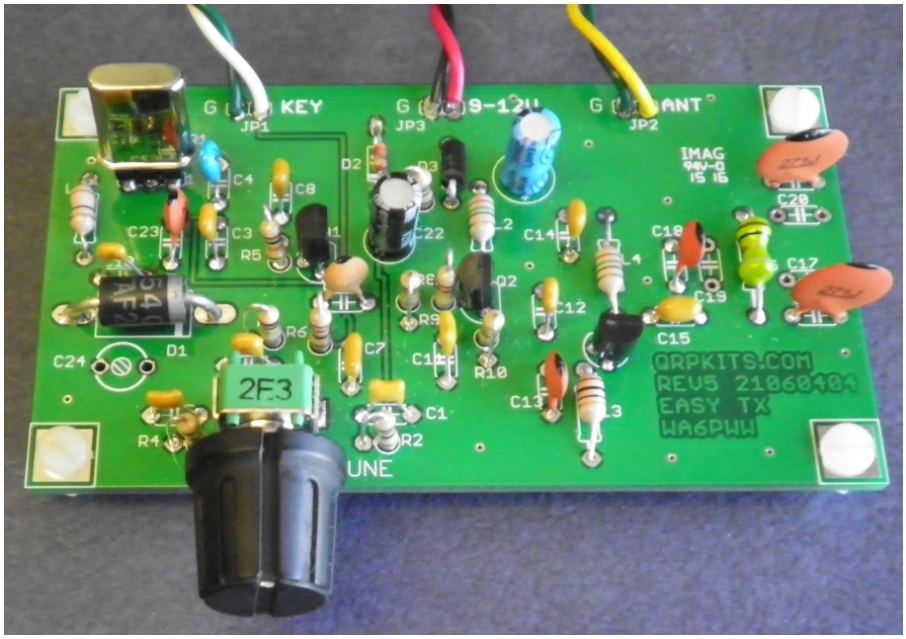
Easy Transmitter



Introduction

The Easy Transmitter kit from qrpkits.com provides a basic, crystal controlled transmitter with VXO tuning to provide a small tuning range around the crystal frequency. It is currently available for 40M but can be put on almost any HF band with minor component and crystal changes.

Description and Specifications

The circuit consists of a 2N3904 based crystal oscillator with VXO. The oscillator feeds a 2N3904 buffer/driver stage and the final amplifier stage utilizes a BS170.
The final amp is followed by a 3 pole low pass filter with elliptic capability for good harmonic suppression. The transmitter provides approximately 2 watts when powered from a 9-14 volt supply.
VXO tuning range is approximately 500Hz around the crystal frequency and fixed frequency operation may be also utilized by replacing the diode with a trimmer or fixed capacitor(optional).
Crystals available for 7.030 or 7.040 frequencies (choose at time of ordering)

Support

Email: qrpkits.com@gmail.com

Recommended Tools

- ◻ Temperature Controlled Soldering Station with small tip or 15-35 watt soldering iron with a small tip.
- ◻ Solder 60/40 or 63/37 Tin-Lead or leadfree
- ◻ Small Diagonal Cutters
- ◻ Small Needle Nose Pliers
- ◻ Pencil, Pen, and/or Highlighter
- ◻ BRIGHT work light

