black-brown-gold
- 1 D1, 1N4001-7 diode
- 2 D2,D3, varactor diode, BB910, marked "910", "B910", or "BB910"
- 1 J1, Horz. PCB BNC female connector
- 1 J2, Coaxial DC power jack, 2.1mm center pin
- 1 J3, 3.5mm female PCB stereo jack
- 1 J4, 2 pin header, and Berg connector (jumper)
- 2 S1,S2, SPDT slide switch
- 1 16 pin IC socket
- 1 8 pin IC socket
- 1 Knob, #1, small
- 1 Knob, #2, med.
- 4 3/8" dia. rubber foot
- 1 12" #24 hook-up wire
- 1 24" #28AWG magnet wire
- 1 red mylar filter

First item to assemble is the PCB chassis.

Even if you have done radio kit assembly before, please read through all the instructions before you start. This kit is a little different, in that the mechanical components are the part of the printed circuit board. The instructions give you the scope of the project and an understanding of the techniques we have employed. You will be assembling the kit from four pieces of PCB material. The base contains all the circuitry for the receiver. There are solder pads, and letter coded parts, that match each other. When you tack and then solder the components it will make a sturdy mechanical assembly. Refer to the figure below for identification of the individual PCB parts. *We also give you the option to use the Base PCB only and mount the receiver in a chassis of your choice.*



On all the mechanical assembly soldering, you will use the same technique. You tack a single tiny point first, and then check to see that it is square and aligned with the registration points and assembly notes. It is easy to re-heat the joint and adjust the alignment when there is only a single point. You will tack all the other pads, before you do the finish soldering.



When soldered, the completed chassis will look like this, with all the holes and circuitry needed for the assembly. There will be no drilled holes to be added.

Soldering the chassis together:

One of the physical properties of solder is that it contracts when it cools. Knowing this, we can allow for it. If two pieces of the pcb material are clamped 90° apart, and you apply solder at the joint, the joint will close about 1°-2°, no matter how well you clamp it, the PCB material will flex and you will end up with an 88° corner. That doesn't sound like a lot, but you don't want that to happen. If you try to straighten it cold, you will lift off the solder pad from the PCB. To counteract this, you position the front panel at slightly greater than 90°. When it's tacked it will pull back to square (90°). Finally, adding the gussets maintain this position and make a strong assembly.

You will need to work on a flat surface. I use a 1 foot square piece of a Formica counter top, but any flat surface will do. The first task is to position the front panel and the base with the "C's" matching, so that both side edges are flush with each other against something you have that is square. It can be a small piece of angle iron, or a square piece of wood with sharp corners. Position a short piece of 1/32" diameter solder or wire 4" long against the bottom of the square corner and lean the front panel back. This gives you the greater than 90° you are looking for. See figures below.



[] A small "tack" at one of the "C" pads is all that is required at this time. *Check for squareness, flush on both sides, and flush on the bottom.* If not all these conditions are met you only have to reheat the one tack and reposition the two pieces. When you are satisfied, "tack" the other "C" pad. *Do not completely solder the pads.*

Position either of the side gussets against the inside edge of the previous assembly. Match the letters. You can hold the small triangle of PCB material while you put a small "tack" on one of the pads. As before, check for squareness, and a flush joint. See the figure below.



- [] "Tack" the other pad on that side. *Do not completely solder the pads*.
- [] Use the same technique with the other gusset.
- [] When you are satisfied with the alignment and squareness of the "tacked" assembly you can go back and complete the soldering of all the pads. Alternate between different pads and add a small amount on each pad until the joints are complete.

This completes the chassis.

Now that the chassis is complete. Refer to the graphic below and the PCB silk screening for the placement of the components.



- [] Install C1,C4,C7,C8, 100pF capacitor, marked 101
- [] Install C2,C5, 470pF capacitor, marked 471
- [] Install C3,C13,C28, 10pF capacitor, marked 10 or 100
- [] Install C6,C20, .001uF capacitor, marked 102
- [] Install C9,C10,C18,C21,C24,C25,C26, .1uF, marked 104
- [] Install C11, 56pF NPO capacitor, marked 56
- [] Install C14,C15, .01uF capacitor, marked 103
- [] Install C16,C17,C19, .047uF, marked 473
- [] Install R5,R9, 100K resistor (brown-black-yellow-gold)
- [] Install R6,R15, 1K resistor, marked (brown-black-red-gold)
- [] Install R7,R16, 1M resistor (brown-black-green-gold)
- [] Install R8, 7.5K resistor (violet-green-red-gold)
- [] Install R10, 47 ohm resistor (yellow-violet-black-gold)
- [] Install R13, 220 ohm resistor (red-red-brown-gold)
- [] Install R14, 22 ohm resistor (red-red-black-gold)
- [] R17 not used at this time
- [] Install L1, L2, 6.8uH axial inductor, marked (blue-gray-gold-silver), larger than the resistors
- [] Install L4, 100uH axial inductor, marked (brown-black-brown-gold), larger than the resistors
- [] Install D1, 1N4001-7 diode, with the band as shown on the figure



[] Install D2, BB910 varactor diode, marked 910, B910, or BB910, observe the outline shown below.



