A Field-Portable Multi-Band Rotatable Dipole Antenna

Build this easy-to-tune and set up antenna that covers 6 – 20 meters.

Jeff Otterson, N1KDO

I like to camp and I like to take my radio along with me. The lead photo shows my assembled antenna on top of fiber-glass “camo-tarp” poles, with Jeff Callahan, K4UIE, operating an Elecraft KX3 radio during a camping trip in the Chattahoochee National Forest. During previous trips, setting up antennas while camping had become an ordeal. I experimented with commercially available options, but they disappointed me. They were difficult to tune and to change bands, they used coils that lowered the efficiency, and they generally lacked physical robustness. My solution centers around the MFJ-1979 17-foot stainless steel telescopic whips, which can be bought for $50 – 60 each. Using two whips, I made a field-portable antenna for 6 – 20 meters. This design could easily be modified to support loading coils at the feed point, should you wish to extend my design to include the 40 meter band.

The Portable Antenna

A pair of the MFJ whips make a fine dipole, but I was concerned about the torque that would be produced on the mount from the weight of the whip extended horizontally. I was afraid that this force would damage the mount, the whips, or both.

I decided to make a mount that would reduce the torque on the end of the antenna by moving some of the force away from the mount. I used PVC pipe and fixtures, longtime favorites of the amateur antenna builder, to support the whips several inches away from the mounting studs (see Figure 1). This significantly reduced the torque on the mounts.

This is not a suitcase or backpack antenna — the 17-foot whips are 28 inches long when collapsed. I prefer to support this antenna with fiberglass “camo-net” poles, often found at hamfests, on a tripod mount. It is great for car camping, Field Day, and hamfest or flea market use, because I can set it up in less than 10 minutes. Changing bands takes just a few minutes.

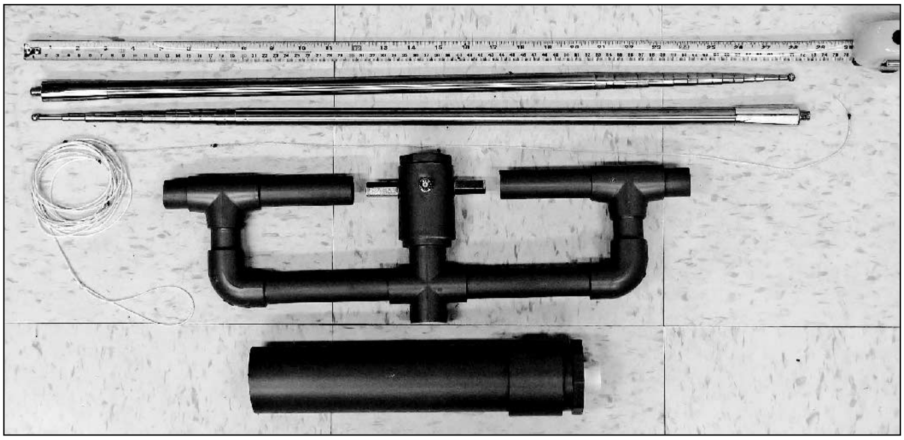

Figure 1 — The antenna components.

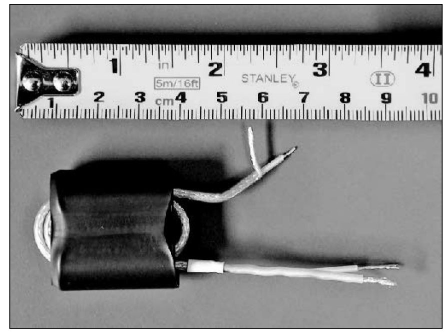

Figure 2 — The choke balun assembly is approximately 1¼ inches across.

The Choke Balun

My mount includes a simple common-mode balun that helps reduce common mode currents from the feed line. The balun is made with a short length of RG-316 Teflon coax wound two and a half turns through a pair of type 43 ferrite beads (see Figure 2). Despite the tiny coax, this balun should handle 100 W as long as the antenna is operated under normal SWR.

The electrical wiring is very simple. The female BNC bulkhead connector mounts through a 1¼-inch PVC coupling. I soldered the feed line coax to the choke balun, and wired the other side of the choke balun to each of the antenna mounting coupling nuts (see Figure 3).

Assembly

I made my mount in two pieces — the *antenna mount* (see Figure 1, middle row), and a *mast adapter* (see Figure 1, bottom). Figure 4 shows how the various PVC components fit together for the antenna mount and the mast adapter. I did not glue the mast adapter to the antenna mount. This allows the parts to break down into smaller pieces, and also will allow me to make a mast adapter for a different kind of mast at some future date.

