Antenna of the Month

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July, 2024

Off-Center Fed Dipole (OCF)

Your Mileage May Vary, they say, and that certainly applies to this type of antenna. One way to access many HF bands on a single wire antenna is to feed a dipole off-center. Depending upon how much space you have, it may be designed to cover most of the bands 80 through 10 or 40 through 10 m with a usable match. You might also get it to work on 6 m. An antenna tuner is almost always a requirement since it will only rarely exhibit a low SWR. Like any horizontally-polarized antenna, it helps to mount it as high as possible and height will also change the impedance, sometimes drastically. There are countless designs on the web as well a commercial ones. In this article, we'll look at a typical design (Fig. 1) and consider some of the challenges associated with this popular antenna.

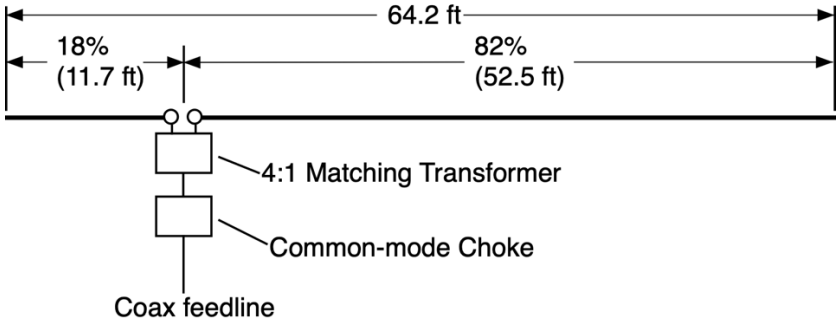

Figure 1. Components of a typical 40 through 10 m OCF dipole.

Recall that any conductor will radiate as long as you can get RF current to flow in it, and where you connect the feedline along a dipole doesn't change the radiation pattern or the gain; it only changes the feedpoint impedance. The only other requirement is that you achieve a decent impedance match at your transmitter in order to transfer maximum power. With the OCF, we adjust both the length and the feed point location until the feed point impedance is **roughly the same** on most of the bands, starting with the one where the antenna is 1/2 wavelength long.

By "roughly the same," I don't mean 50 ohms, and in fact it's generally around 200 ohms or perhaps higher, and it's not just a pure resistance. So the first thing we need is a wideband matching device at the feedpoint. A 4:1 impedance transformer is the standard choice.

The second thing we need is a robust common-mode choke on the coax. Because the antenna is highly asymmetrical, substantial common-mode current is guaranteed to flow on the outside of the coax. In other words, the coax becomes an additional element of the antenna. This will cause several problems: Antenna tuning becomes less predictable. High RF voltage may appear in your shack, raising all kinds of havoc. And local noise (RFI) riding on the outside of the coax will be conducted to the antenna, increasing your noise floor. All of these problems are mitigated by a common-mode choke (which should be a component of nearly every antenna installation).

What kind of SWR might you see? Figure 2 shows data provided by Palomar Engineers [Ref 1] for a 40-10m OCF installed at 30 feet. Assuming you actually get this result, any transceiver with a built-in antenna tuner is likely to match this on all the specified bands. If you're really lucky, it might also match on 80 m, though you may damage the balun/choke if you try to run very high power there. The longer 80 m designs may sacrifice the match on one or more higher bands in exchange for better results on 80. Please note that installation details can affect SWR, sometimes drastically, especially if the wire is close to other objects, near the ground, or bent into arbitrary paths. Adjusting the lengths may improve results. Plan on spending a lot of time with your antenna analyzer.

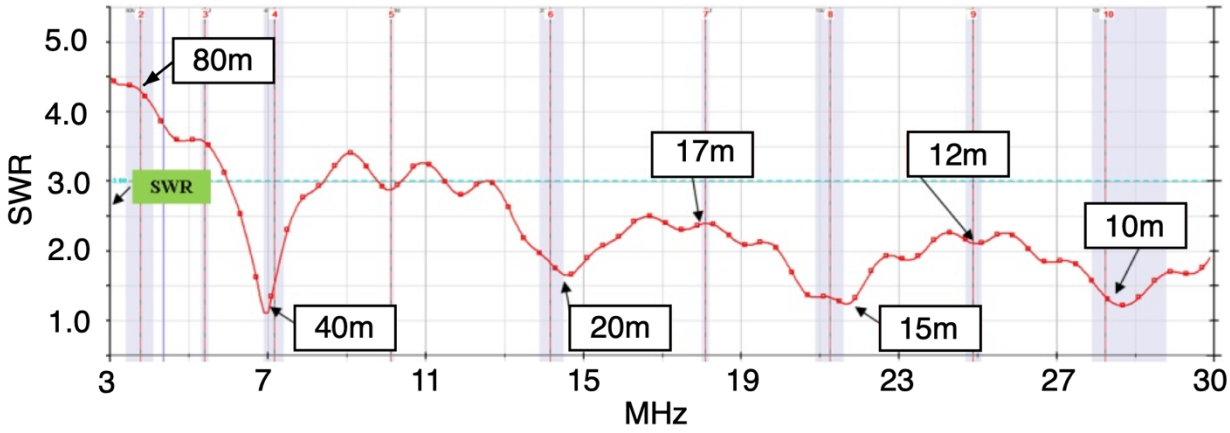

Fig. 2. SWR for a 40-10m OCF. Copied from the Palomar Engineers website and edited for readability. It should also work on 6 m. If you're really lucky, you might be able to use this on 80...

Radiation patterns from these all-band antennas can only be described as chaotic. Every band will have a different pattern with higher frequencies consisting of a great many lobes in various directions. Height will of course change everything and as always, higher is generally better. It's fairly pointless to do a lot of simulations since the results are so dependent upon installation details. This is after all a compromise antenna, not a high-gain death-ray.

Finally there is the choke/balun, a very important component. It needs a 4:1 impedance ratio, which implies a 2:1 turns ratio. It also requires a very high common-mode impedance. This can be achieved with two components, a transformer plus a choke, or with a single component commonly known as a Guanella current balun. When properly designed, a Guanella can handle high power and meets all requirements. Figure 3 shows the schematic for this device. It consists of two common-mode chokes that are driven in parallel and then connected in series at the output.

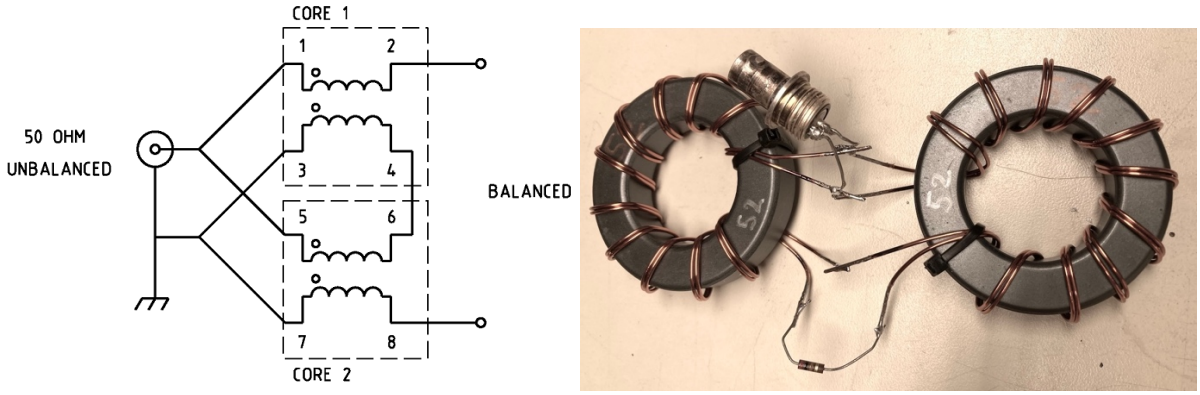

Figure 3. (Left) Schematic of a 4:1 impedance Guanella current balun using two ferrite cores. Copied from the VK6YSF website. (Right) one of my test baluns.

Ferrite core material choice is important. I tested three types (Fair-Rite mixes 52, 43, and 31) and found that the lowest loss (0.20 dB at 30 MHz) was achieved with mix 52. Mix 43 was almost as good and may also be used. All cores are 2.4 inch OD. They may be wound with bifilar magnet wire or PTFE insulated wire, preferably 14 AWG. About 9-11 turns is optimal. The VK6YSF website has some clear fabrication instructions. https://vk6ysf.com/balun_guanella_current_1-4.htm. It should be housed in a weatherproof nonmetallic enclosure, such as a 4x4x4 PVC Cantex box, available at Home Depot.

Some OCF users report problems with RF in the shack on certain bands. This is often because of insufficient choking impedance in the balun. An additional common-mode choke can be added, preferably at the antenna feedpoint but further along the feedline may also be helpful. That may also help avoid the *flaming balun* problem if you attempt to run high power.

To summarize, the OCF is likely to give you access to most of the HF bands with just a single wire. Radiation pattern will be random but certainly adequate for ordinary hamming. SWR may or may not be optimal on all desired bands in your particular installation but with some trimming it probably will be satisfactory and compatible with your antenna tuner. Hang it as high as you can and don't be afraid to bend it here and there to fit your yard. And always be sure to use a well-designed balun/choke.

References

1. https://palomar-engineers.com/tech-support/tech-topics/antenna-notes/off-center-fed-dipole-notes