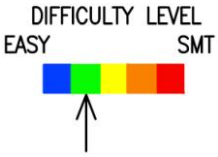
QRPBuilder

Micro 40-15m EFHW Half Wave Tuner/SWR Indicator/Antenna



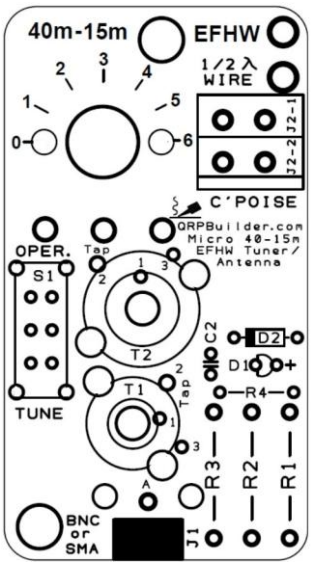
First, familiarize yourself with the parts and check for all the components. If a part is missing, please contact us and we will send one. You must use ***qrpbuilder@gmail.com*** to request a part.

Please read the assembly instructions carefully before starting.

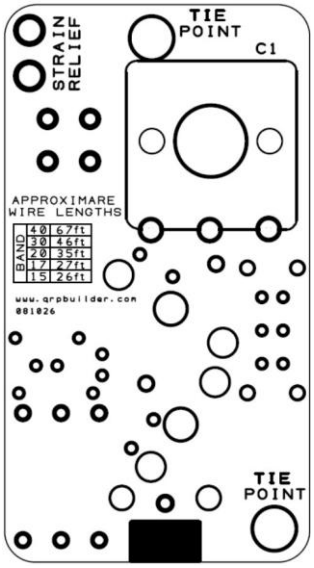
Parts List

1 – QRPGuys Micro EFHW Tuner/Antenna PCB
1 – EFHW wire end support PCB
1 – C2, .1uF (100nF) mono capacitor, marked 104
1 – D1, red LED w/clear lens
1 – D2, 1N4148 signal diode, sm. glass, w/black band on one end
3 – R1-3, 51 ohm 2W power resistor (green-brown-black-gold)
1 – R4, 470 ohm resistor (yellow-violet-brown-gold)
1 – FT37-43 toroid core (black)
1 – T50-6 toroid core (yellow)
1 – Polyvaricon, w/mounting hardware and shaft extension
1 – BNC female connector
1 – SMA female connector
1 – Slide switch – DPDT
1 – Ø16mm instrument knob
1 – 48” of 26AWG magnet wire for the toroids
1 – 2 position pushbutton pcb terminal block
4 – small plastic tie

All of the components mount on the top side of the board with the exception of the polyvaricon.



Top



Bottom

Install the following components in the top side of the board.

[ ] Install C2, .1uF, marked 104.

[ ] Install D2, 1N4148 signal diode, matching the black polarity band (cathode) with the silkscreened outline.

[ ] Install R4, 470 ohm, resistor, (yellow-violet-brown-gold).

[ ] Install R1 – R3, 51 ohm, 2w, (green-brown-black-gold). Mount them about 1/16” off the surface of the board to allow for air circulation.

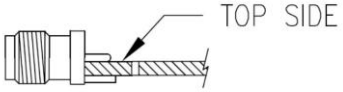
[ ] Install D1, the red clear lens LED. The polarity must be correct. The long lead is “positive” and mounts towards silkscreened “+”. Seat the LED flush with the surface of the board.

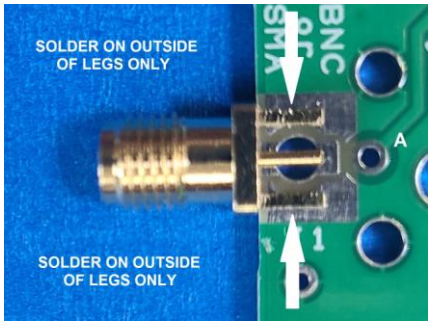
[ ] Install S1, slide switch, soldering all four corners and electrical pins.

[ ] Install J2, two position pushbutton terminal block.

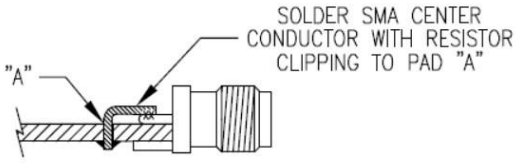
Next, decide which connector you want to use for connection for your feed coax and install the BNC or SMA.

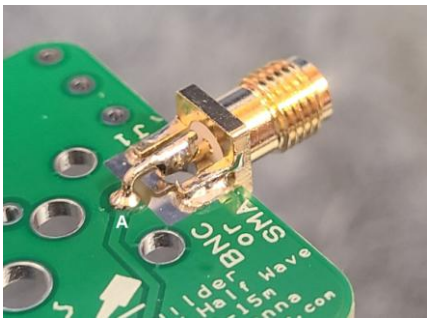
[ ] If BNC, install the BNC connector flush with the *top* side of the board, or to use the SMA connector, position the SMA connector on the *top* side of the board centered on the hole as shown below. First solder all four ground pegs first, top and bottom. Solder on the *outside* of the four pegs only.



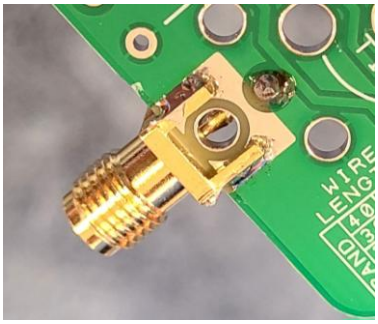


[ ] Next, solder a trimmed resistor lead from the center pin of the SMA connector to the pad just beyond the connector, marked by a small letter “A”.





Top

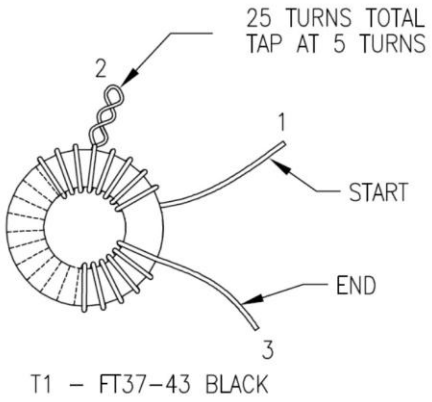

Bottom

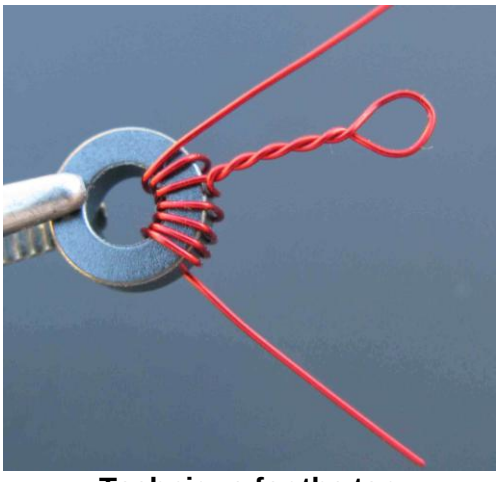
[ ] When you have finished, place the switch into the **OPER.** position, and check that you have **NO** continuity between the center pin of the SMA connector and the shell of the connector.

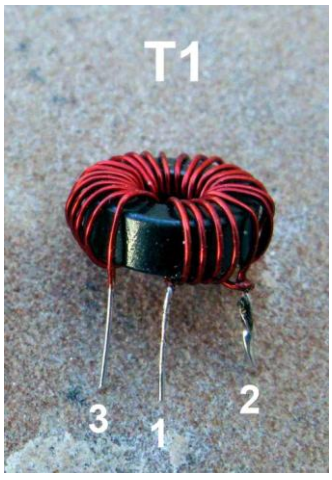
Wind and install the two toroids as described below:

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

[ ] For T1, use the FT37-43 (black) core and 24” of the supplied magnet wire. You are winding a total of **25** turns, with a tap at **5** turns from the beginning of winding. Remember, every time the wire goes through the center of the core, it counts as one turn. The picture and figure below show the beginning of winding and the twisted technique for the tap. The total of 25 turns will completely fill the toroid. If you wind the toroid like the illustration and bend the wires straight down, they will align with the pcb holes 1,2,and 3.



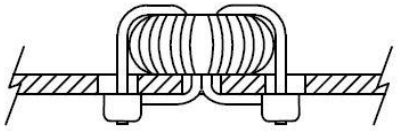




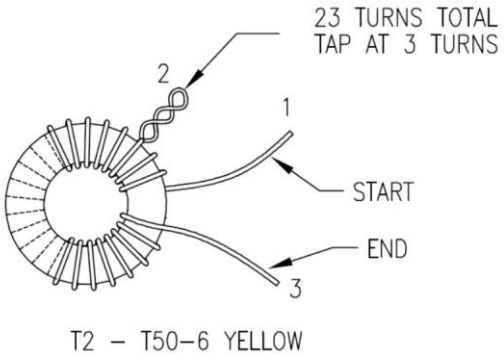
Technique for the tap

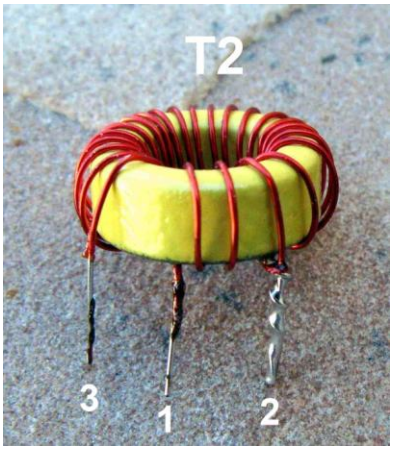
[ ] Bend the leads down, trim to 1/4” long, and tin the leads prior to soldering and install them to the top of the board. The magnet wire supplied Is Thermaleze® brand and will tin easily with a hot soldering iron. *Always tin the leads before trying to solder them in place and you will greatly eliminate any continuity problems.*

[ ] Install T1 where indicated on the PCB, and centered on the silkscreened circle. You will notice The holes are numbered and the tap hole is indicated, and is slightly larger in diameter to accept the double twisted wire. Install the toroid flush with the top of the board. Do not elevate it off the board. Do not pull the wires through the holes past where they are tinned. Re-tin if needed. You will be securing it with two of the small plastic ties as shown below. Do not over tighten, you can break the core.



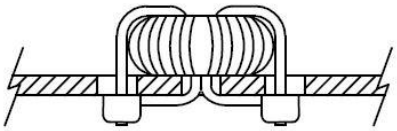
[ ] For T2, use the T50-6 (yellow) core and 24" of the supplied magnet wire. You are winding a total of **23** turns, with a tap at **3** turns from the beginning of winding. Remember, every time the wire goes through the center of the core, it counts as one turn. The picture and figure below show the beginning of winding and the twisted technique for the tap. If you wind the toroid like the illustration and bend the wires straight down, they will align with the pcb holes 1,2,and 3.





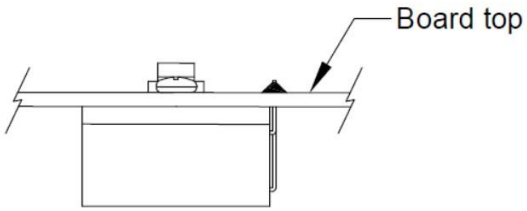
[ ] Bend the leads down, trim to 1/4" long, and tin the leads prior to soldering and install them to the top of the board. The magnet wire supplied Is Thermaleze® brand and will tin easily with a hot soldering iron. *Always tin the leads before trying to solder them in place and you will greatly eliminate any continuity problems.*

[ ] Install T2 where indicated on the PCB, and centered on the silkscreened circle. You will notice The holes are numbered and the tap hole is indicated, and is slightly larger in diameter to accept the double twisted wire. Install the toroid flush with the top of the board. Do not elevate it off the board. Do not pull the wires through the holes past where they are tinned. Re-tin if needed. You will be securing it with two of the small plastic ties as shown below. Do not over tighten, you can break the core.



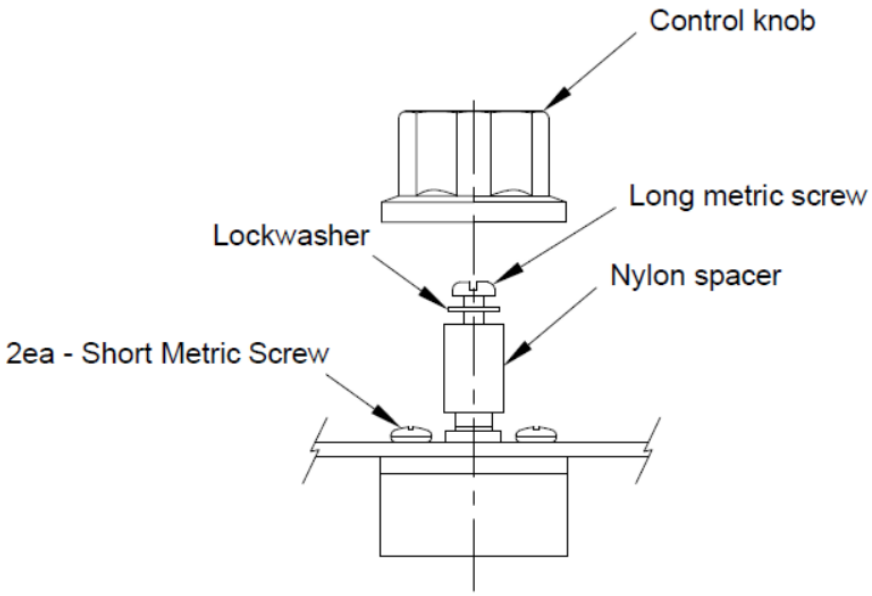
[ ] Adjust the two trimmer caps on the back of the polyvaricon to their *minimum* value as shown below.

[ ] Install the polyvaricon capacitor on the ***back*** side of the board by carefully bending the three leads towards the shaft end of the capacitor. Feed the three leads through the board and secure it with the two short metric Phillips screws from the top. Solder and clip the three leads flush.



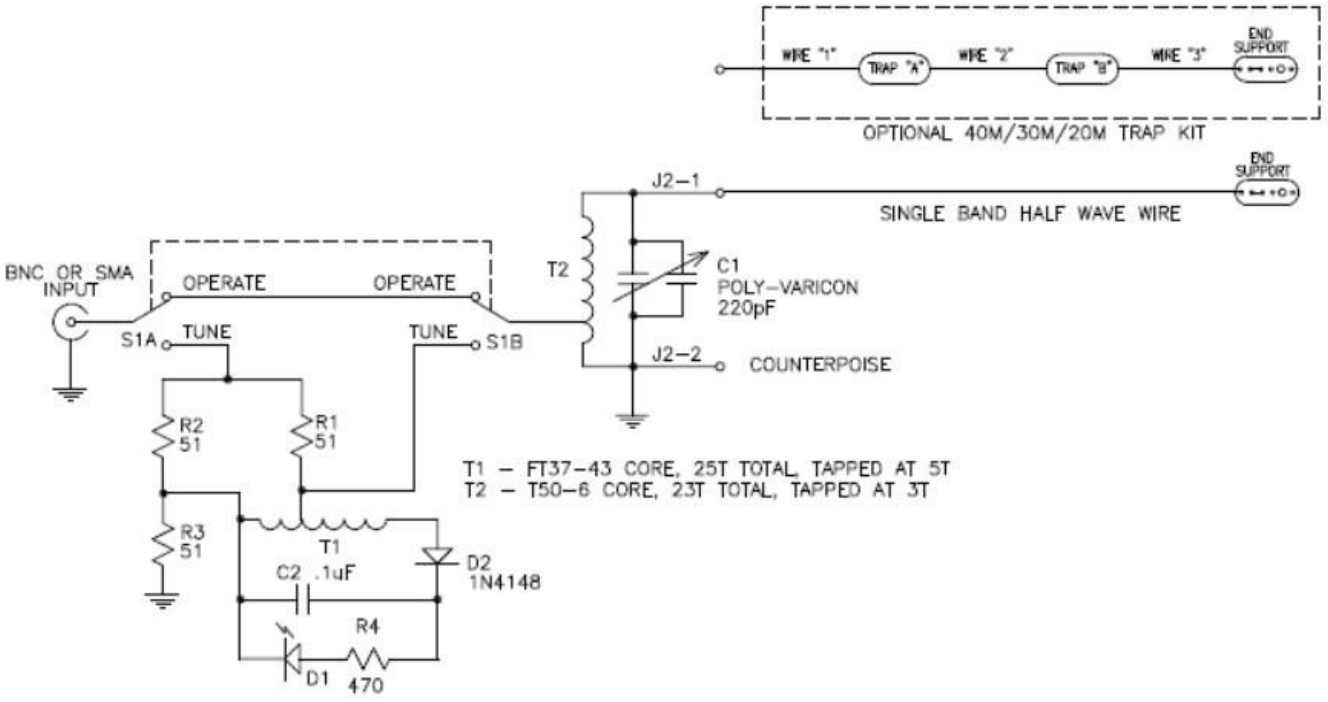
[ ] Install the nylon shaft spacer, retaining screw, and control knob onto the polyvaricon as shown.

The control knobs are inspected 100% for the small shaft set screw to be present, however in shipment, they can vibrate out of position. Carefully check the contents of the sealed pouch if yours is not in the knob.



This completes the electrical and mechanical assembly.

Schematic:



Troubleshooting

By far, most construction and usage issues have been traced to not tinning the toroid wires before soldering or pulling the wires past where they are tinned when installing. Pay close attention to this.

SWR/LED Tuning Indicator usage

The LED indicates the relative SWR of your antenna. The tuner is rated at 10 watts PEP max., and incorporates a LED absorption bridge circuit for sensing SWR. In the TUNE position, you cannot damage your transmitter caused by a high SWR. The worst your transmitter is looking at is a maximum of 2:1 SWR in the TUNE position. The LED is only showing reflected power. At full brilliance your SWR is 4:1 or greater, at half brilliance your SWR is approximately 2:1, and the LED will completely extinguish at 1:1.

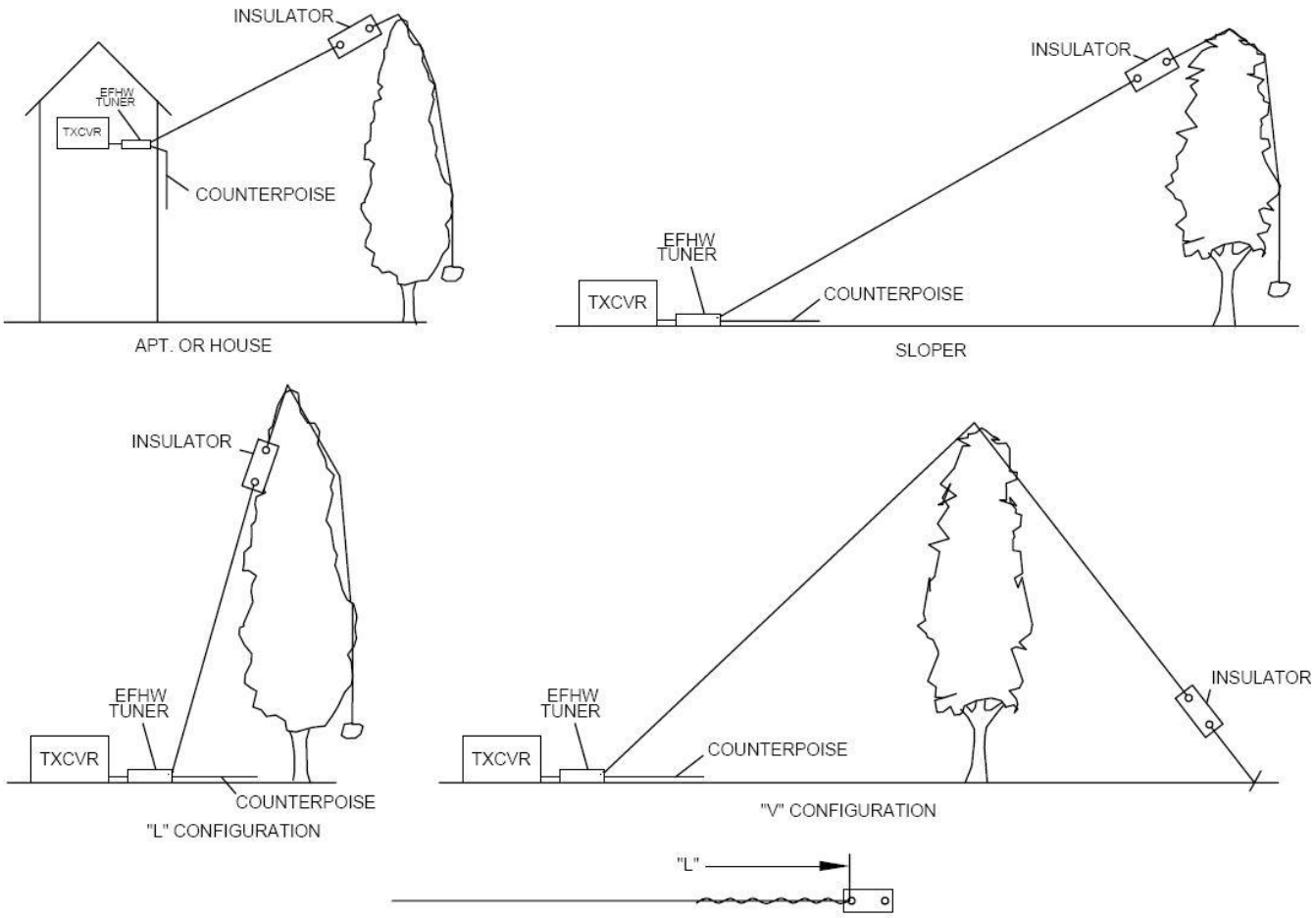
Tip from Dan… If the led does not completely go out at 1:1 there may be a little too much gain on T1, the indicator transformer. Just reduce the turns on the high side of the tap, one or two turns. This is due to differences in LED brilliance specifications.