Optional

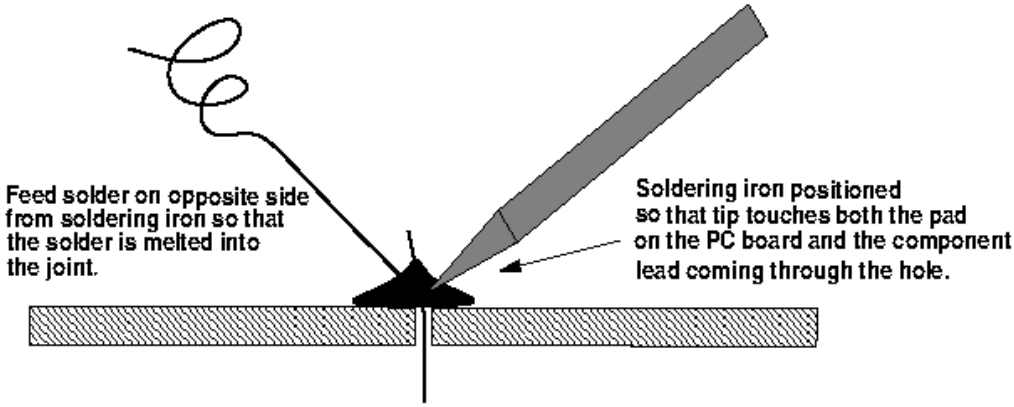
- ◻ Magnifying headpiece or lighted magnifying glass.
- ◻ Multi-meter
- ◻ Dummy Load
- ◻ Scope or RF power meter
- ◻ Solder Sucker or Solder Wick
- ◻ Small multi-blade Screw Driver
- ◻ Knife or Wire Stripper
- ◻ Small Ruler
- ◻ Cookie Sheet to build in and keep parts from jumping onto the floor.

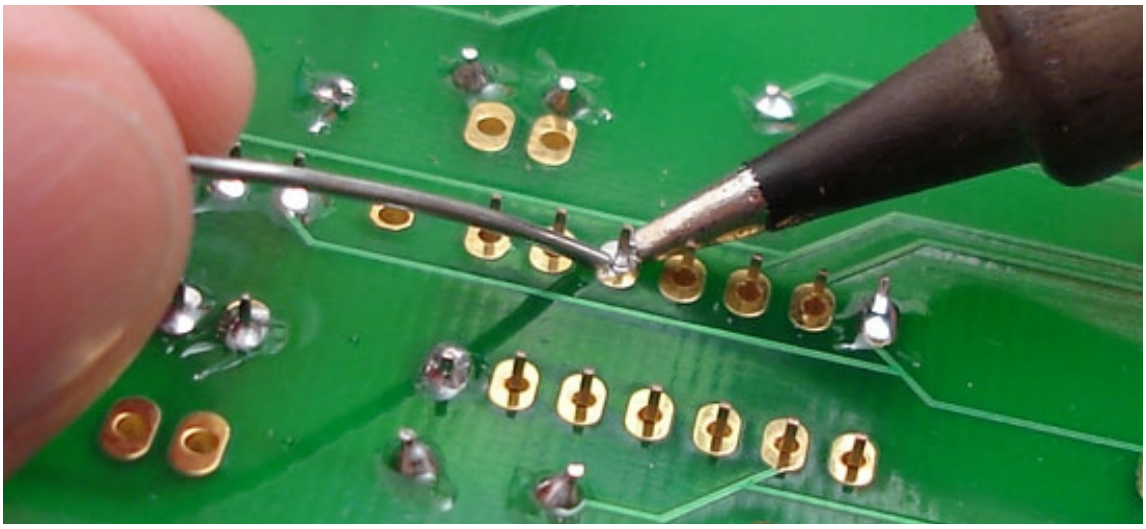
Construction Techniques

- ◻ The Parts List has columns for inventory and construction.
- ◻ Please take time to inventory the parts before starting. Report any shortages to QRPKITS.com (In many cases it may be faster and cheaper to pull a replacement from your parts supply, but please let us know if we missed something.)
- ◻ Pre-sorting the resistors and capacitors can speed up the assembly and reduce mistakes.
- ◻ **There is no need to print out the whole assembly manual unless you want a copy. Print the Parts List and Schematic (last two pages) then view the rest of the manual on a computer, laptop, or tablet.**
- ◻ You can insert several parts at a time onto the board. When you insert a part bend the leads over slightly to hold the part in place, then solder all at the same time. Clip the leads flush.
- ◻ Most parts should be mounted as close to the board as possible. Transistors should be mounted about 1/8” above the board. Solder one lead on ICs or IC sockets and then check to make sure the component is flush before soldering the remaining leads.
- ◻ Use a Temperature Controlled Soldering Station with small tip or 15-35 watt soldering iron with small tip. Conical or very small screw driver tips are best.

- DO NOT use a large soldering iron or soldering gun.
- If you are a beginner, new to soldering, there are a number of resources on the web to help you get on the right track soldering like a pro. Google “Soldering Techniques”.

