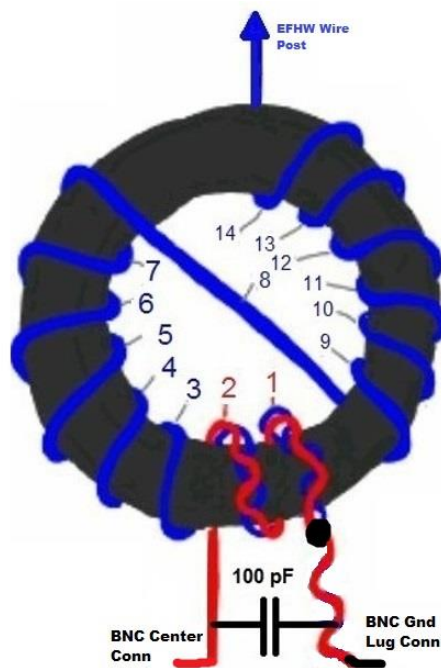


“Spicy” EFHW Antenna

After exhausting the contents of a plastic spice container, they can serve as a unique small lightweight enclosure for the described 49:1 EFHW antenna transformer that weighs less than 3 oz. My build used two plastic spice containers found at the dollar store.

After securing two identically sized spice bottles, the parts for this EFHW antenna were collected out of my spare parts bin, with me already possessing a couple FT114-43 toroids, a 100pF 6KV capacitor, BNC panel mount connectors, nuts, bolts, and lock-washers. The lengths of bolts, nuts, solder lugs, and associated lock washers were not critical, and you may use what you have at your disposal. The enamel wire for the transformer was 18 ga, and sourced via Amazon, which is electrically overkill for this size 49:1 to run QRP power; however, it was chosen because it is stiff, easy to strip back to bare copper, fits into the center pin of the BNC connector, and will allow operation at higher than QRP levels.

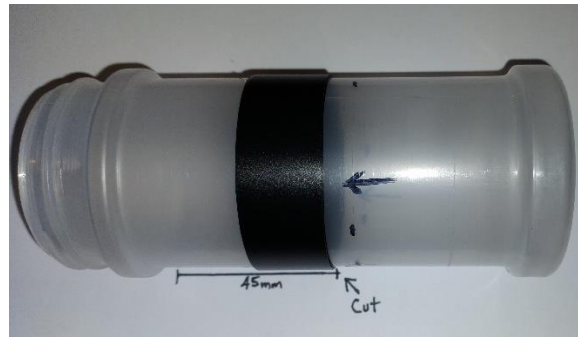
Should you have to purchase everything new at full retail, I imagine you’d be out less than a moderate priced dinner. Please leverage the pictures of parts, winding details, and the step-by-step instructions to net a lightweight antenna sure to radiate your signal.



1) Take two FT-114-43 toroids and superglue them together insuring full alignment around all edges of the toroid. Prepare the empty clean spice containers by gluing down, with epoxy, any flip-up lid that is part of the screw-on cap. Some spice lids may not have any such flip-up feature. Leave all undisturbed to dry overnight.

2) Given your particular spice container cap diameter, mark for drilling a panel mount BNC connector and the ground/counterpoise lug of the feedline cap. Notice they offset each other on

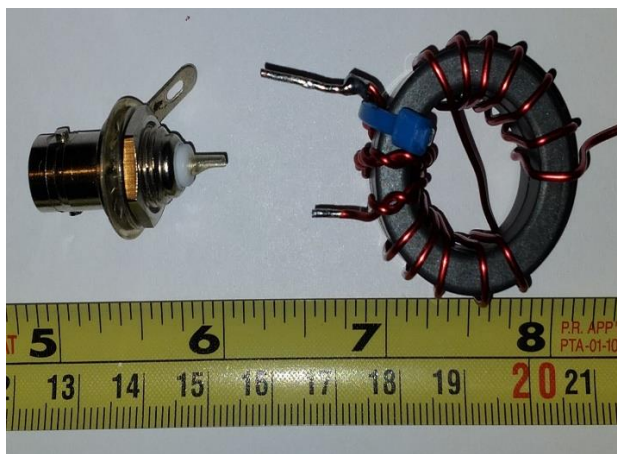
the feedline end cap, and that they are positioned towards the center sufficiently for the cap to still screw onto the container when transformer is standing upright. I marked the sprinkle container lid I used with red for the BNC, and green for the ground drill points per photo.



3) Drill two holes into the cap leveraging progressively larger drill bits for the larger hole to house the female panel mount BNC connector. The other hole needs drilled to fit whatever size through-bolt which is leveraged for ground/counterpoise/tie-down connection.

4) Shorten the container by measuring 45-50mm from cap edge, when screwed on, to the body of the container, mark it, and then wrap about 5 turns of electrical tape around the body to serve as a guide for a cutting the container almost in half. I cut with a Dremel and cutoff wheel wearing safety glasses throughout the cutting process.

5) You will cut two pieces of 18 ga enamel wire; one being 7" and the other 24" long. Five inches of the wires are twisted tightly together to net the first two turns of a primary. After the two turns are placed on the toroid, I secure with a zip-tie. You wind remainder of core with single wire, known as secondary, as the pictorial and crossing to other side of toroid as your 8th turn. Count turns accurately, and also secure the EFHW single wire with zip-tie to keep things in place.



6) The starting twisted pair of enameled wires is the primary and is connected to ground; however, only one of the twisted wires needs brought away from the toroid to eventually solder to the ground lug on the BNC connector. You'll see in photo, ground is the longer of the wires coming off same side of transformer. I chose to unwind the twisted wires back to the edge of the toroid. Strip 3/8" enamel insulation off both wires right at the juncture of the toroid. Now twist the stripped copper on copper 3/4 twist and solder to short the two wires at the edge of toroid. Snip off one of these leads and prepare and tin the single wire as seen in photo with ground lug enamel wire being 3/4" long and the center pin enamel center pin enamel wire 1/2" as seen in photo against tape measure.

7) Two pieces of 18 ga insulated stranded wire, each 4" are stripped 1/4" on each end, and each end tinned. Securely mount and tighten all metal BNC, lock washers, and solder lug hardware to the first screw-on feedline BNC plastic end cap. Do the same for the ground lug/tie-off bolt on this same plastic end cap. On the solder lug to the ground bolt, you may go ahead and solder a 4" wire to the lug. Position and push the 1/2" BNC center wire from transformer into the unsoldered BNC socket center pin. Position the 3/4" ground lead to the ground lug. They should connect/touch to the BNC connector. Besides transformer ground, the lug on the BNC connector will have one of the 4" wires soldered to it, but don't solder just yet.

8) On a second plastic container cap the same size as the first one, drill and securely mount in center a single 1" wire post bolt with another wire solder lug on the interior of the lid using lock washers and bolts. The order from the interior of the cap should be bolt head, solder lug, flat washer, thru plastic lid, then on outside, flat washer, lock washer, nut, all snugged up tight. You may even consider a drop of lock-tite, as you don't want it loosening over time as you screw on and off the antenna wire repeatedly with a wing-nut to finally install on the outside end of bolt. You may go ahead and solder a 4" wire to the antenna solder lug on the interior of the second plastic cap.

9) Back to the first plastic container cap, double check and re-test fit and bend the two leads of the transformer to line up to the backside of the BNC connector. Before any soldering to BNC occurs, test fit and prepare the 100pF capacitor, by wrapping or pinching one lead to the BNC center conductor and then the other lead to the ground lug that should already have the transformer ground, and the 18ga jumper wire from the ground bolt (green) attached.

10) Next, install the transformer to the BNC connector in vertical fashion. Add a tight little hook in the 3/4" ground lead, and hook it into the BNC ground lug that should also have the unsoldered 4" jumper wire that came over from the counterpoise/ground/tie-down bolt. Note, that you can trim back this 4" wire down to half or less length that just makes connection with the lug, as 4" is more than needed for this little BNC ground jumper to the bolt.

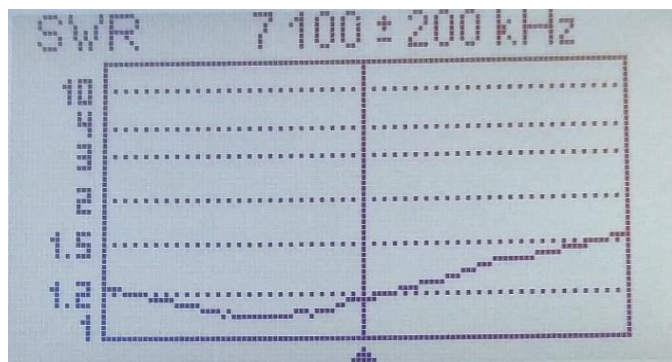
You are now ready to solder up the BNC connector. First, solder the short (1/2") center lead after sliding the tinned wire into the center conductor hole of the BNC connector, insuring also that one end of the capacitor gets soldered at this same point. Second, solder the hooked longer (3/4") transformer ground connection, the shortened jumper wire to the bolt, and the other end of the capacitor to the ground lug of the BNC connector. Note: this will be tight quarters to solder in.

Extra hands may be helpful, and you may wish to put something on edge of plastic cap so as not to melt it while soldering. Final result should look like photo with transformer standing vertical on the cap. Trim off any long leads from capacitor or 18 ga wire jumper.

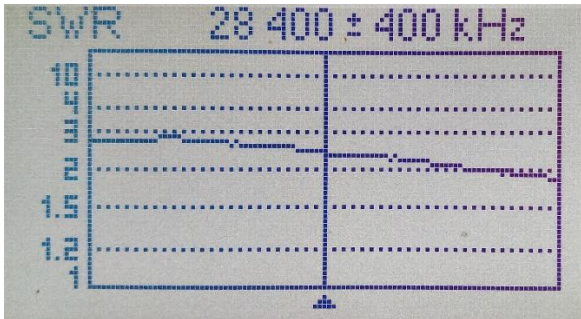
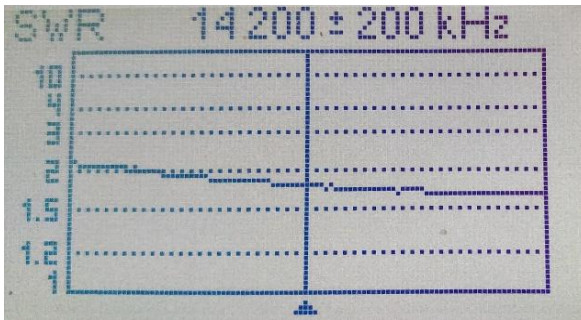
11) Now trim the secondary enameled wire lead at the very end of secondary winding of transformer to about 3/4", and strip and tin 3/8" at the end of that enamel wire, and just let it stick up in the air, as in the picture. This will become a solder to point of the stranded wire, so make sure it is tinned very well.

12) Screw the first feedline BNC end cap snugly onto the plastic container. All of the transformer innards will be covered, with the one end plastic container still open, and the tinned antenna connect wire sticking up at the top of the container. Test fit the antenna wire cap, on the cut end of the container. Uncap, and pay heed to the necessary wire length and space allowing for solder iron into the space and trim back the 4" wire and tin the last 3/8 inch. Solder this stranded wire end to the rigid tinned enamel wire end sticking up.

13) With the feedline end cap screwed on already, fit the other cap, which does not screw on and will pressure fit evenly on cut end of container. This antenna wire cap needs secured, so the antenna wire does not pull it off the container. While measuring and fine tuning, I chose to wrap the second lid onto the bottle with black electrical tape. After all my measurements and wire fine tuning, I did silicone glue the 2nd Antenna connect plastic cap to the container and let dry 24 hrs.



After completing the 49:1 transformer above, I started with a #28 Teflon coated stranded wire at 67', hung between gazebo at 5' running up into a tree about 25', which is most likely to mimic my field operations leveraging a 32' kite pole. I find the Teflon coated wire ideal for durability, low visibility, and ease of unkinking, which I have an uncanny knack for causing. I measured, with an antenna analyzer, and trimmed repeatedly until the radiator was reduced to 64'10". The SWR measurements for this 40M trimmed wire can be seen in chart above, and which suited my operations in the CW sub-bands. The SWR readings for harmonic band are listed in chart that follows.



Measured Frequency Range	Final Cut Length	SWR at Resonance
7.000-7.150Mhz	64' 10"	1.2:1 – 1.5:1
14.000-14.300	64' 10"	2.0:1 – 1.8:1
21.000-21.400	64' 10"	3.0:1 – 2.0:1
28.000-28.800	64' 10"	2.8:1 – 1.9:1

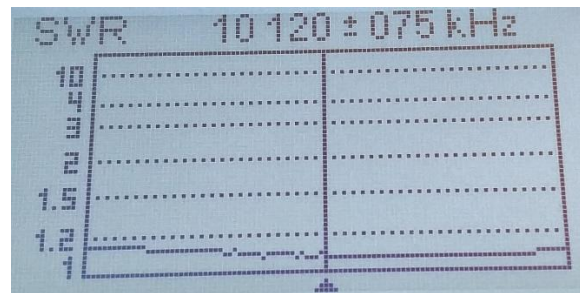
Clearly, no tuner is needed on 40M CW QRP frequencies, and the target harmonic bands should work fine with touch up by any tuner at your disposal. If you are mostly interested in 40M SSB, you will need to trim the antenna wire shorter in 1-2" increments. This 40M half wavelength wire will not resonate or operate efficiently on 80, 30, or 17M, although a good 10:1 tuner will likely put it on 30 or 17M for you.

