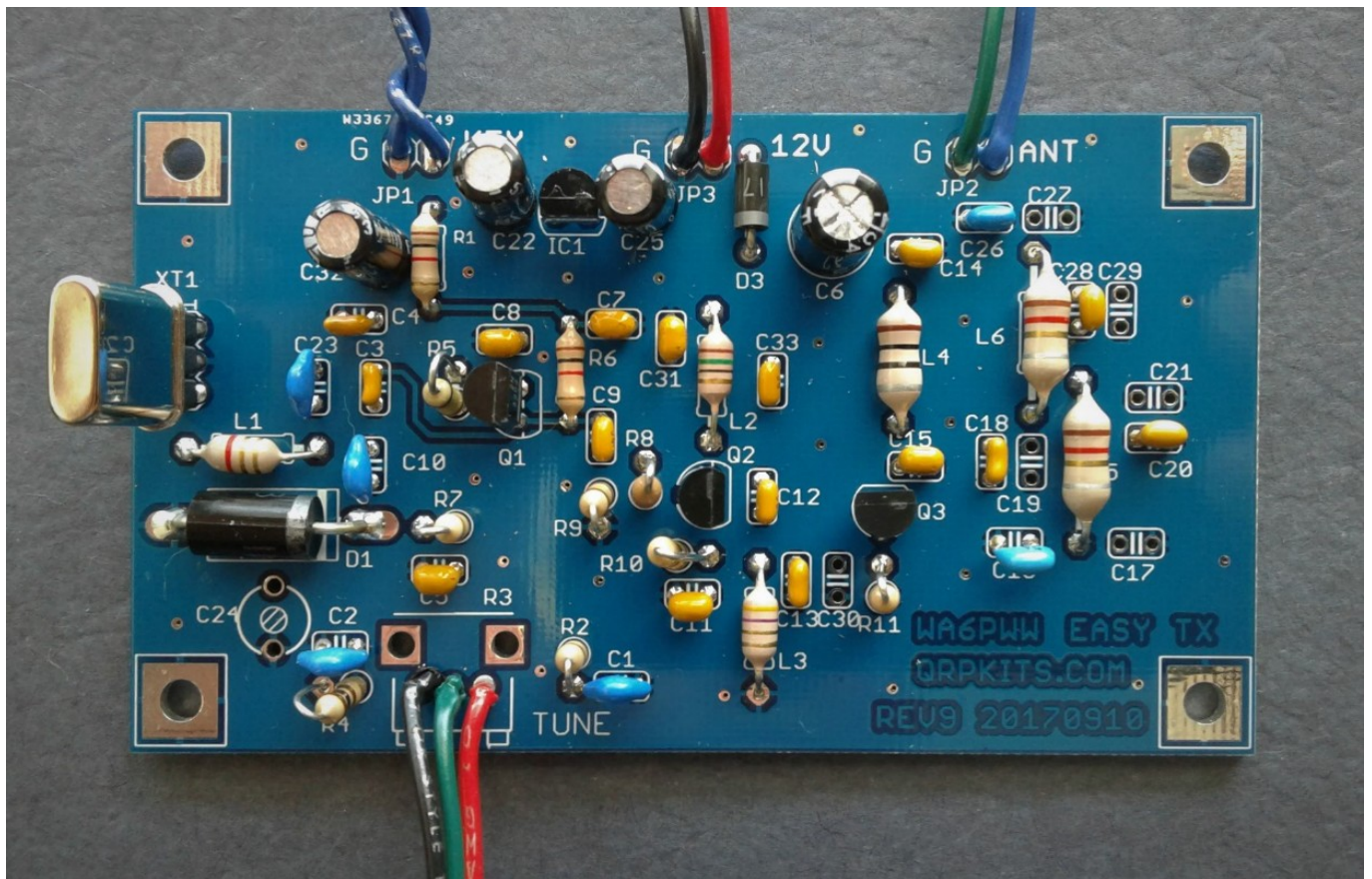


Pacific Antenna Easy Transmitter Kit



Introduction

The Easy Transmitter kit from qrpkits.com provides a crystal controlled transmitter with VXO tuning.

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.

Description

Provides approximately 2 to 2.5 watts when powered from a 9-14 volt supply.

5 pole low pass filter with elliptic capability to provide a clean signal.

Tuning range of approximately 1 kHz on 40M.

Crystal included for either 7.030 or 7.040 frequencies (choose at time of ordering).

Uses all molded inductors with no toroids or other coils to wind.

Easy to assemble- a great first kit for new or returning builders or as a club project.