We supply two TO-92S size BB910 varactors for D2,D3. Using a single varactor will yield about 150kHz band spread on 40m, and the best resolution. Putting both varactors in D2 and D3 you can get the whole 300kHz band, but with coarser tuning. Try a single one first.

- [] Install C12, 10pF trimmer (white), observe the outline
- [] Install R2, R3, 47K 6mm PCB pot. as shown in the graphic below.



[] Install R11, 500 ohm 6mm pot. as shown in the graphic below.



- [] Install U2, 78L08 voltage regulator, observe the outline
- [] Install U3,U5, J310 FET transistor, observe the outline
- [] Install J4, 2 pin header. *The Berg connector (jumper) is optional for bypassing the RF amplifier.*

Note on the pre-amp: I have not found the pre-amp necessary on 40m. We included the parts, but you can select it or disable it by means of the jumper. If you decide to try other bands you may find it useful. You disable the pre-amp by installing the jumper at J4.

- [] Install the two IC sockets where shown for U1 and U4
- [] Install C22,C23,C27,C29, 100uF electrolytic capacitor, *observe polarity*, long lead positive
- [] Install J3, 3.5mm female PCB stereo jack
- [] Install J2, DC power jack, 2.1mm pin
- [] Install S1,S2, SPST slide switch
- [] Install J1, horzizontal PCB BNC female connector, discard the nut and washer, if present
- [] Install R1, 1k 9mm square vertical pot.
- [] Wind L3 as shown below, and install upright for 40m, use the T37-2 (RED) core and 24" of the supplied magnet wire. You are winding a total of **29** turns. Every time the wire goes thru the center counts as one turn. You are starting with 29 turns. There is wide a adjustment in the alignment procedures, however If you cannot raise the frequency high enough to get the whole 40m band you may need to remove 1 turn on L3. Try 29 turns first, it is easier to remove a turn, than to add one.



Note: Now is a good time to mention a good way for counting the turns on your toroids. Many times on a toroid with a lot of turns, you can lose track going around, as some are quite small. A good trick is to take a digital picture of it before you trim the leads and enlarge it on your computer screen. Counting is clearly a lot easier.

[] Install R4, 10K 10 turn pot centering the shaft in the front panel clearance hole. Remove the nut and lock washer. Check around the three terminals for excess sealant and trim if needed, if the four projections do not fit flush on the board. Position the pot on the PCB with the four projections on the PCB. Center the projections within the guidelines silkscreened on the PCB.

Solder the center lug. Check for alignment and reheat if necessary, and adjust. Then finish soldering the other two lugs. The PCB holes are oversize to allow the "T" shape terminal to get thru the hole.





[] Mount R12, 50K pot. in the front panel above the tuning pot., as shown in the figure below and wire the three contacts as shown. This view is from the rear.



- [] Install the two control knobs. Larger one on the "Tuning" pot., smaller on the "AF Gain" pot.
- [] Install the four rubber feet on the bottom where indicated by the silkscreen. Trim any rubber flash if needed to fit.
- [] Trim the red mylar filter and tape the edges over the rectangular hole on the inside.

Optional Digital Display Assembly Considerations:

When you assemble the digital dial, mount the digital dial push button switch and trimmer capacitor on the back side of the display PCB if you want to have access to them without removing it for adjustment. Do not use the 2 pin headers that came with it for power and signal. Use the flat head screws and spacers that came with the Digital Dial. When installed, they will be almost flush with the face of the front panel. Connect the power and signal to the display using the solder pads identified on the lower right side of the receiver PCB to the display signal and power pads with the supplied hook-up wire. A single ground connection is all that is required for both power ground and signal ground. *You will not be programming an offset into the display firmware.* The DD SIG. pad is at the receiving frequency. Make sure the Digital Dial is functioning correctly before installing it in the receiver.

- [] Install the Digital Dial with the hardware and spacers that came with it.
- [] Power up the receiver with 11-13.5VDC. The center pin is "+" on J2. Check for +8.0V on pin #4 of U1. Check for +9-13V on pin #6 of U4. If all is OK, install U1 and U4 in the sockets as shown below.



When inserting IC's the pins are flared so that they can be retained by auto insertion tools. Gently rock them on a flat surface so the pins are parallel and they will insert into the sockets more easily.