The assembly is mostly straightforward, but nitpicky, because the alignment of the PVC pieces is critical. PVC cement is unforgiving — you have just a few seconds to align the parts, once assembled, before the cement sets. Cut all the pieces first, and "dry-fit" everything before applying cement. Once assembled without cementing, you can determine the locations to drill the holes for the antenna coupling nuts by placing the whips into position. The dry-fit parts will show the spacing for all parts.

I made two jigs out of scrap lumber to aid the alignment, and spread out the assembly over several days. On the first day, I cemented the pairs of three pieces of pipe into the PVC **T** sections, and the long segments of pipe into the PVC elbows. The next day, I cemented the **T** sections to the elbow sections, aligning the PVC pipes with the first wooden jig. I also drilled the 1¼-inch coupling to receive the antenna coupling nuts, and cemented the reducing bushing into that coupling, and the 2-inch coupling for the mast adapter. On the third day, I cemented the PVC cross to the "elbow" sections, again with help of a purpose-built jig, and with some extra sections of PVC pipe "dry-fit" into the cross, perpendicular to the sections to be cemented, to ensure proper alignment.

The last tricky step was to glue the 1¼-inch coupling with the antenna coupling nuts to the cross. At this point, the mount was nearly complete. I used the antenna whips to locate and index this part properly while cementing it into position.

Tuning

My tuning aide mechanism is a piece of string with a loop tied at one end (visible in Figure 1). The loop goes over the center of the antenna, and a knot is tied at the proper length that the whips must be extended for each band. I "calibrated" my string using an antenna analyzer, by setting the whips to the resonant length for each band, and then tying a knot in the string at that length of the whip. This has proven to give very repeatable setup results. The knot

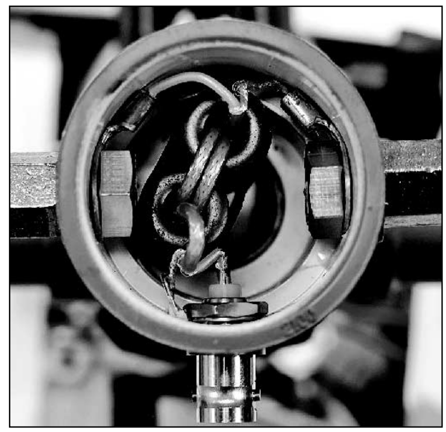

Figure 3 — The choke balun assembly installed in the antenna bracket.

