INEXPENSIVE HALF-WAVE 2-METER MOBILE ANTENNA

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I needed a 2-meter mobile antenna, so I thought: "Why not build it myself? How hard could it be, anyway?" A search of the garage yielded an old gutter-mount CB antenna which could provide a mount and coax, but the whip looked hopeless for 2-meter use.

The hardware

I went to Radio Shack to look for a suitable whip and was pleasantly surprised when I found a stainless steel CB whip exactly the right size for a half-wave 2-meter antenna.

Now that I had the new half-wave whip and the old CB gutter-mount frame, my project was on a roll. While browsing at Radio Shack, I discovered that gutter-mount frames and other styles, like mirror mounts and single-hole types, were available at low cost without attached CB antennas.

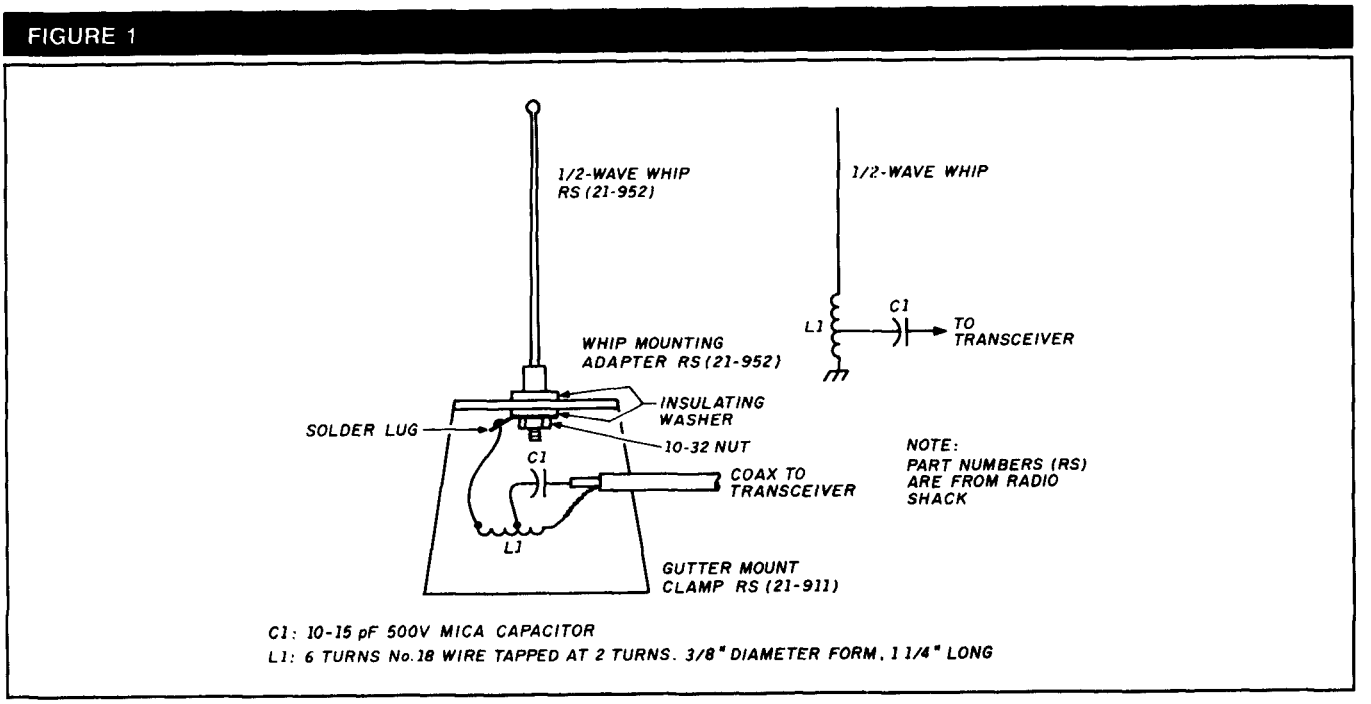
The impressive performance of my AEA "Hot Rod" half-wave handheld antenna heightened my enthusiasm for this project. I completed my design after consulting the RSGB *VHF/UHF Manual*.[1] It showed me how to turn my growing collection of parts into a usable antenna by adding a coil of wire and a small capacitor.

How it works

The main obstacle when building a half-wave whip antenna lies in matching its high input impedance to 50 ohms. Because the input impedance is high, you can't simply connect one end of the coax to the whip while grounding the other end, as you would for a quarter-wave antenna. However, if you add a six-turn coil tapped at two turns, along with a small capacitor, you can form a matching network that transforms this high impedance to the required 50 ohms.

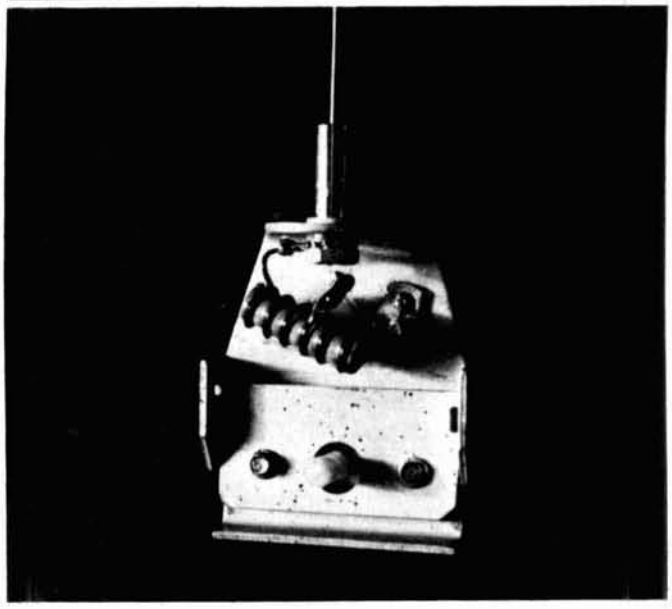
The coil is the principal means of transforming impedance; the capacitor compensates for a reactive component introduced by the coil. **Figure 1** shows the connections and parts used. The resulting antenna has good bandwidth and covers most of the 2-meter band with acceptable VSWR.

FIGURE 1



Pictorial and electrical schematic of the 2-meter half-wave antenna.

PHOTO A



Matching coil is located under the mount to inhibit radiation.

When building this antenna, I did deviate from the usual construction methods by locating the matching coil under the mount, where it can't radiate (see **Photo A**). This coil is usually placed above the mount, where it can contribute to signal strength on both transmit and receive. However, casual comparisons of this antenna with my AEA "Hot Rod," with the coil above the mount haven't revealed any major differences. Installing the coil under the mount does simplify construction significantly.

It's interesting that the half-wave antenna is thought to perform better than a 5/8-wave whip when a good ground plane isn't available. This could be quite helpful on a gutter-mount antenna, where half the ground plane is missing.

Construction

The stainless steel CB whip, Radio Shack part no. 21-952,* provides the 39 inches necessary for a half wave on the 2-meter band. My gutter mount was an old Radio Shack CB antenna similar to the current part no. 21-909. These parts cost about $6 each.

Start your construction by modifying or fabricating an insulating washer to insulate the base of the whip from the top of the mount. A similar washer is needed to insulate the nut and lug from the bottom of the mount. The top washer of my gutter mount had a lip that I fitted into the mounting hole to center the whip in the opening. The bottom washer was a typical flat plastic one. I had to thin these washers so the 10-32 threads on the whip would extend far enough through to allow me to attach a nut. I used a thin blade saw to cut one of the washers in half; you can also sand or grind them down. You may have to make these washers if you can't salvage them from a used antenna.

Next, wind the coil on a 3/8-inch diameter wooden dowel form. You need six turns of no. 18 wire, 1-1/4 inches long, with a tap at two turns. The series capacitor doesn't appear to be critical in terms of capacitance. The RSGB manual suggested 15 pF, but the 10 pF I had available worked fine.

*Replaces Radio Shack part nos. 21-904/908/940. Ed.

Finally, wire the assembly as shown in **Figure 1**.

Adjust the completed antenna for minimum VSWR. You can do this by compressing or expanding the coil turns, as well as adjusting the whip length. When you're satisfied with the VSWR over the band, use epoxy glue to cement the coil turns firmly in place and waterproof the wooden dowel form. It's worthwhile to monitor the VSWR when attaching the coil, as the epoxy may have a slight effect on the VSWR. Tweak the coil, if necessary, to optimize the VSWR before the epoxy hardens.

After the epoxy hardens, use a dab of silicone sealant to hold the whole coil in place and waterproof the coax. It's a good idea to leave a little extra whip length within the mounting adapter. This will allow for some adjustment when you mount the antenna on your the vehicle, or if the sealant has any effect on your VSWR. **Photo A** shows the completed antenna.

Closing remarks

With all the half-wave whips and mounts available, and all the used CB antennas lying around, it's easy to build VHF mobile antennas. It should also be possible to convert an AM/FM antenna using this approach. The Radio Shack half-wave whip screws into the base of the AM/FM antenna on my Toyota. The addition of a coil and capacitor at the base of the antenna in the fender well should produce good results on 2-meters.

The only real problems in converting CB antenna parts to VHF mobile use appear to come from adapting the various mounting thread sizes and the possibility of molded-in base loading coils.

Next time you need a VHF mobile antenna give this approach a try. In less than a day you can have the satisfaction of homebrewing a quality antenna using inexpensive, readily available parts.

REFERENCES

1. G.R. Jessop, G6JP, *VHF/UHF Manual*, Fourth Edition, Radio Society of Great Britain, 1985, page 8.33.