Alignment:

With R2, R3, and the trimmer capacitor C12, you can adjust to the curve on the varactor diodes to obtain your preference for band segment and band spread. Also spreading or compressing the turns on the toroid L3, will affect the starting frequency. They all four interact with each other, so be prepared to tweak them to your preference. As a general rule of thumb on 40m, you get about 10kHz of coverage for each .1V of change on TP1.

<u>40m band:</u> Let the receiver warm up for about 5 minutes.

The example below is for one BB910 diode installed at D2 or D3, for lower band edge at ~7000kHz, upper at 7150 -7180kHz.

1. Start by setting R2 and R3 to the middle of their range.

2. Check the voltage at TP1. There should be ~1.5V spread from the left most position of the main tuning control to the right most position.

3. With the tuning pot at the left most position, adjust C12 so the readout is close to 6975-7000kHz. Adjust R2 and R3 if necessary.

4. The tuning pot at the right most position should now be ~7150-7180kHz.

The example below is for two BB910 diodes installed at D2 and D3, for lower band edge at ~7000kHz, upper at ~7300-7350kHz.

1. Start by setting R2 and R3 to the middle of their range.

2. Check the voltage at TP1. There should be ~3.0V spread from the left most position of the main tuning control to the right most position.

3. With the tuning pot at the left most position, adjust C12 so the readout is close to 6975-7000kHz. Adjust R2 and R3 if necessary.

4. The tuning pot at the right most position should now be close to 7300-7350kHz.

Remember that R2, R3, C12, and the turns on L3 all interact with each other, so a little back and forth may be necessary to achieve the band spread and resolution you want. If you cannot raise the lower edge of the frequency enough due to component tolerances and varactor variations, try removing 1 turn from L3.

Usage:

The receiver will work well with a variety of antennas from dipoles, verticals, to simple wire antennas. The R1 pot is for RF Gain. The audio passband is adjustable in the CW position using R11 for your listening preference. There is plenty of audio output to drive an external speaker. For those that do not want to use the open frame design, discard the gussets and front panel. There are four corner holes on the main PCB that can be used to mount the receiver in a chassis of your choice. We have included a position for a dual varactor (D4) for experimenters. Also, for those wanting to try an axial varactor, simply use the D2 or D3 position and mount it vertically. Be sure to observe the polarity.

Note on the pre-amp:

I have not found the pre-amp necessary on 40m. We included the parts, but you can select it or disable it by means of the jumper. If you decide to try other bands you may find it useful. You disable the pre-amplifier by installing the jumper at J4.

Note to experimenters:

For experimenters that want to try other bands. The MC3361C is rated up to 60mHz. The passband filter (C1,C2,C3,C4,C5,L1,L2) ahead of the MC3361C would need to be re-configured. The local oscillator component L3 would also need configuring. The frequency dependant components have pads as well as thru holes for components. We recommend tacking any experimental components to the pads to reduce the stress of the thru holes as shown below. If for any reason you think there is too much gain on the front end, place the jumper on J4 to disable the J310 rf-amplifier.



We had done some experimenting on other bands and have arrived at the following starting values for 80m, 30m. Your results may vary and may need a little tweaking. We encourage experimenting and sharing your results.

For 80m - (C1,C4 - 270pF), (C2,C5 - 680pF), (C3 - 10pF), (L1,L2 - 10uH), L3 - 37 turns on a T37-1 (blue) toroid.

For 30m, (C1,C4 - 68pF), (C2,C5 - 470pF), (C3 - 5pF), (L1,L2 - 3.3uH), L3 - 19 turns on a T37-2 (red) toroid. For 30m we also installed a 3.9K resistor in the R17 position to reduce the bandspread. You can add this resistor on the bottom of the board if you like.

For 20m – (C1-100pF) ,(C4 - 82pF), (C2,C5 - 470pF), (C3 - 10pF), (L1,L2 - 1.8uH), L3 – 16 turns on a T37-6 (yellow) toroid.

The alignment procedure is basically the same process as for 40m. Adjusting R2, R3, and C12 should yield the portion of the spectrum you need. If you are unable to get to the portion of the band with the L3 turn count stated, simple remove a turn from L3 to raise the frequency, or add a turn to lower it.

Schematic:



Representative Block Diagram



This device contains 92 active transistors.

MC3361C Circles indicate pins used

Many thanks to Wim, SP5DDJ for permission to carry on with his design. It is dedicated to his wife Lidia. For pictures of his receivers built and in use, visit:

https://translate.google.com/translate?hl=en&sl=pl&u=http://www.sp5ddj.pl/Lidia%252080%2520DC%2 520Receiver/Lidia%2520Dziennik%25202013.htm&prev=search

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Notes: