About this Article

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16.3 PROJECT: MOBILE WHIPS FOR VHF AND UHF

16.3.1 ¼-WAVELENGTH WHIPS FOR VHF AND UHF

The ¼-wavelength vertical whip is simple to make and can be made for nearly any type of mount. The preferred stainless steel wire or rod is available from two-way radio shops and CB antenna dealers. Cut the whip to length using a grinding wheel or score it with a file and break it — use eye protection! Any type of wire can be used in a pinch. Coat hangers, copper wire from home wiring cable, galvanized fence wire — all have been successfully used to replace broken or missing whips. Being able to repair or substitute for a broken antenna is a skill any amateur can learn for flexibility and resiliency during emergency situations.

Table 16-1
¼-Wavelength Whip Lengths

Frequency (MHz)	*Length (inches)*
53	53
146	19³⁄₁₆
222	12⅝
440	6
902	2⁷⁄₁₆

Table 16-1 shows the approximate lengths for ¼-λ whips in the VHF and UHF amateur bands based on a ³⁄₃₂-inch diameter whip. Thinner whips will be slightly longer and thicker whips slightly shorter. Be sure to include the antenna base in the total length of the antenna. If the base holds the whip with a set screw, cut the whip approximately 5% long and adjust for best SWR before making a final trim to length.

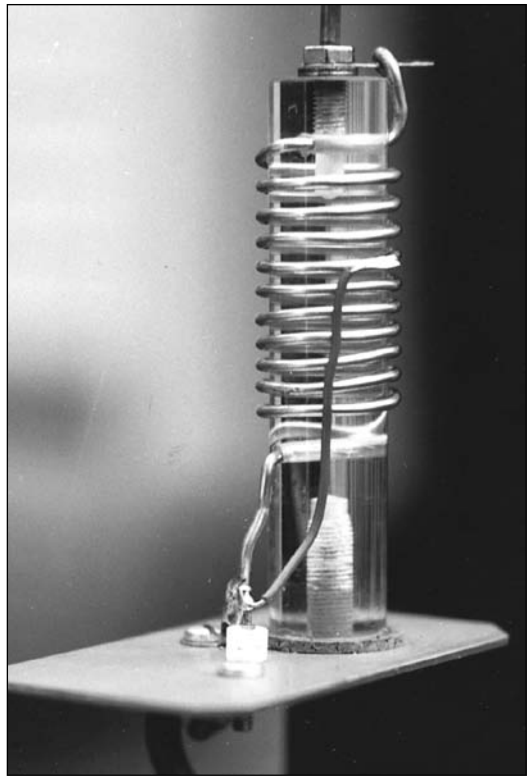
16.3.2 ⅝-WAVELENGTH WHIP FOR 2 METERS

As compared to a ¼-λ whip, the ⅝-λ whip has 1 dB of gain. This antenna is suitable for mobile or fixed-station use because it is small, omnidirectional, and can be used with radials or a solid-plane ground (such as a car body). If radials are used, they need be only ¼-λ long. The whip can be any tempered rod or wire that will spring easily.

Construction

The antenna shown here is made from low-cost materials. **Figure 16.9** shows the base coil and aluminum mounting plate. The coil form is a piece of low-loss solid rod, such as plexiglass or phenolic. The dimensions for this and other parts of the antenna are given in **Figure 16.10**. A length of brazing rod is used as the whip section.

The whip should be 47 inches long. However, brazing rod comes in standard 36-inch lengths, so if used, it is necessary to solder an 11-inch extension to the top of the whip. A piece of #10 AWG copper wire will suffice. Alternatively, a stainless-steel rod can be purchased to make a 47-inch whip. Shops that sell CB antennas should have such rods for replacement purposes on base-loaded antennas. The limitation one can expect with brazing rod is the relative fragility of the material, especially when the threads are cut for screwing the rod into the base coil form. Excessive stress can cause the rod to break where it enters the form. The problem is complicated



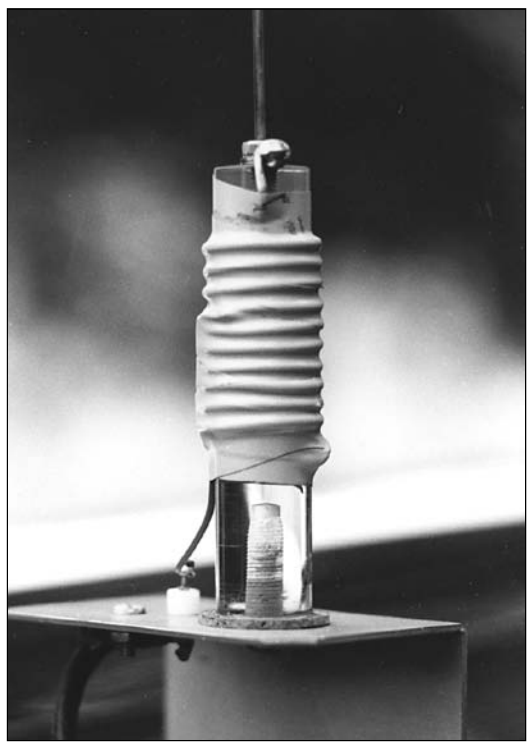


Figure 16.9 — At top, a photograph of the ⅝-λ vertical base section. The matching coil is affixed to an aluminum bracket that screws onto the inner lip of the car trunk. Below is the completed assembly. The coil has been wrapped with electrical tape to keep out dirt and moisture.

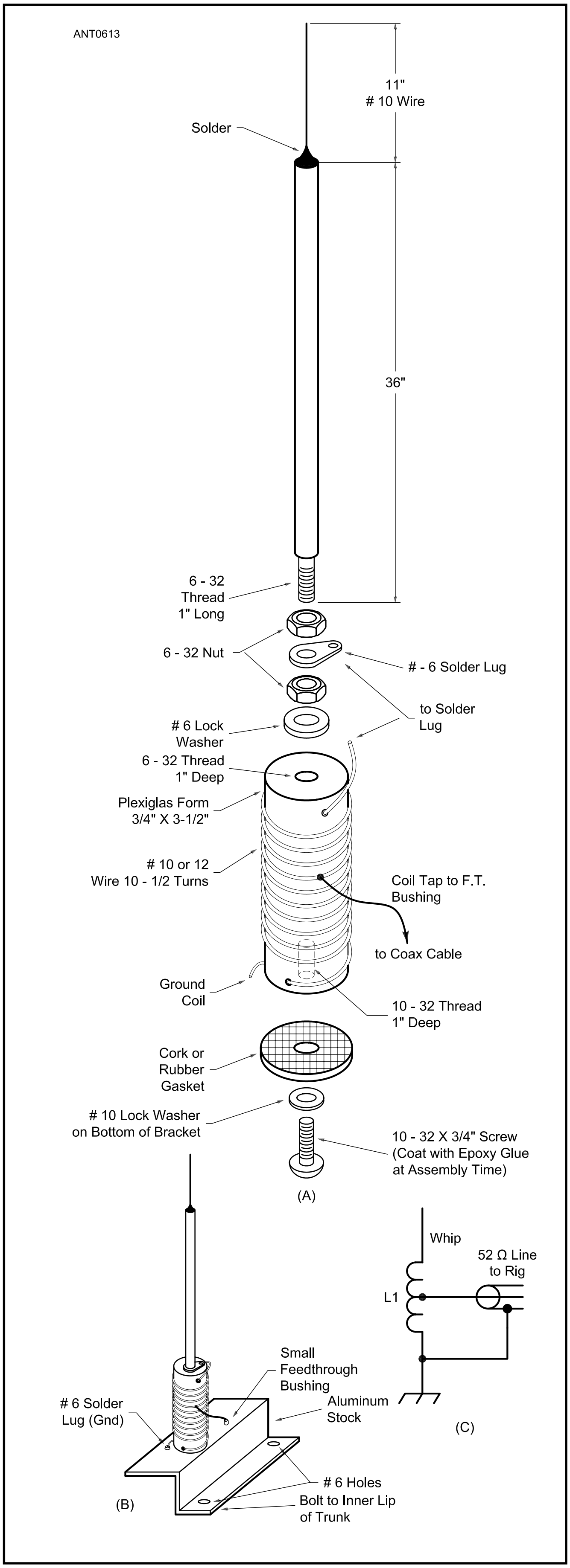


Figure 16.10 — Structural details for the 2 meter ⅝-λ antenna are provided at A. The mounting bracket is shown at B and the equivalent circuit is given at C.

somewhat in this design because a spring is not used at the antenna mounting point. Builders of this antenna can find all kinds of solutions to the problems just outlined by changing the physical design and using different materials when constructing the antenna. The main purpose of this description is to provide dimensions and tune-up information.

The aluminum mounting bracket must be shaped to fit the car with which it will be used. The bracket can be used to create a no-holes mount with respect to the exterior portion of the car body. The inner lip of the vehicle trunk (or hood) can be the point where the bracket is attached by means of #6 or #8 sheet-metal screws. The remainder of the bracket is bent so that when the trunk lid or car hood is raised and lowered, there is no contact between the bracket and the moving part. Details of the mounting unit are given in Fig 16.10B. For rigidity, 14-gauge metal (or thicker) is recommended.

Wind 10½ turns of #10 or #12 AWG copper wire on the ¾-inch diameter coil form. The tap on L1 is placed approximately four turns below the whip end. A secure solder joint is imperative.

Tune-Up

After the antenna has been mounted on the vehicle, connect an SWR bridge in the 50-Ω feed line. (An antenna analyzer could also be used without the requirement of transmitting a signal during antenna adjustment.) Key the 144-MHz transmitter and experiment with the coil tap placement. If the whip section is 47 inches long, an SWR of 1:1 can be obtained when the tap is at the right location. As an alternative method of adjustment, place the tap at four turns from the top of L1, make the whip 50 inches long, and trim the whip length until an SWR of 1:1 occurs. Keep the antenna well away from other objects during tune-up, as they may detune the antenna and yield false adjustments for a match.

16.3.3 ⅝-WAVELENGTH MOBILE WHIP FOR 222 MHZ

The antenna shown in **Figures 16.11** and **16.12** is similar to the 2 meter version discussed in the previous section. The base insulator portion is made of ½-inch plexiglass rod. A few minutes' work on a lathe is sufficient to shape and drill the rod. (The innovative builder can use an electric drill and a file for the lathe work.) The bottom ½-inch of the rod is turned down to a diameter of ⅜-inch. This portion will now fit into a PL-259 UHF connector. A ⅛-inch diameter hole is drilled through the center of the rod. This hole will hold the wires that make the connections between the center conductor of the connector and the coil tap. The connection between the whip and the top of the coil is also run through this opening. A stud is force-fitted into the top of the plexiglass rod. This

Figure 16.11 — The 222-MHz ⅜-λ mobile antenna. The coil turns are spaced over a distance of 1 inch and the bottom end of the coil is soldered to the coax connector.