Table 1
Whip Length for Different Bands

Band, meters	*Length, inches*
6	58
10	102
12	115
15	134
17	159
20	Extend fully

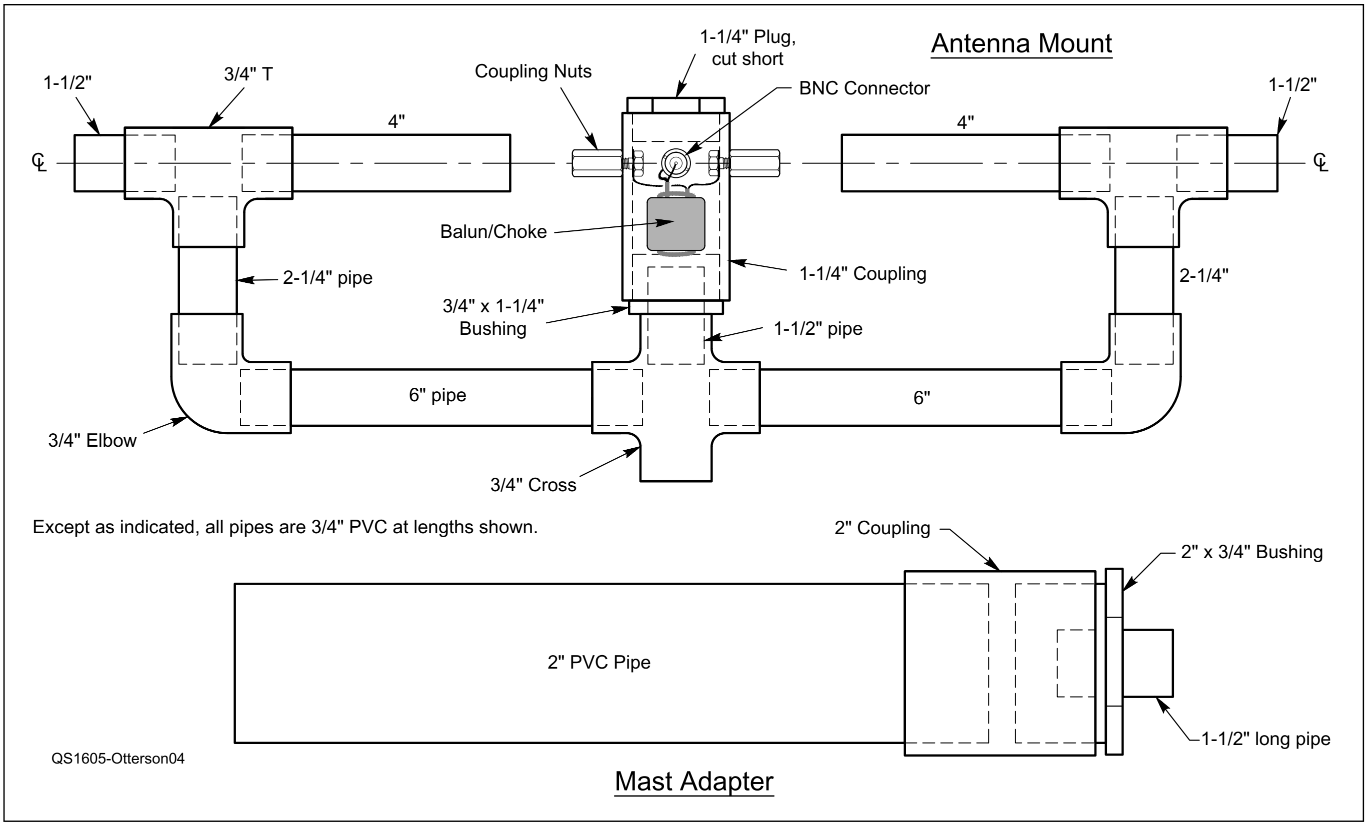

Figure 4 — The antenna bracket assembly.

Two MFJ-1979 17-foot stainless steel telescopic whips (www.mfjenterprises.com)
¾" schedule 40 PVC pipe, about 4 feet
Two ¾" PVC elbows
Two ¾" PVC schedule 40 T
Two ¾" PVC schedule 40 cross
1¼" × ¾" PVC schedule 40 reducer bushing
1¼" PVC schedule 40 coupling
1¼" PVC schedule 40 plug
¾" × 2" PVC schedule 40 reducer bushing
2" schedule 40 PVC coupling
2" schedule 40 PVC pipe, about 24" length
Two type 18-8 stainless steel coupling nuts,
⅜-24, 1⅛" long, ½" wide (McMaster-Carr, www.mcmaster.com)
Two type 316 stainless hex head cap screw, ⅜-24, ¾" long, fully threaded (McMaster-Carr, www.mcmaster.com)
Two ⅜" stainless steel internal tooth lock washer
Bulkhead BNC jack Amphenol #112426, Mouser part #523-11426
Two Fair-Rite 2643540002 type 43 ferrite beads (Mouser, www.mouser.com)
2 feet RG-316/U (The Wireman, www.thewireman.com)
Heat-shrink tubing
20 feet of string
PVC pipe cement
Two ⅜" ring terminals

locations for my string are shown in Table 1.

Using the Antenna

Using the hamfest-special fiberglass camo-net poles, and a tripod adapter from the same hamfest vendor, I can put the antenna up 20 – 25 feet in less than 10 minutes. Band changes, using the calibrated string to set the lengths of both whips, take just a few minutes. I've used my Elecraft KX3 low-power transceiver with this antenna for contacts across the US and Europe from my campsites on the 20 meter band and higher. I had never used a rotatable dipole before, and was pleasantly surprised to find deep nulls off the antenna ends. You can rotate the antenna to minimize noise and interference. I had seen plots of dipole patterns in textbooks, but to listen and watch the S meter while rotating the antenna really brought this home.

Photos courtesy of the author.

First licensed in 1991, Jeff holds Amateur Extra class license N1KDO. He is a software developer by trade, but has been an electronics experimenter since age 5. Jeff enjoys HF DXing, contesting, ragchewing, portable operations, and VHF/UHF weak signal and repeater operations. He likes to design and build electronic projects, including loudspeakers, embedded control apparatus, antennas, and other analog and digital circuits. He was first published in *QST* in February 1997 with his article, "Build a $60 Repeater Controller." Jeff holds a Bachelor of Science in Computer Science from Southern Polytechnic State University. He is a Life Member of the ARRL and a Volunteer Examiner. You can reach Jeff at **n1kdo@n1kdo.com**.