An End-Fed Center-Fed 20-Meter Portable Antenna

A simple, matched, end-fed half-wave antenna for portable operation.

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My portable operations are almost exclusively QRP CW, and my band of choice is 20 meters, as it's usually open during the day and the antenna size is reasonable. As the new Cycle 25 sunspot activity increases, 20 meters will be open longer, and will provide more reliable low-power DX operation.

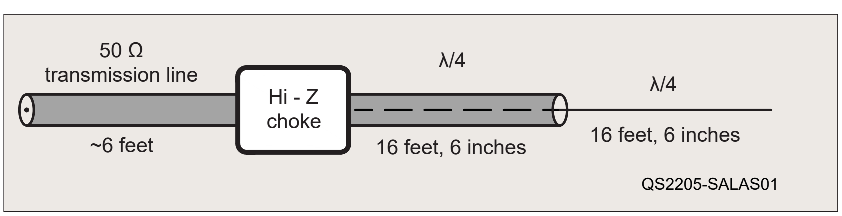
Design Solution

The end-fed center-fed (EFCF) dipole is a good solution for a single-band antenna. The 50 Ω transmission line directly feeds the center of the dipole, and the outside of the transmission line shield provides half of the dipole. This antenna can be erected as an end-fed half-wave dipole, or an end-fed half-wave vertical or sloping vertical. As the EFCF antenna uses the outside of the transmission line shield as half of a dipole, you must provide a high-impedance choke a quarter wavelength back from the center feed point (see Figure 1).

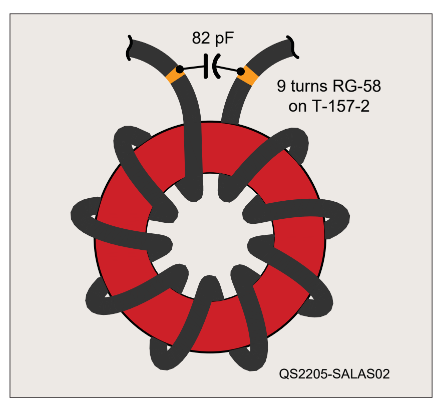
Trap Construction

I chose to use a parallel tuned-circuit trap instead of a ferrite choke as I could get a reasonably high choking impedance with a small form factor. The drawing of the trap is shown in Figure 2. It consists of nine turns of RG58 wound as a single layer on a T157-2 powdered iron core, and an 82 pf resonating capacitor. I calculated that 110 pf would be needed, but the interwinding capacitance was high enough such that only 82 pf was required.

I began by purchasing a 25-foot section of RG58 cable with BNC connectors on each end. It is important that the cable has a copper — not aluminum — braid. Cut off the connector on one end and wrap nine turns of the coax through the toroid, leaving 16½ feet of coax between the toroid and the cut end of the coax. This leaves about 6 feet of feed line for



▲**Figure 1** — The final dimensions for the end-fed center-fed dipole antenna.



▶**Figure 2** — The trap schematic. There is one pass through the toroid center per turn. The nine coax turns will fit snugly as a single layer.

Table 1 Trap Component Temperatures versus RF Power Level			
TX Power (W)	**Toroid Temp (°F)**	**Coax Winding Temp (°F)**	**Capacitor Temp (°F)**
15	83	83	83
25	87	87	87
50	91	99	91
100	94	121	103

▲**Figure 3** — The tinned and tie-wrapped cable.

▶**Figure 4** — The finished trap.

your transceiver-to-antenna interface. The feed line can be extended, if needed. Use a tie wrap to hold the ends of the coax together as they exit the toroid. Then, carefully scrape some insulation from each end of the RG58 right as it enters and exits the toroid. Tin the braid at these two points, as shown in Figure 3. Finally, solder an 82 pf, 1 kV mica capacitor across the shields of the two cable ends, as shown in Figure 4.

I originally left the uncut capacitor leads in place, so I could measure the trap isolation with my VNA. Figure 5 shows the measured trap isolation. Note that it is better than 31 dB across the lower half of the 20-meter band, which is equivalent to a trapping impedance of over 3,500 Ω.

Keep in mind that the trap is only effective on the outside shield. The transmission line — which consists of the inside of the shield and the center conductor — is unaffected.

Dimensions and Supports

The final dimensions of the antenna are shown in Figure 1. Notice that the dimensions follow the 468/f equation for the dipole length, as this really is just a