Soldering Technique





Inventory and Parts List

Use the first column to check the parts as you inventory and the second as you install them

Inventory	Inst.	Qty	Parts	Value	Identification	Description
		0	R1	N/A	Not used	Not Installed
		2	R2, R4	100	brn-blk-brn-gold	Resistor, 1/4W , 5%
		1	R6	1K	Brn-blk-red-gold	Resistor, 1/4W , 5%
		2	R5, R7	100K	Brn-blk-yel-gold	Resistor, 1/4W , 5%
		1	R8	220K	Red-red-yel-gold	Resistor, 1/4W , 5%
		1	R9	150K	Brn-grn-yel-gold	Resistor, 1/4W , 5%
		1	R10	470	Yel-vio-brn-gold	Resistor, 1/4W , 5%
		1	R11	150	Brn-grn-brn-gold	Resistor, 1/4W , 5%
		3	C1, C2, C11	1000pF	102	Capacitor, monolythic
		2	C3, C4	68pF	68	Capacitor, disk NP0
		1	C12	100pF	101	Capacitor, monolythic
		1	C5	0.1uF	104	Capacitor, monolythic
		1	C6	47uF	47uF	Electrolytic Capacitor
		2	C7, C15	0.047uF	473	Capacitor, monolythic
		2	C8, C14	0.01uF	103	Capacitor, monolythic
		2	C9, C23	22pF	22	Capacitor, disk
		3	C10,C16,C20	270pF	271	Capacitor, disk
		1	C13	51pF	51	Capacitor, disk
		0	C17	N/A	Not used	Not used
		1	C18	56pF	56	Capacitor, disk
		0	C19	N/A	Not used	Not used
		0	C21	N/A	Not used	Not used
		1	C22	22uF	22	Electrolytic Capacitor
		0	(C24)		Trimcap	Not included
		1	L1	18uH	Brn-gry-blk-gold	Molded inductor
		2	L2, L4	15uH	Brn-grn-blk-gold	Molded inductor
		1	L3	10uH	Brn-blk-blk-gold	Molded inductor
		1	L5	1uH	Brn-blk-gold-gold	Molded inductor
		1	D1	1N5401	1N5401	Large black plastic diode
		1	D2	1N5240	1N5240	Glass 10V Zener diode
		1	D3	1N5817	1N5817	Small black plastic dioode
		2	Q1, Q2	2N3904	2N3904	TO 92 plastic case transistor
		1	Q3	BS 170	BS170	TO 92 plastic case transistor
		1	Header	XT1	XT1	header for crystal socket
		1	R3	10K	B10KB	Linear Potentiometer
		1	BNC	BNC	Connector	Panel Mount BNC
		2	Wire	Wire	2-12 inch sections	Hookup wire, 2 colors
		1	Knob	Knob	.55” knob	Small knob for tuning pot
		1	PCB	PCB	Rev5	Easy TX Circuit Board
		1	X1	Choice	Crystal	7.030 or 7.040

Inserting the Parts

Note: A board layout showing parts locations and schematic diagram are located at the end of this manual, we suggest you print out a copy for reference during assembly.

Resistors

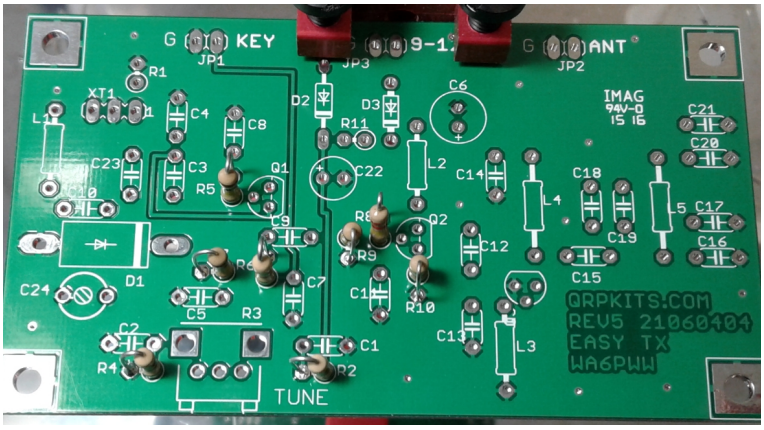
Sort the resistors R2 through R10 by value and insert them smallest value first, largest value last. Be sure to check the color code for each resistor as you install. [Measuring with an Ohm meter is a good idea.]