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

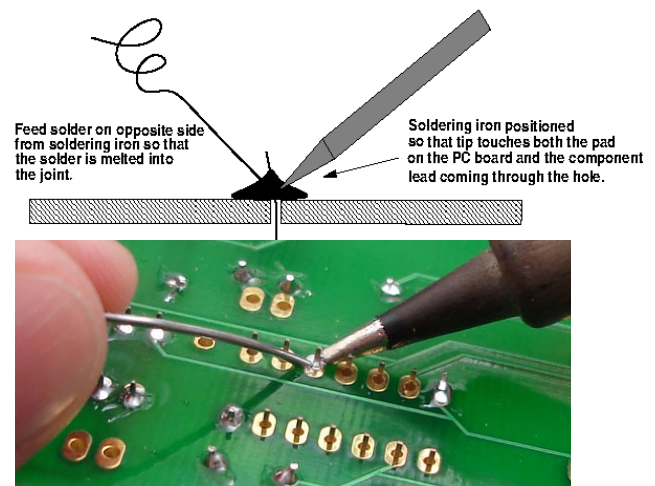
- ❑ Magnifying headpiece or lighted magnifying glass.
- ❑ Multi-meter
- ❑ Dummy Load
- ❑ Scope or RF power meter
- ❑ Solder Sucker or Solder Wick
- ❑ Small multi-blade Screw Driver
- ❑ Knife or Wire Stripper
- ❑ Small Ruler
- ❑ Cookie Sheet to build in and keep parts from jumping onto the floor.

Construction Techniques

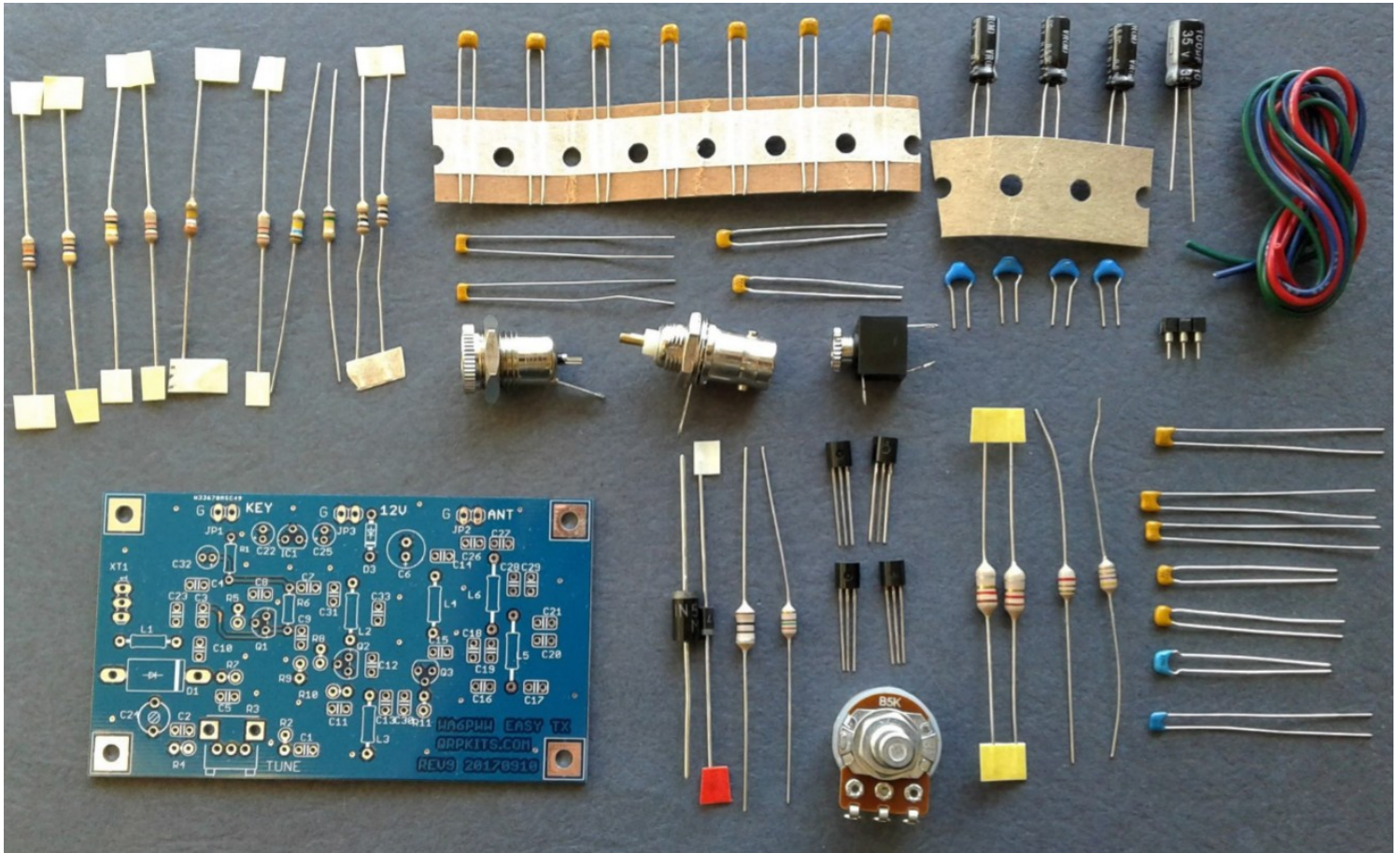
- ❑ The Parts List has columns for inventory and construction.
- ❑ Please take time to inventory the parts before starting. Report any shortages to QRPKITS.com (In many cases it may be faster and cheaper to pull a replacement from your parts supply, but please let us know if we missed something.)
- ❑ 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.

Soldering Technique

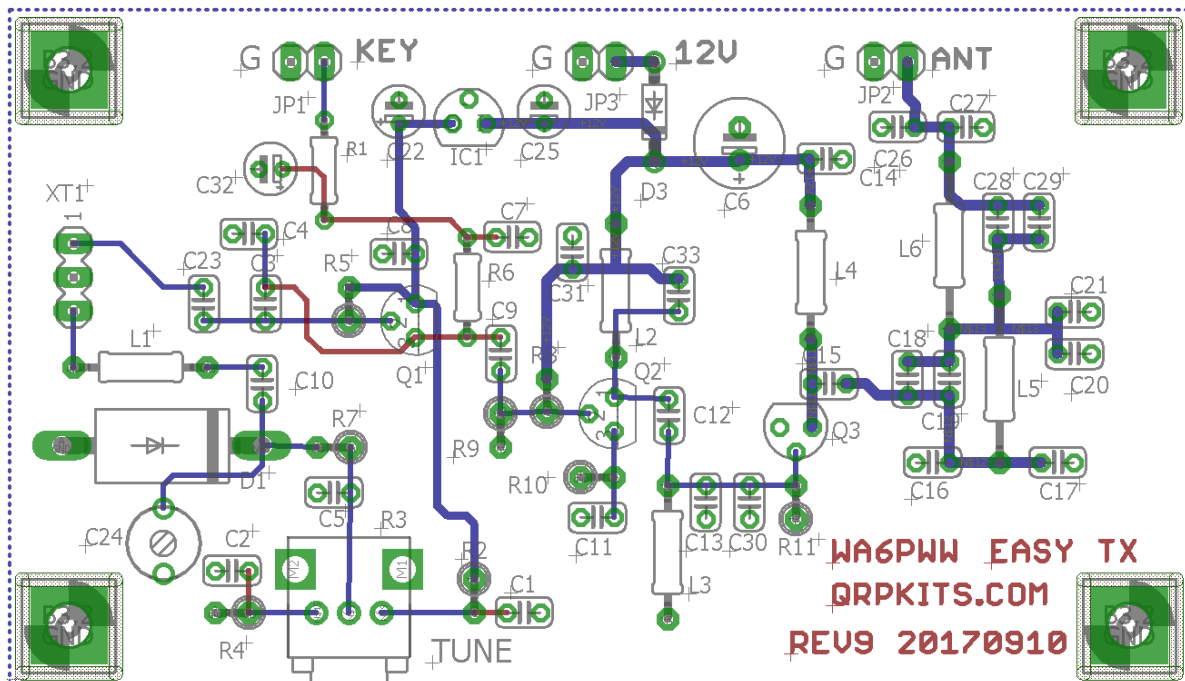
- ❑ Use a Temperature Controlled Soldering Station with small tip or 15-35 watt soldering iron with small tip. Conical or very small screw driver tips are best.
- ❑ DO NOT use a large soldering iron or soldering gun.
- ❑ If you are a beginner, new to soldering, there are a number of resources on the web to help you get on the right track soldering like a pro. Google "Soldering Techniques".



Typical Parts Included in the Kit



Board Layout



Inventory and Parts List

Use the last columns to inventory the kit parts and to check off as they are installed.

Qty	Value	Description	Parts	Identification	Inv	Inst.
1	47 ohm	RESISTOR, 1/4W	R10	Yel-vio-blk-gold		
2	100 ohm	RESISTOR, 1/4W	R2, R4	Brn-blk-brn-gold		
2	1K ohm	RESISTOR, 1/4W	R1, R6	Brn-blk-red-gold		
1	10K ohm	RESISTOR, 1/4W	R11	Brn-blk-org-gold		
1	100K ohm	RESISTOR, 1/4W	R7	Brn-blk-yel-gold		
1	150K ohm	RESISTOR, 1/4W	R9	Brn-grn-yel-gold		
1	160K ohm	RESISTOR, 1/4W	R5	Brn-blu-yel-gold		
1	390K ohm	RESISTOR, 1/4W	R8	Org-wht-yel-gold		
2	22pF	CAPACITOR, mono	C9, C12	Marked 22 or 220		
2	68pF	CAPACITOR, mono	C3, C4	Marked 68 or 680		
4	1000pF	CAPACITOR, mono	C1, C2, C10, C23	Marked 102		
7	0.1uF	CAPACITOR, mono	C5, C7, C8, C11, C14, C15, C31	Marked 104		
1	1 uF	Elect. Capacitor	C32	Marked 1 uF		
2	4.7uF	Elect. Capacitor	C22, C25	Marked 4.7uF		
1	100uF	Elect. Capacitor	C6	Marked 100uF		
1	10uH	INDUCTOR molded	L4	Brn-Blk-Blk-Slv or Gld		
1	15uH	INDUCTOR molded	L2	Brn-Grn-Blk-Slv or Gld		
1	1N5408	DIODE	D1	Large, marked 1N5408		
1	1N5817	1.0A RECTIFIER	D3	Small, marked 1N5817		
2	2N3904	NPN Transistor	Q1, Q2	TO92, Marked 2N3904		
1	BS170	MOSFET	Q3	TO92, Marked BS-170		
1	78L09	V Regulator	IC1	TO92, Marked LM78L09		
1	BNC	Panel BNC	Panel BNC	BNC panel mount		
1	Jack	3.5mm mono jack	3.5mm audio jack	Black 3.5mm mono jack		
1	Jack	2.1mm power jack	Coaxial Power Jack	Metal or plastic power jack		
1	5K	R3, Potentiometer	Potentiometer, panel B5K	B5K linear potentiometer		
1	Knob	Small knob	Knob	Small black knob		
1	Header	3 pin round pin strip	XT1	crystal socket		
1	Wire	Hookup wire 3 colors	Hookup wire, 3 colors, 8" each	Hookup wire, 3 colors		
1	PCB	Circuit Board	ETX Rev9	PCB ETX Rev9		
1	47pF	CAPACITOR, mono	C13 40M BANDKIT	Marked 47 or 470		
	*	CAPACITOR, mono	C30 BANDKIT	Not used		
1	22pF	CAPACITOR, mono	C33 40M BANDKIT	Marked 22 or 220		
1	360pF	CAPACITOR, mono	C16 40M BANDKIT	Marked 361		
	*	CAPACITOR, mono	C17 BANDKIT	Not used		
1	47pF	CAPACITOR, mono	C18 40M BANDKIT	Marked 47 or 470		
	*	CAPACITOR, mono	C19 BANDKIT	Not used		
1	680pF	CAPACITOR, mono	C20 40M BANDKIT	Marked 681		
	*	CAPACITOR, mono	C21 BANDKIT	Not used		
1	330pF	CAPACITOR, mono	C26 40M BANDKIT	Marked 331		
	*	CAPACITOR, mono	C27 BANDKIT	Not used		
1	100pF	CAPACITOR, mono	C28 40M BANDKIT	Marked 101		
	*	CAPACITOR, mono	C29 BANDKIT	Not used		
2	1.2uH	INDUCTOR molded	L5, L6 40M BANDKIT	Brn-Red-Gld-Slv or Gld		
1	4.7uH	INDUCTOR molded	L3 40M BANDKIT	Yel-Vio-Gld-Gld or Slv		
1	8.2uH	INDUCTOR molded	L1 40M BANDKIT	Gry-Red-Gld-Gld or Slv		
1	Crystal	7.030 OR 7.040	CRYSTAL, choice, Bandkit	Frequency marked		

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

It is recommended to sort the resistors R1 through R11 by value and insert them smallest value first, largest value last.

Be sure to check the color code for each resistor as you install. Confirming the value with an Ohm meter is always a good idea



A good reference for reading resistors is here:

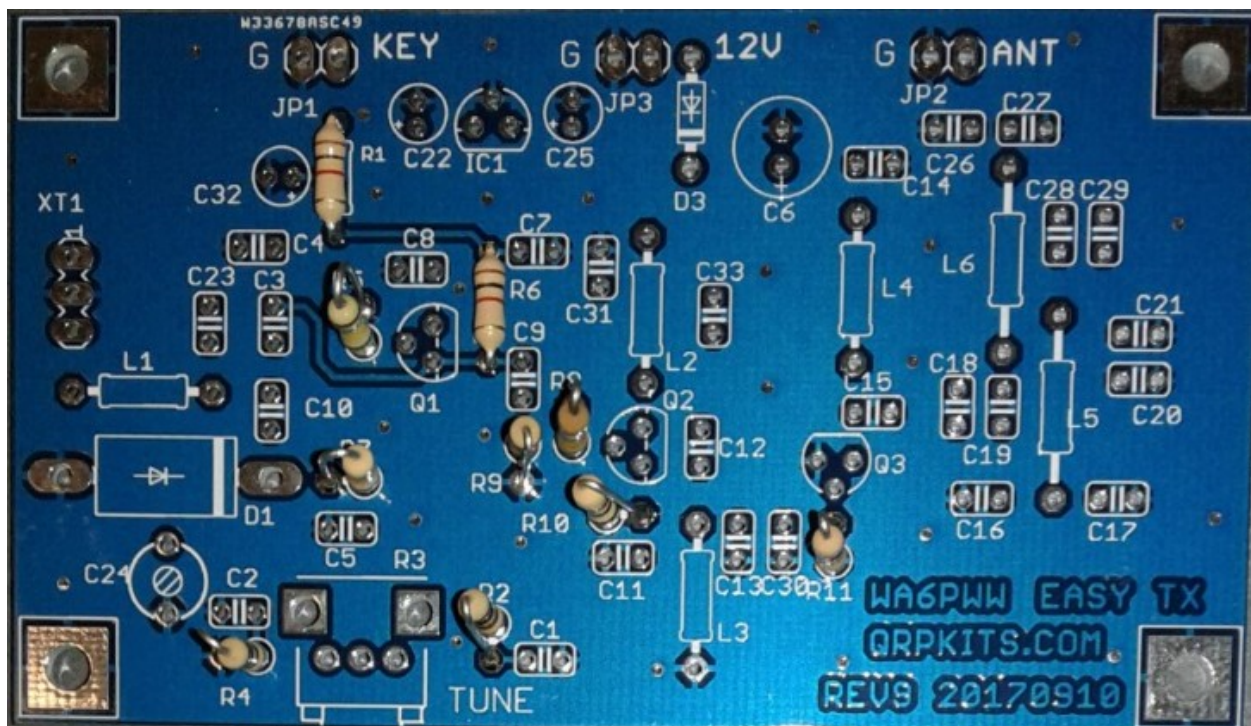
<http://www.token.com.tw/resistor/resistor-color-code.htm>

Except for R1 and R6, 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 that can serve as a test point for checking voltages for debugging.

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 and locations



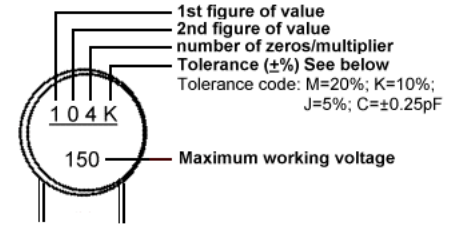
Ceramic Capacitors

Next sort by value and insert the capacitors C1 to C5 and C7 to C12 along with C14, C15, C23, C24 and C31.

The molded ceramic capacitors will be somewhat rectangular and may be blue, tan or brown in color and will have the value marked on the body. It may require a good magnifier to read accurately.

Be sure to double check the values before soldering.

Note: Other capacitor positions are part of the bandkits and will be installed later. Not all capacitor locations are used so be sure to check installation guide and parts list for locations.