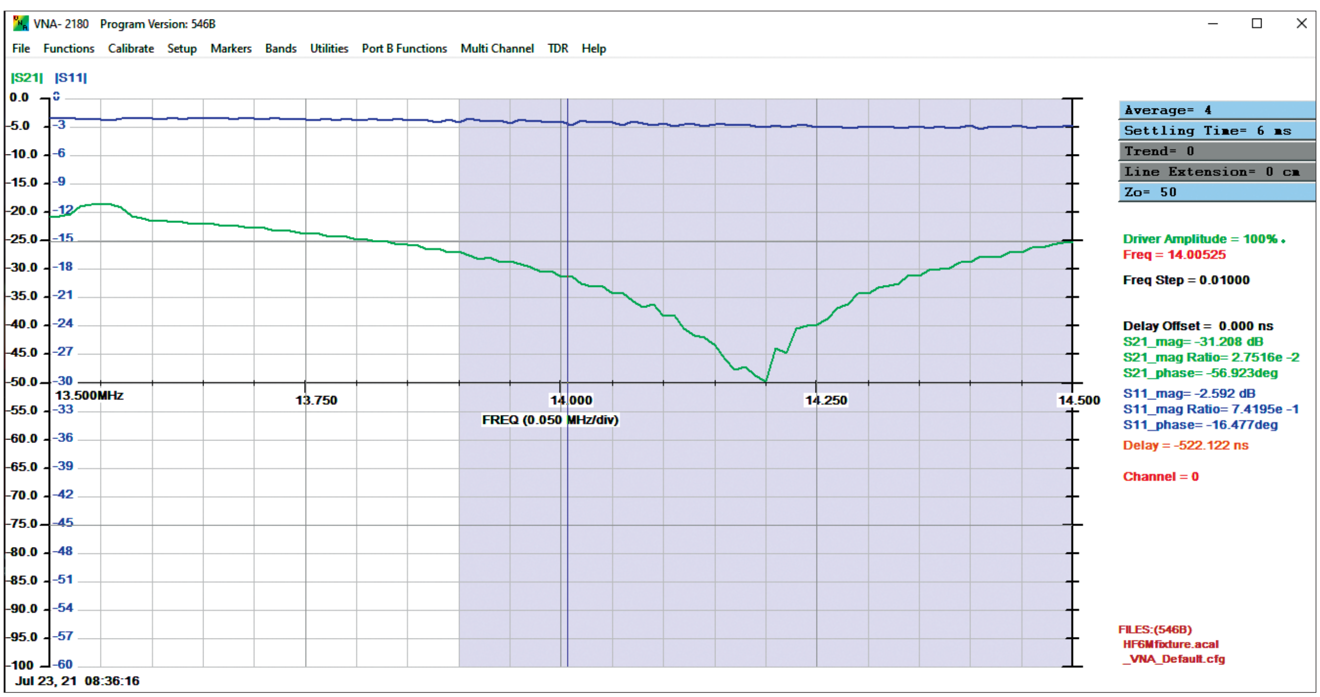


Figure 5 — The trap isolation measurement.

▲**Figure 6** — The wire and coax junction.

▶**Figure 7** — The end insulator and support.

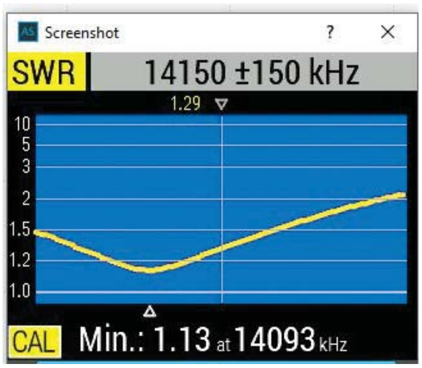


Figure 8 — The measured SWR of the EFCF antenna.

dipole. The ¼ coax section is measured from the point the capacitor is soldered across the shields. A nylon spacer filled with hot glue strengthens the connection of the coax center conductor and wire end, as seen in Figure 6. Another nylon spacer at the wire end is attached to a nylon cord and then to a large nut, so the antenna end can be easily attached to a railing or thrown up into a tree (see Figure 7).

Standing Wave Ratio

Figure 8 shows the RigExpert AA55 Zoom Analyzer measured SWR of the antenna arranged as a sloping half-wave antenna with the far end attached to my second-floor balcony railing. The feed end was on a picnic table where I had my 20-meter QRP radio. The lead photo shows the rolled-up antenna ready to go on my next outing.

Power Handling

The RF voltage at the open end of a dipole can be quite high, depending on the power level. Circulating currents in the inductor and capacitor (*L/C*) parallel resonant circuit can also be high. Depending on various assumptions (antenna *Q*, characteristic impedance, wire dimensions, etc.), you can calculate a variety of answers with regard to power handling. I decided that the easiest way to determine the trap's power handling capability was to simply measure the trap component's heating at various power levels. I set up my Icom IC-706MKIIG feeding this end-fed dipole. The ambient outside temperature was 83 °F during the tests. All measurements were made after a 30-second continuous key-down period using a Kintrex IRT0421 infrared thermometer. The results are shown in Table 1.

Based on these measurements, I'd be comfortable using this antenna at power levels up to 100 W with low duty cycle modes (CW and SSB). However, for high duty cycle modes, you may want to keep the power level at 50 W or less. If you want to operate at 100 W and high duty cycle, I'd recommend replacing the capacitor with two parallel-connected 42 pf/1 kV micas. Use a T184-2 or T200-2 toroid and Teflon-insulated RG58 for the coax.

This is an effective and easy-to-deploy 20-meter antenna for portable operation. Build one and have fun!

Phil Salas, AD5X, an ARRL Life Member, has been licensed continuously since 1964. His interest in ham radio led him to pursue BSEE and MSEE degrees from Virginia Tech and Southern Methodist University, respectively, followed by a 35-year career in RF, microwave, and lightwave design and management. Now fully retired, Phil enjoys tinkering with ham radio projects and spending time with his two grandsons.

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