A good reference for reading resistors is here:
http://www.token.com.tw/resistor/resistor-color-code.htm

The resistors are mounted standing up on the board. To do this, just bend one lead back along the resistor body before inserting into the board. This will leave the lead on top exposed to serve as a test point for checking voltages.

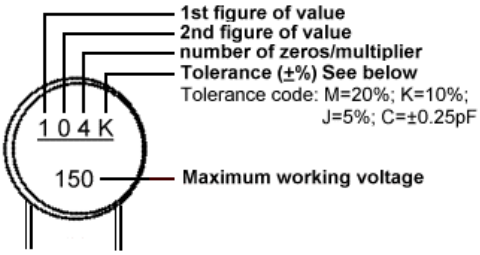
A good reference for mounting resistors vertically is here:
http://www.wb5rvz.com/sdr/common/Common_Component_Mounting.htm#resistors

See the photo below as a guide for resistor installation.

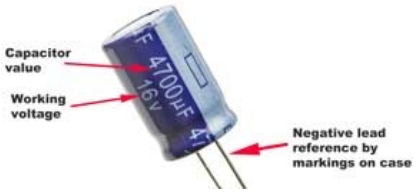


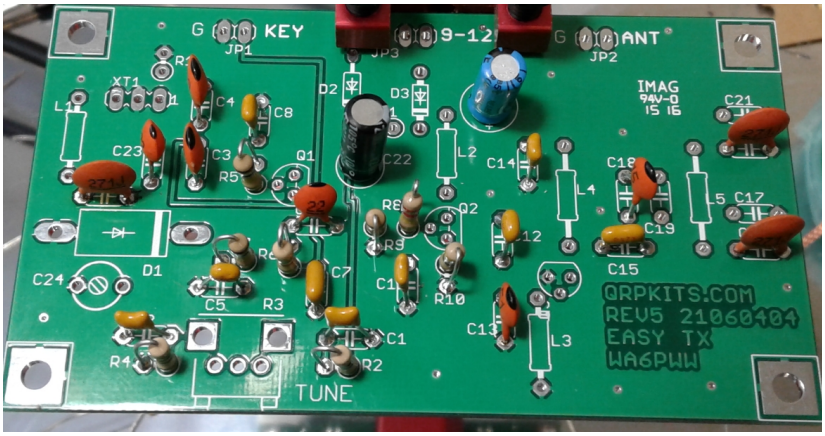
Capacitors

Monolythic and Disk Next sort by value and insert the molded and disk capacitors C1 to C5 and C7 to C20 and C23. Be sure to double check the values before soldering. The molded capacitors will be somewhat rectangular and may be blue, tan or brown in color. The disk ceramic capacitors will be brown disks. Both will have printed markings indicating the value.



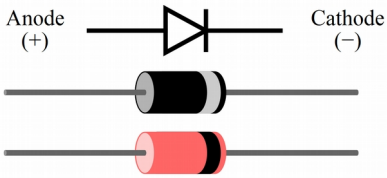
Electrolytic Now locate and insert the electrolytic capacitors C6 (47uF) and C22 (22uF) They are round cans with leads and may be blue or black. These capacitors are polarized. The longer lead is usually the positive + (plus) lead and should go in the positive hole that is marked on the circuit board with a + symbol. The shorter lead is usually the - (minus) lead. The negative lead is also marked with a black bar on the side of the capacitor so be sure to confirm with this marking before soldering.





Diodes

Sort and install the diodes D1, D2 and D3. Be sure to confirm the value and double check orientation before soldering. Diode D1 (1N5401) is a large black plastic package, D2 (1N5240) is a small glass packaged diode and D3 (1N5817) is a medium sized black plastic case.

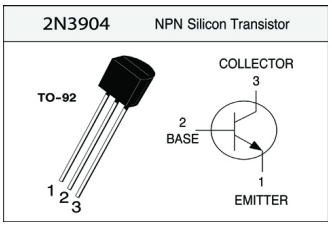


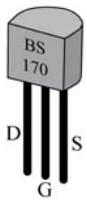
Inductors

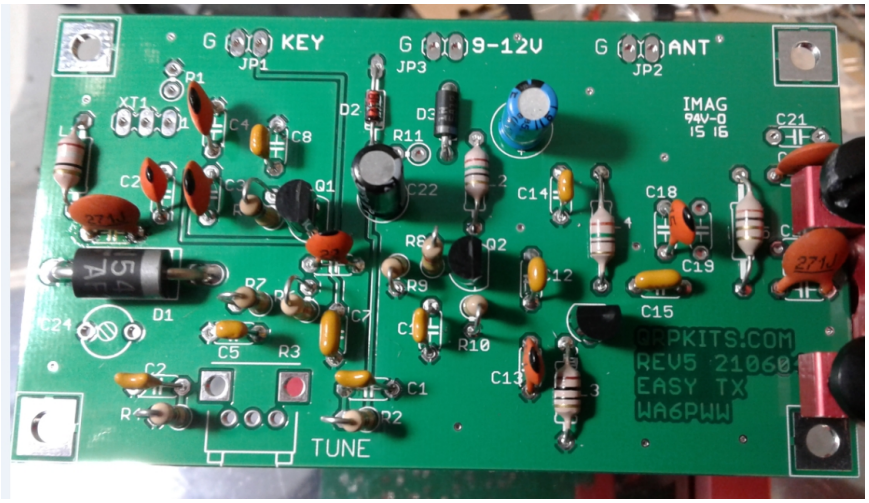
Next, locate and install the inductors L1-L5. They are similar in appearance to resistors but typically have larger bodies and are often different color bodies. If in doubt, check with an ohmeter. Inductors will have very low resistance as they are just coils of wire inside. Bend the leads 90 degrees at the end and insert into the board positions as indicated.

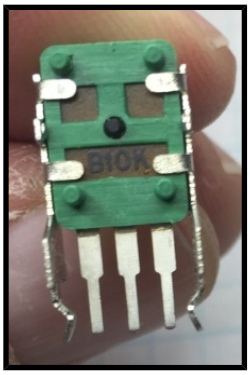
Transistors

There are 3 transistors (Q1, Q2 and Q3) in the kit. Q1 and Q2 are 2N3904 and Q3 is a BS-170. They are in the same TO-92 package but can be identified by the markings on the flat side of the case. You will need to slightly bend the center lead to fit the board layout. Be sure to confirm the part and location before soldering.