Additionally, after the antenna is tuned up, keeping the bridge in the circuit, in the ("Tune" position), will reduce the power by a factor of four to a matched antenna. This can occasionally be useful when trying to bring a 3w QRP transmitter to under the 1w level for certain sub-one watt contest multipliers.

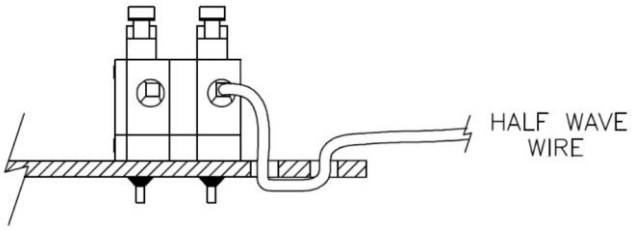
Setting up the antenna

Use all the normal cautions throwing wires up in the air near power lines, and start with the lengths suggested on the board for the band you wish to operate. The lengths listed on the board are a little longer so it allows you fold back the ends, when securing. Adjust the lengths through experimentation as needed. Start with the suggested length and fold back in 2-3 inch increments until you achieve the best resonance. How the wire is configured depends greatly what you have to work with in terms of support, terrain, trees, and structures. The simplest configuration is an inverted "V", where the active element runs from the antenna connection of the tuner, up to a tree branch, and back down towards the ground. An "L" configuration may work well if you can get the part of the wire from the tuner up to the tree as vertical as possible.

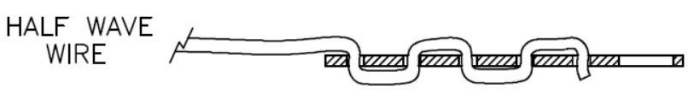
Use a counterpoise wire and lay it out in a straight line, 180º from the antenna wire when possible. Any length that is non-resonant to your frequency is best. I use 10ft. or 20ft. The main antenna element and counterpoise lengths suggested may vary, depending on the terrain and soil conditions.

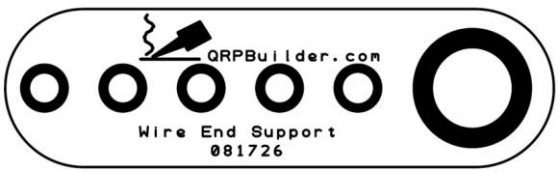


Route the half wave wire through the two holes as shown below for strain relief. Also there are two tie points for a cord at each end of the tuner pcb.



Route and terminate the far end of the half wave wire as shown below with the supplied Wire End Support.





Even with low power, feed line radiation can cause false, erratic swr readings, and poor performance. To eliminate feed line radiation, use a choke or 1:1 balun. Install at the end of your coax where it connects to the antenna.

Feed line radiation refers to the phenomenon where the transmission line connected to an antenna radiates energy, which can cause interference and affect the performance of the antenna system. This radiation can occur at any power level when the feed line becomes part of the radiating system. It is important to minimize feed line radiation to ensure efficient transmission and reception. Techniques such as using a 1:1 balun or feed line choke can help minimize this effect.

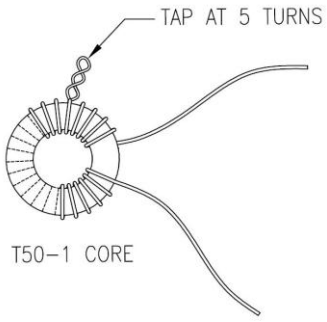
This is an example of a simple feed line choke using a few turns of RG174 coax through a clamp-on ferrite.

Appendix:

This kit can be built for 80m, however the modification will work on 80m only. And the trap option will not apply. Use the instructions below for modification:

Note: When you wind the toroid for 80m, it will only load on 80m. It will not work on the original 40m-15m bands.

[ ] For L1, use a T50-1 (blue) core and 26awg magnet wire. Wind a total of **45** turns, with a tap at **5** turns from the beginning of winding. The picture, and figure below show the twisted technique for the tap. The 45 total turns will completely fill the toroid.



All the rest of the instructions will apply. For the feed element wire, start with ~68ft. and adjust as needed.

Notes: