Making a Linked EFHW for Multiband Resonant Operation

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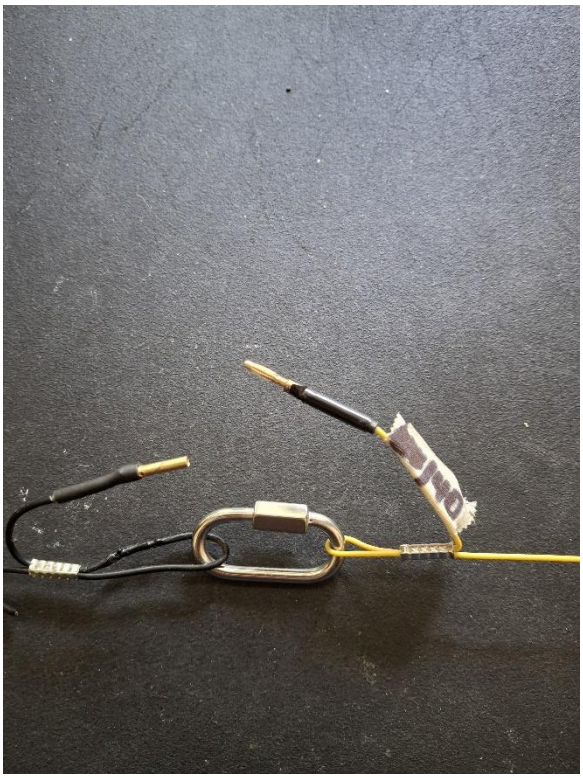
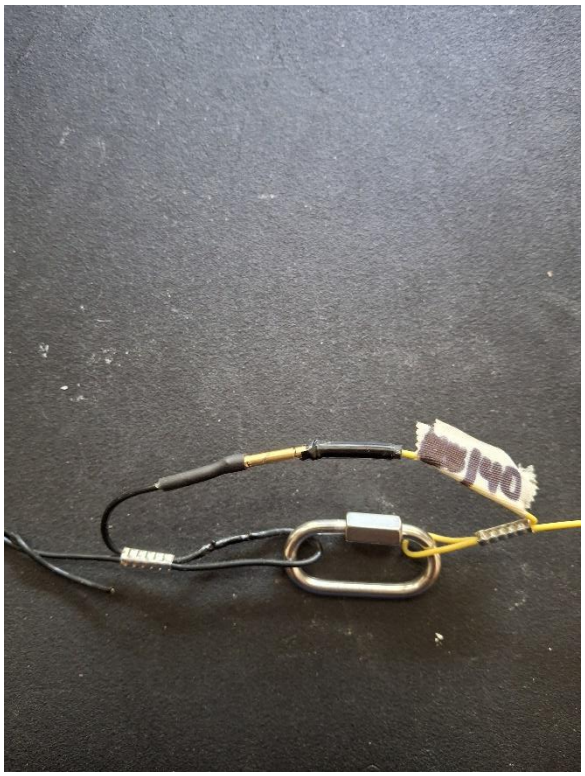
End-fed half-wave (EFHW) antennas are very popular for portable operations such as POTA, SOTA, field day and emergency response. There are several reasons for this, including: multi-band operation, only one support is needed, no need for radials or counterpoise, wide frequency response, long radiating element, inexpensive, easy to homebrew and can be very light weight / portable. Some downsides are the need for an unun to transform the high feedpoint impedance to 50 Ω, can be noisy due to partially vertical (sloper) orientation and power loss in unun especially if under-sized for power level.

I have used EFHW antennas with great success during portable or base station operation. For portable operation, I use an EFHW cut for 40M, which is simply a 66' long wire element attached to 49:1 unun. This antenna will also resonate on 20M, 15M and 10M. At home, I have an 80M EFHW which is ~132' long. This antenna will cover all bands from 80M – 10M, although a wideband tuner may be required for non-harmonic (WARC) bands. Furthermore, the 80M EFHW benefits from mounting a high-voltage capacitor at the midpoint to move the resonance point up into the 75M phone region. It also may need an inductor several feet from the feedpoint to reduce resonance point in the 10M band. These tweaks are well-documented online and commercially available from several suppliers (MyAntennas, HyEndFed). Commercial EFHW antennas can get fairly expensive at $200 - $300.

I mentioned above that no counterpoise is needed. If you do not attach a separate wire to act as a counterpoise, then the outer braid of you coax will act as a counterpoise. For this reason, you should not use an RF choke at the feedpoint of an EFHW (unless you provide a separate counterpoise wire). I use ferrites at the transceiver end of the coax. If you choose to use a counterpoise wire, it is recommended to be at least 0.05λ at the lowest frequency of the antenna (6.6' for 40M).

For the rest of this article, I will describe a project to increase the band agility of my 40M QRP EFHW antenna (kit from KM4ACK). I plan to also implement this for my 40M QRO EFHW (homebrew). This method has been the subject of several YouTube videos (for example: K8MRD PackTenna) and can be applied to any wire antenna. The method is to create links in the antenna where the length of the radiating element can be easily changed. This is done as shown in the photos at the top of the next page. Basically, a strain relief is created by making loops in each end of the wire pieces and connecting them with some type of link (quick link, S-biner, etc). The loops are secured with ferrules crimped at the base of the loop. The link is made by soldering a mini-banana plug and jack to the opposite wire ends. Adhesive-lined heat shrink tubing was used to cover the solder joint, providing some weather protection and



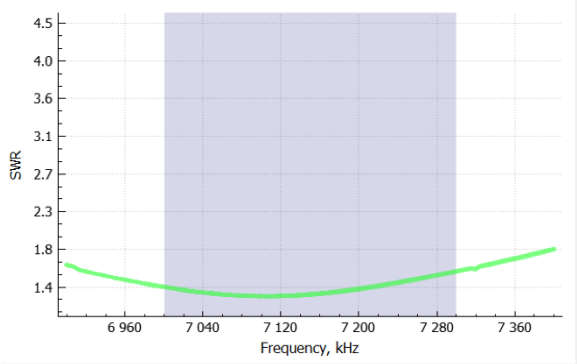


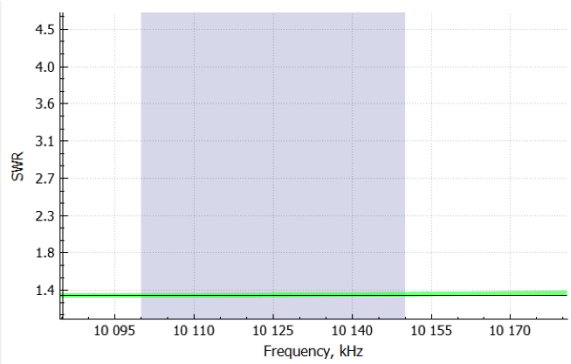
mechanical stability. For 22-gauge antenna wire, I used 12-gauge ferrules and 2mm banana jacks / plugs.

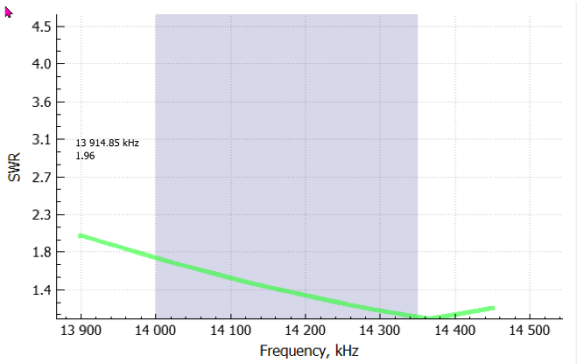
As mentioned above, the 40M EFHW will also work on 20M, 15M and 10M. In my experience though, the resonance point is usually just above the 15M band and at the upper (FM) end of the 10M band. To compensate for this, I marked the wire so that I could adjust for which bands that I wanted to use. In the new version, I use a link for this. While I still have to lower the antenna to make or break the link, it is easy than adjusting the wire length. My goal was to add the 17M and 30M bands to the antenna by links. To do this, I cut the 66′ wire at 25′ 10″ and made a temporary loop with a uncrimped ferrule. On the remaining ~40′, I also made a temporary loop and attached the loops with a quicklink and pulled the EFHW into the air with a rope over a tree branch. I used my antenna analyzer to adjust the length to 17M resonance.

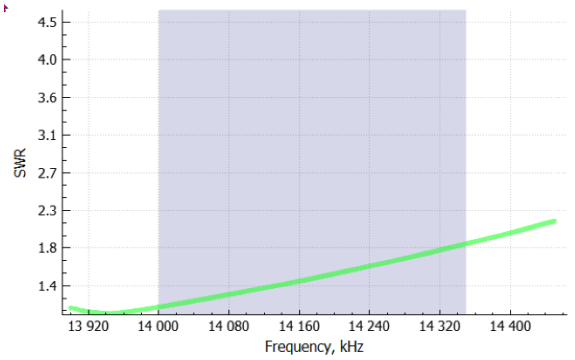
When satisfied with the 17M performance, I soldered on the banana jack and plug. I then trimmed the ~40′ wire to 20′5″ which combined with the 17M link should resonate near 30M. Again, temporary loops were made and the wire was trimmed until 30M resonance was achieved. Finally, I made a 19′3″ wire length, temporarily attached it and trimmed for 40M resonance. At this point, 20M, 15M and 10M were a little high in their respective bands. I

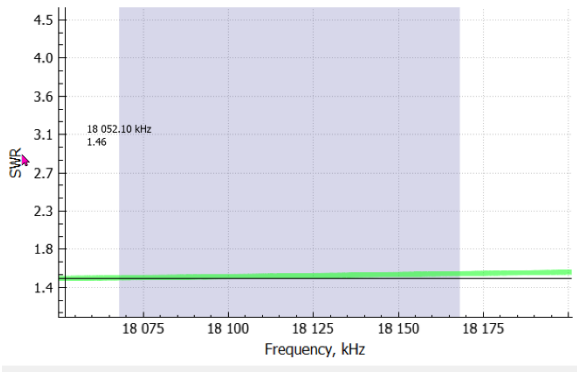
added a short (~2') link to bring minimum SWR into better band position. Final results are pictured below using SWR charts.

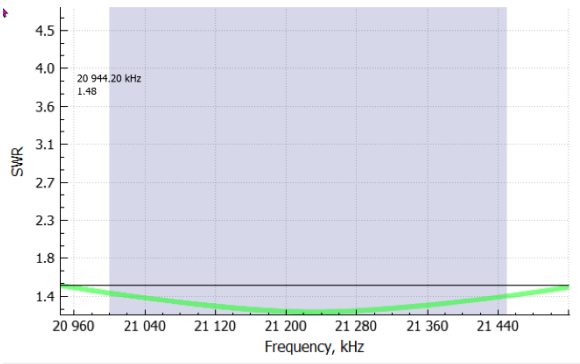


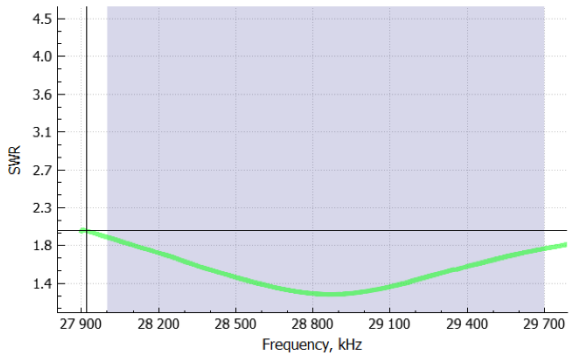












In a multiband antenna like this, you could spend days optimizing. I got every band to what I think is good enough (~1.5:1 or better across the band) with the SWR minimum about mid-band and accepted that. For context, with an SWR of 1.5:1, using 25' of RG-174, the power loss is 16%. Using 25' of RG-8X decreases the loss to 6% and the loss with LMR-400 is only 3%. Refer to KV5R for a very good transmission line loss calculator. I could not get 10M, 15M, 20M, and 40M all centered simultaneously, so there are two curves for 20M. One with the last ~2' link connected and one without. With that link connected, the EFHW is best for 20M CW and digital. With the link disconnected, the EFHW is best for 20M SSB. I should note, however, that 20M performance should acceptable over the entire band in either case (SWR <1.8:1).

The final antenna is pictured below on a scale. The finished weight is only 6.5 ounces or 0.5 ounces more than the stock KM4ACK kit antenna. This is great for backpacking QRP expeditions or just low power (50W SSB, 20W CW / digital) portable operation.