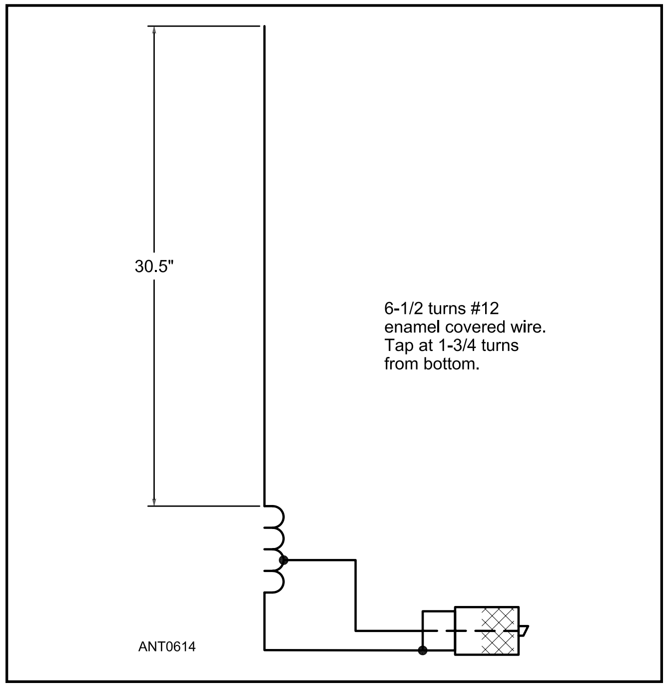


Figure 16.12 — Diagram of the 222-MHz mobile antenna.

allows for removal of the whip from the insulator.

The coil should be initially wound on a form slightly smaller than the base insulator. When the coil is transferred to the plexiglass rod, it will keep its shape and will not readily move. After the tap point has been determined, a longitudinal hole is drilled into the center of the rod. A #22 AWG wire can then be inserted through the center of the insulator into the connector. This method is also used to attach the whip to the top of the coil. After the whip has been fully assembled, a coating of epoxy cement is applied. This seals the entire assembly and provides some additional strength. During a full winter's use there was no sign of cracking or other mechanical failure. The adjustment procedure is the same as for the 144-MHz version described above.

16.4 PROJECT: BIG WHEEL FOR TWO METERS

The following section is an overview of the construction project, "A New Spin on the Big Wheel" by L. B. Cebik, W4RNL (SK), and Bob Cerreto, WA1FXT, in the March 2008 issue of *QST*. The complete article detailing the design's history, evolution, and critical elements is available on this book's CD-ROM with all construction details and drawings.

Most attempts to develop a horizontally polarized omnidirectional (HPOD) 2 meter antenna have sought to minimize the antenna's size. Shapes such as circles (halos), squares and rectangles usually result in the need for either hypercritical dimensions or difficult matching conditions — or both. By turning to more conventional full size structures using three dipoles, we can reduce the number of critical parameters and ease the process of replicating the antennas in a home workshop. In fact, we shall describe two versions of the same basic antenna. One is a triangle of three dipoles that folds into a flat package, suitable for easy transport to a hilltop. The other is a circle of three dipoles suitable for mobile operation that

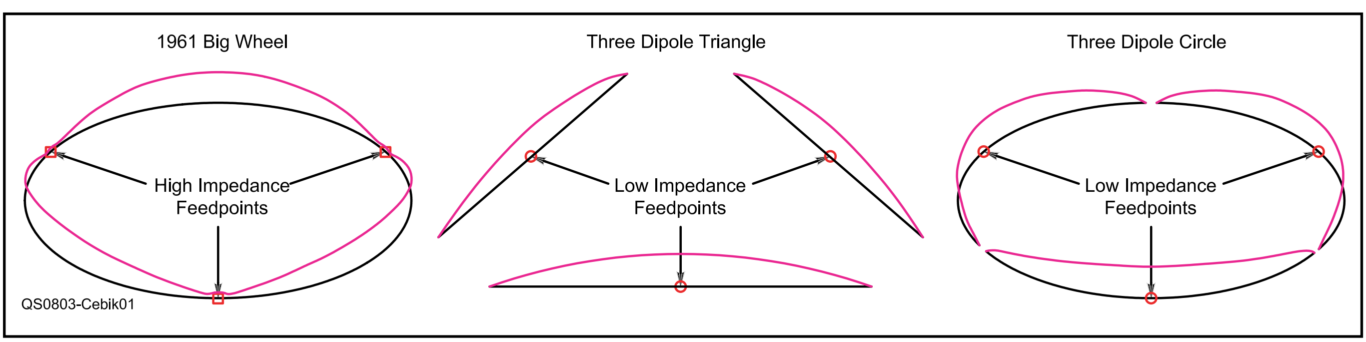


Figure 16.13 — Relative current magnitudes on three different three element HPOD antennas.