Electrolytic Capacitors

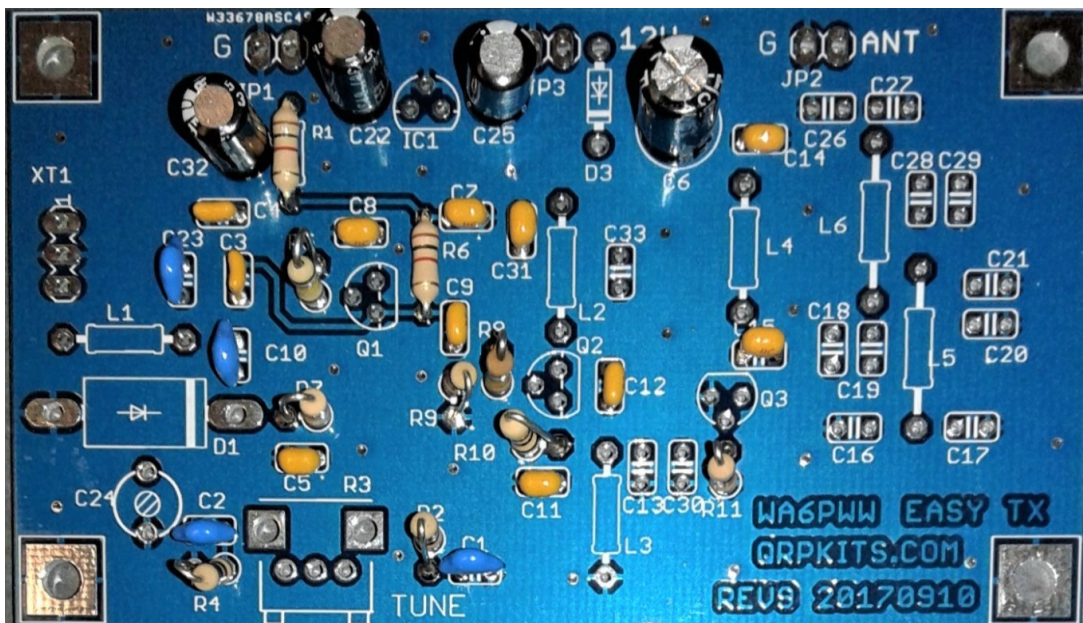
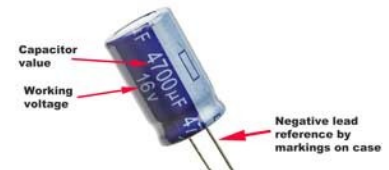
Now locate and insert the electrolytic capacitors C22, C25 (4.7 μF), C32 (41 μF) and C6 (100 μF)

They are round cans with leads and are usually blue or black. The 1 μF and 4.7 μF capacitors are the same size and color and are easily confused so be sure to check labels and location. The 1 μF is C32.

Note: that electrolytic capacitors are polarized and must be installed correctly.

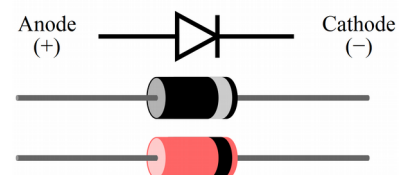
The longer lead is usually the positive + (plus) lead and should go in the positive hole that is marked on the circuit board with a + symbol.

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 and D3. Be sure to confirm the value and double check orientation before soldering. Diode D1 (1N5408) is a large black plastic package and diode D3 (1N5817) is a medium sized black plastic case.



Inductors

Next, locate and install the inductors L2 and L4. They are similar in appearance to resistors but typically have larger bodies and slightly different shape than typical resistors.

If in doubt, check with an ohmmeter since 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.

Be sure to double check the color codes before soldering.

See the image below for typical appearance and location of the inductors.



Transistors and Voltage regulator

There are 3 transistors (Q1, Q2 and Q3) and one voltage regulator in the kit.

Q1 and Q2 are 2N3904 and Q3 is a BS-170.