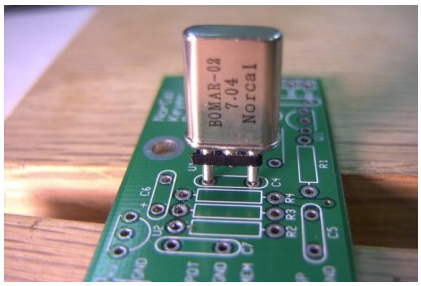




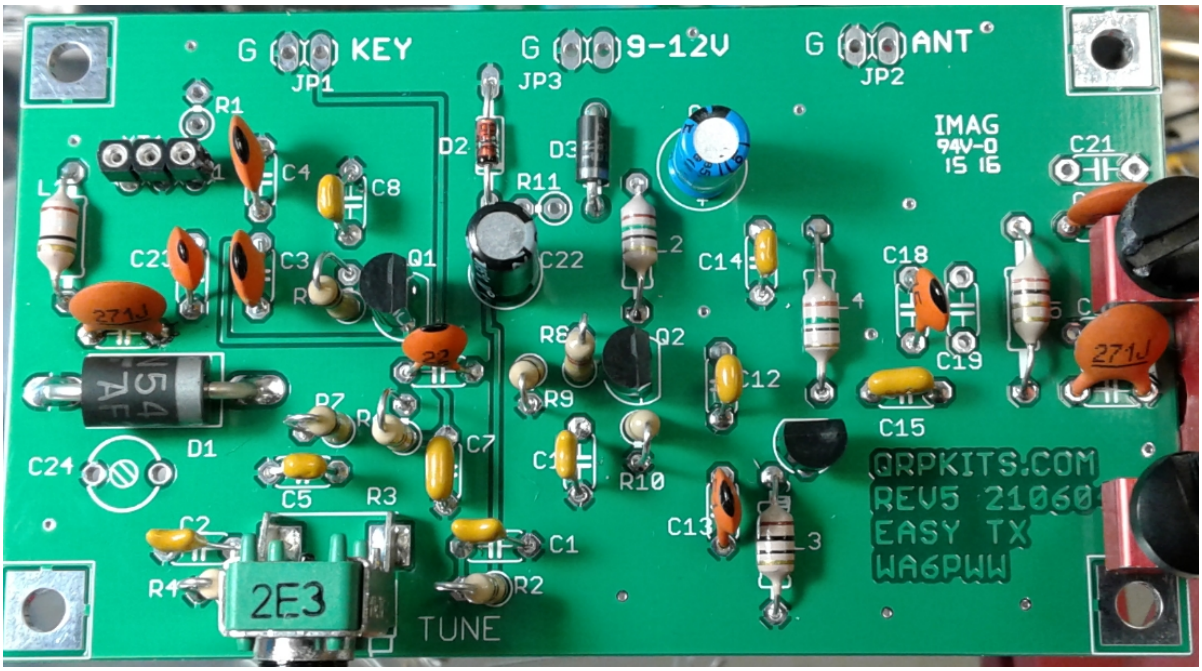
Tuning Potentiometer

Install R3, labeled as B10K. This is a potentiometer that mounts in the pc board and serves to tune the transmitter. It has two tabs that snap into the board and 3 leads. Be sure it is seated before soldering. First solder one tab and recheck that it is seated before soldering the other. Lastly, solder the three contact pins in the middle.

Crystal Socket and Crystal



Install the 3 pin header to serve as a crystal socket that will hold the crystal. To insert the crystal, you may find it helpful to slightly trim the crystal leads but this is not critical and they can be left at full length. We have a reference on the website to show how a socket can be made from a header strip:
http://www.qrpkits.com/buildertip03.html
In this case, the board has a center hole so there is no need to trim the middle lead on the header strip.



Hooking Up

Your Easy Transmitter kit is now completed. For packaging and testing, you will find included in the package, a BNC along with some hookup wire. You will need to provide a connection for DC power and a method for keying the transmitter. For initial testing, you can just temporarily connect short wires to the board pads and use clip leads for connection of antenna and power. A fuse of 3-5 A rating is recommended in the power lead to protect in the event of a short. The transmitter is designed for power supplies in the 11-12V range but can be used with power supplies up to 15V.

Troubleshooting

The Easy Transmitter is designed to be a simple kit to build and to use. However, occasionally, problems may happen. In our experience, these are often soldering issues (shorts or cold solder joints) or component misplacement Here are a few things to check if the kit does not function as it should.

1. Verify component placement, including resistors and capacitors

2. Inspect all solder joints with a magnifying glass, looking particularly for any that may have small whisker shorts or which look dull and blotchy indicating a cold solder joint.

3. Verify orientation of the diodes and transistors. One end of the diodes will have a marked band and this should match the board layout.

4. Check DC voltages to ground at the following points in the circuit:

Emitter of Q1, 4 to 6 volts key down, 10V key up
Emitter of Q2, 5-7 Volts key up or key down
Junction of C5 and R7, variable from 0.2V to 9.8V

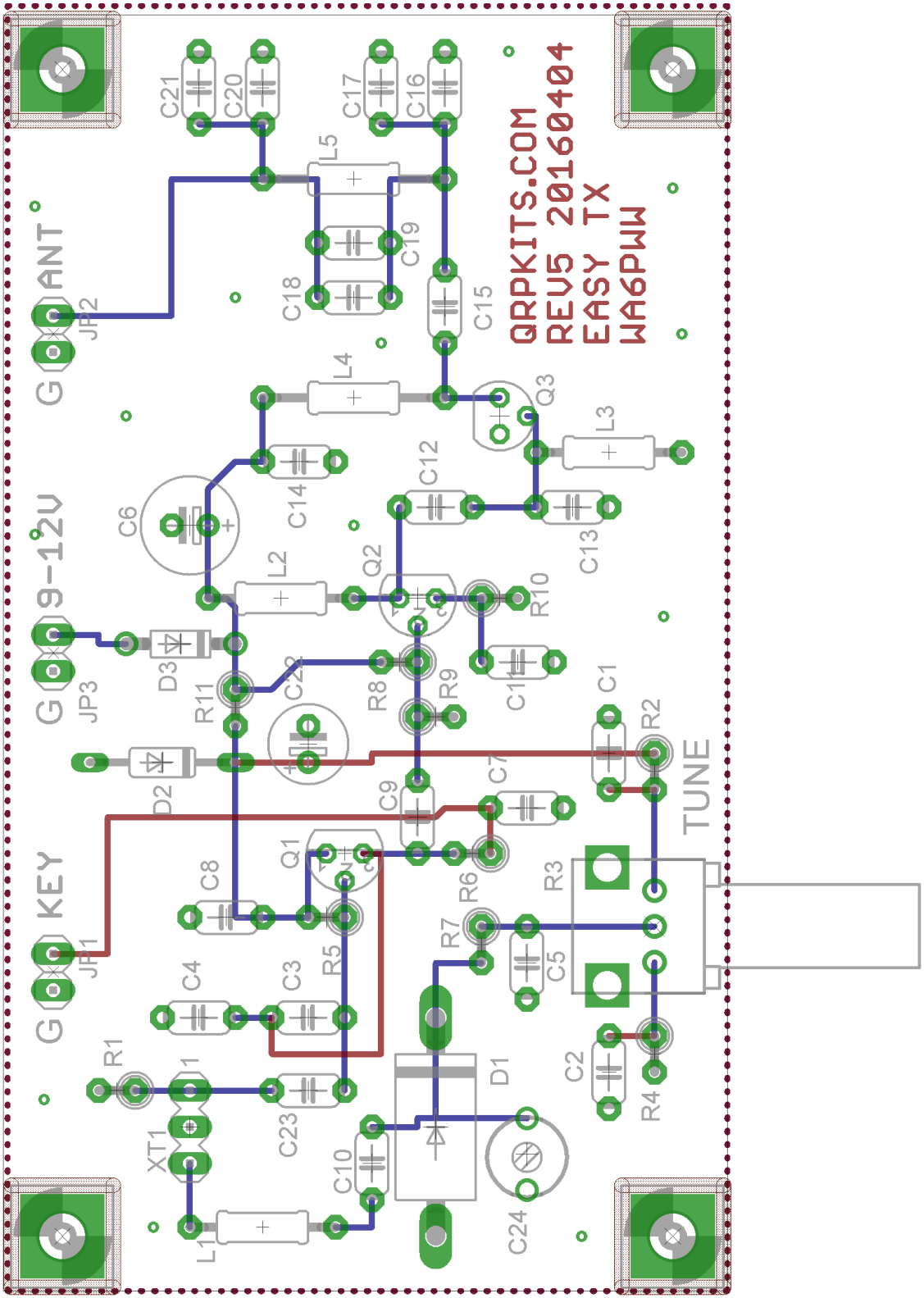
Packaging

Again packaging is left up to the builder. The can be built into a case or operated open on the bench. If used as an open board, use care not to damage or short connections on the bottom of the board

Operation

The Easy TX kit allows for limited tuning range around the crystal frequency. Turning the tuning dial will vary the operation from approximately 500Hz above the marked crystal frequency to 500Hz below. A point approximately in the middle of the tuning range will put the transmitter on the marked frequency but this may vary slightly from kit to kit. The intent of the limited tuning is to provide sufficient range to put the transmitter on the chosen qrp frequency without requiring excessive adjustment during operation.

Board Layout



Schematic Diagram