The high impedance of the EFHW wire will vary with changes in frequency, antenna length, height, orientation and ground conductivity below the antenna. As well a counterpoise may influence to the SWR as well. I never leveraged the counterpoise wire connection in any of my final cuts and measurements of SWR, but the connection is there should you desire to experiment with one, and wish to place an alligator clip with 10' of wire onto the counterpoise bolt.

Should you desire assured lower SWR readings for the target harmonic bands akin to the 40M band SWR readings, and without need of a tuner, move to individual half-wave wires in place of the 40M wire. An accurately trimmed wire, per band, will attain lower SWR readings (example: 32'5" wire for 20M netted a 1:1 match at resonance)

Individual resonant wires, are also the remedy for efficiently putting the 49:1 transformer onto 60M, 30M, 17M, 12M, or really any HF band you desire. Just calculate, cut, and then trim a half-wave wire to connect to the transformer. Some measured examples follow.

Measured Frequency Range	Final Cut Length	SWR across Frequency Range
10.100-10.150 Mhz	44' 3"	1.2:1 – 1.1:1
18.068-18.168Mhz	24' 3"	1.3:1 – 1.4:1



Thus completes my project for an effective, efficient, and lightweight antenna solution for my field operations which is usually QRP, but might reach to 25W for demonstration purposes. Should you build one, I hope you will be pleased in the ability to extend your low power operations into the field without excessive weight added to your portable backpack.

Addendum 1

While the antenna was lightweight, and it worked very well on any frequency I cut wires for, the number of individually cut resonant wires, started to impede on the suitability for a quick hike with a small backpack, given each wire was wrapped around six labeled kite string winders.

I devised a solution allowing for linking wires to operate independent resonant half-waves for each of my bands of interest (10M, 15M, 17M, 20M, 30M, and 40M) to gain the best SWR match on each band. I ended up with a solution having wires wound on just two kite string winders, and often only take one of the two to the field with me.

Each wire is cut and pruned to resonance beginning with the highest frequency of interest, and then extended by means of electrical butt connectors, and additional wire to net subsequent band resonance. The very first section of wire for band of interest, has a crimp-on U connector to connect up to the antenna bolt on the EFHW transformer. The other end of this first wire is a female butt connector. Note from photo the male connectors had their plastic covers removed for soldering of antenna wire, and some heat shrink tubing added over mating wire to add some protection from any flexing of the 26 ga. wire. An additional couple male connectors have a crimp circular ring soldered on with nylon loop of tie off string.

On one kite winder, I have a linked wire aerial for 20M, 30M, and 40M, and another kite winder with linked wires for 10M, 15M, and 17M. I just plug or unplug the butt connector links to net the desired half-wave length wire to feed to the 49:1 transformer, and then feed the coax to the rig. In practice , any un-used wire linkage, could be tossed on to the counterpoise bolt.

The butt connectors have sufficient strength to hold, if your wire is lightweight, and it is not pulled taunt but just draped down from a tall support. Larger wire probably dictates heavier duty connectors, but even these small ones can be tightened by occasionally squeezing of the female side with a light-duty pair of pliers.

Figure 1.



Top wire in photo, is the connection to 49:1 transformer antenna wire lug. Middle butt connectors show means of wire extension for different bands. Bottom wire shows end of wire connector tied off to string to secure antenna end. Males always plug in to add more wire, or a tie-off string.

Band	Link Increment	Total Length
10M		14' 5"
15M	6' 2"	20' 7"
17M	3' 10"	24' 5"
20M	8' 2"	32' 7"
30M	11' 10"	44' 5"
40M	20' 5"	64' 10"

The above chart conveys the total length of wire per band inclusive of the butt connectors. Your conditions may vary these lengths by 1-4" on each band. Tune and prune for each desired band you desire to operate on.