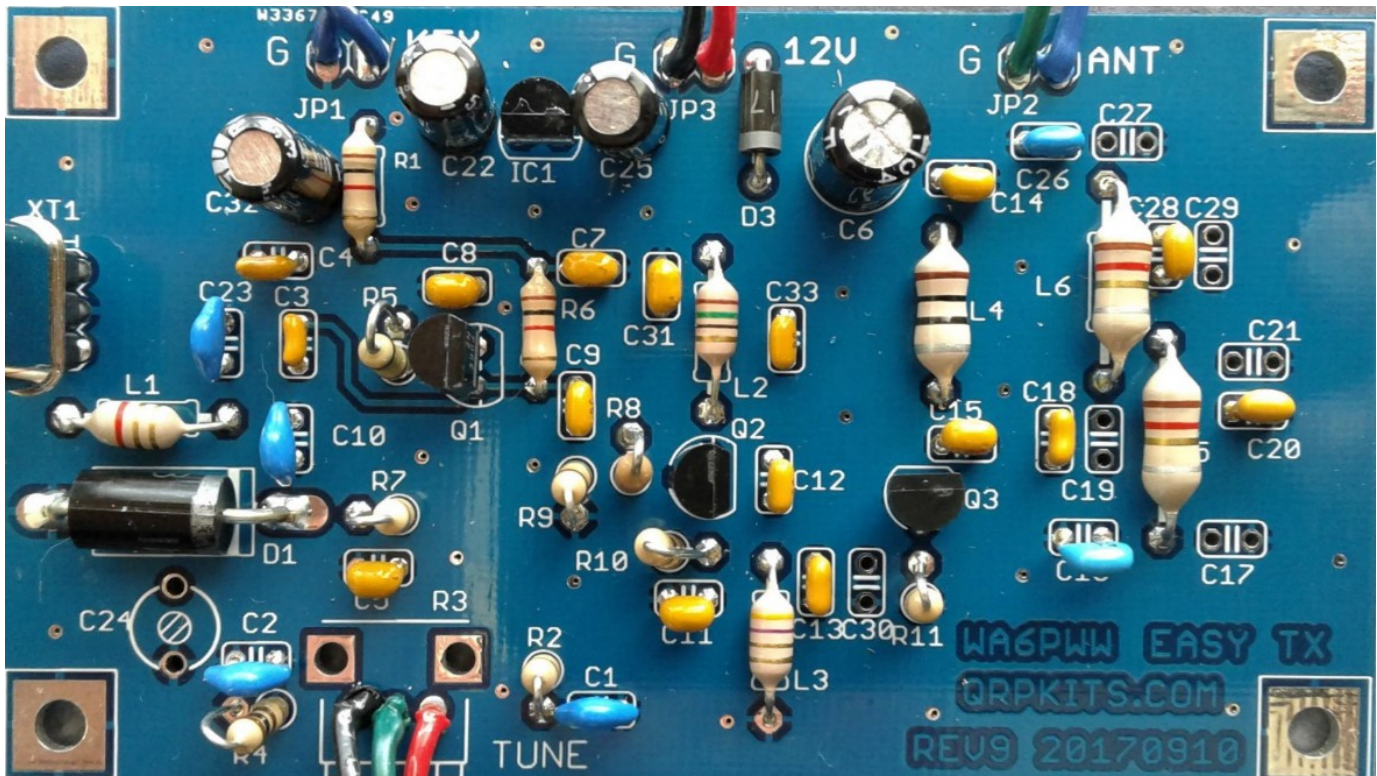
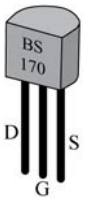
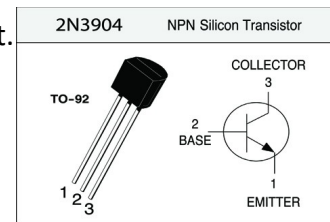
The regulator (IC1) is a LM78L09.

They are all 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.

See the image below for typical appearance and location of the transistors and the regulator (IC1)

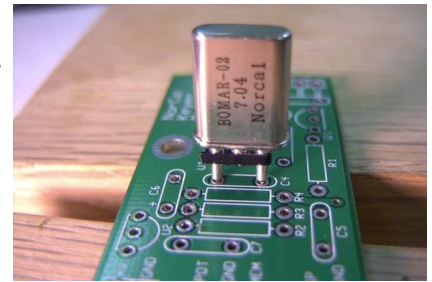


Crystal Socket and Crystal

Install the 3 pin header to serve as a crystal socket that will hold the crystal.

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>

On the ETX kit, the board has a center hole so there is no need to trim the middle lead on the header strip, just solder the 3 pin strip in place



Bandkit Parts

It is now time to install the band specific parts.

These parts determine the frequency of operation of the transmitter and provide a low pass filter to reduce transmitted harmonic energy.

These parts are also listed in the main parts table and relisted here as an aid to building

Qty	Value	Description	Parts	Identification	Inv	Inst.
1	47pF	CAPACITOR, mono	C13 40M BANDKIT	Marked 47 or 470		
	*	CAPACITOR, mono	C30 BANDKIT	Not used		
1	22pF	CAPACITOR, mono	C33 40M BANDKIT	Marked 22 or 220		
1	360pF	CAPACITOR, mono	C16 40M BANDKIT	Marked 361		
	*	CAPACITOR, mono	C17 BANDKIT	Not used		
1	47pF	CAPACITOR, mono	C18 40M BANDKIT	Marked 47 or 470		
	*	CAPACITOR, mono	C19 BANDKIT	Not used		
1	680pF	CAPACITOR, mono	C20 40M BANDKIT	Marked 681		
	*	CAPACITOR, mono	C21 BANDKIT	Not used		
1	330pF	CAPACITOR, mono	C26 40M BANDKIT	Marked 331		
	*	CAPACITOR, mono	C27 BANDKIT	Not used		
1	100pF	CAPACITOR, mono	C28 40M BANDKIT	Marked 101		
	*	CAPACITOR, mono	C29 BANDKIT	Not used		
2	1.2uH	INDUCTOR molded	L5, L6 40M BANDKIT	Brn-Red-Gld-Slv or Gld		
1	4.7uH	INDUCTOR molded	L3 40M BANDKIT	Yel-Vio-Gld-Gld or Slv		
1	8.2uH	INDUCTOR molded	L1 40M BANDKIT	Gry-Red-Gld-Gld or Slv		
1	Crystal	7.030 OR 7.040	CRYSTAL, choice, Bandkit	Frequency marked		

Bandkit Capacitors

Next sort by value and insert the bandkit capacitors listed above in the indicated locations.

Be sure to double check the value and location before soldering.

Note that all locations are not used.

Bandkit Inductors

Sort and install the bandkit inductors (L1, L3, L5, L6) in the indicated locations

Be sure to double check the value and location before soldering.

Completing your ETX Kit

Off board parts

Your Easy Transmitter board is now completed. For packaging and testing, you will find included in the package, a BNC, key connector, power connector and a tuning potentiometer along with some hookup wire.

You will need to provide DC power, a method for keying the transmitter and an antenna or dummy load for testing.

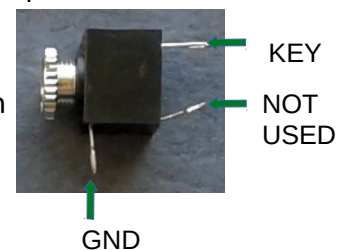
A method for measuring power output is also helpful for checkout.

Our Dummy Load Kit: <http://qrpkits.com/dummyloadv2.html> provides both a dummy load for the transmitter and an onboard RF probe for measuring RF power with only a multimeter.

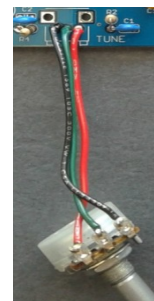
A fuse of 3-5 A rating is recommended in the power lead to protect in the event of a short. The transmitter is designed for power supplies in the 11-12V range but can be used with power supplies up to 15V.

The connections for Key, Antenna and Power input are labeled. G indicates the ground pad for each of these.

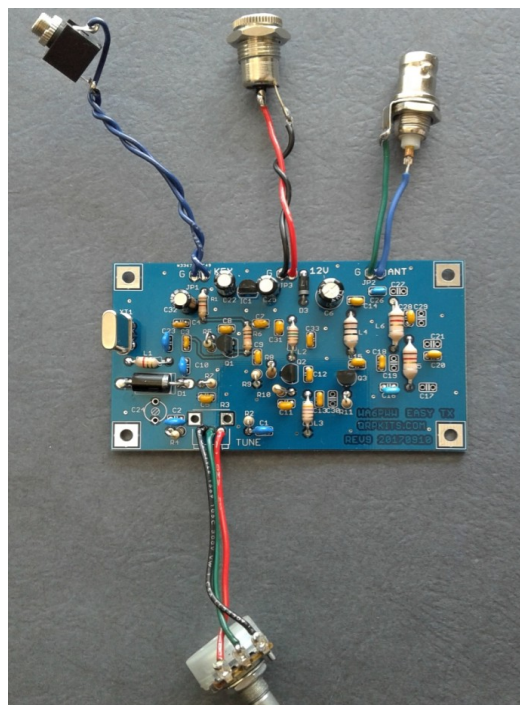
Note that the audio connector for a key only needs two connections. The third pin on the audio jack is for a switched connection and is not used.



The potentiometer is wired as shown in the photograph. The center pad on the board goes to the center connection of the potentiometer. In the orientation shown here, the outer wires cross over. This will result in tuning that goes up in frequency as the knob is turned clockwise. If the opposite occurs, just swap the outer leads on the potentiometer.



The photo below shows typical connections using the supplied parts.



Checkout

The Easy Transmitter is designed to be a simple to build and to use.

However, occasionally, problems may happen.

Problems 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.

Packaging

Packaging is left up to the builder.

The ETX transmitter 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

There are a number of suitable enclosures available online from companies such as Digikey, Mouser or from Ebay.

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 frequency without requiring excessive adjustment during operation.

Support

Email: qrpkits.com@gmail.com

Schematic Diagram

