Constructing a Simple 5/8-Wavelength Vertical Antenna for 2 Meters

No loading coils — inexpensive — easy to build. Does that sound like the 5/8-λ antenna you've been wanting to build? You've got it now!

By E. J. Bauer,* W9WQ

A diligent search of the amateur journals will reveal a plentiful supply of articles concerning the use of the deservedly popular 5/8-λ antenna on the vhf bands. Being a recent convert to 2-meter fm operation, I took a closer look at this type of antenna. In the process of constructing several versions, I formulated some new ideas which may be of interest to those who derive satisfaction from making their own antennas.

Electrical Theory

Refer to Fig. 1A. The feed-point impedance of a 5/8-λ vertical antenna exhibits a resistive component in the vicinity of 50 ohms. It requires a suitably chosen series inductor, however, to cancel the capacitive reactance which also exists at that point. Only then will a reasonable impedance match be presented to a 50-ohm coaxial-cable feed line. One constructor, K4LPQ, obtained the required inductance by means of a short-circuited stub of coaxial line of proper length.[1] (If the required reactance is known, the length of the stub can be calculated). He improved the mechanical construction of the antenna by placing the stub inside the radiating element. See Fig. 1B. This approach requires an electrical connection to be made between the braid of the stub and the lower end of the radiator. Soldering such a connection would be difficult unless a material such as brass or copper is used for the radiator. If the center conductor of the stub is extended one-quarter wavelength beyond the inductive shorting point (as in Fig. 1C), a signal-frequency short will occur at that point. Furthermore, there is now no need for the stub to be made of coaxial cable. An insulated wire of suitable length (somewhat longer than an electrical quarter wavelength) is all that is needed to develop the required series inductance at the feed point of the antenna. It is only necessary to adjust the length of this stub until an acceptable VSWR is obtained. If desired, the radiator length can also be trimmed.

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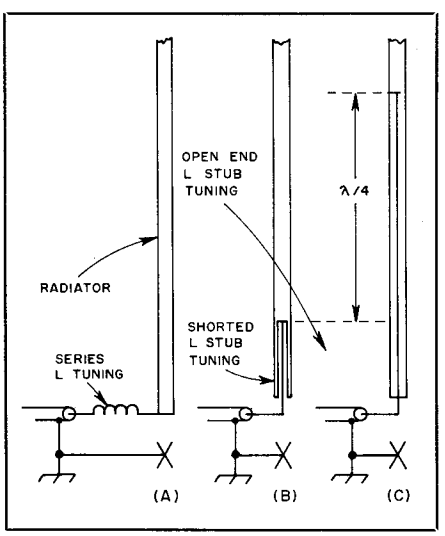

Fig. 1 — The three basic configurations of the 5/8-λ antenna mentioned in the text. The stub tuning method shown at C may be easily arranged mechanically.

Construction

I selected a surplus whip antenna to be used as the radiating element for the 5/8-λ vertical.[2] Cutting the fully extended whip at a distance of four feet (1.22 m) from the tip leaves the larger (base) end with a 3/8-in. (10-mm) OD section. This size tubing fits closely into the hole at the barbed end of a PVC pipe adapter. See Fig. 2. The hole in the threaded end of this same adapter mates snugly with the body of a PL-259 coaxial connector. Cement

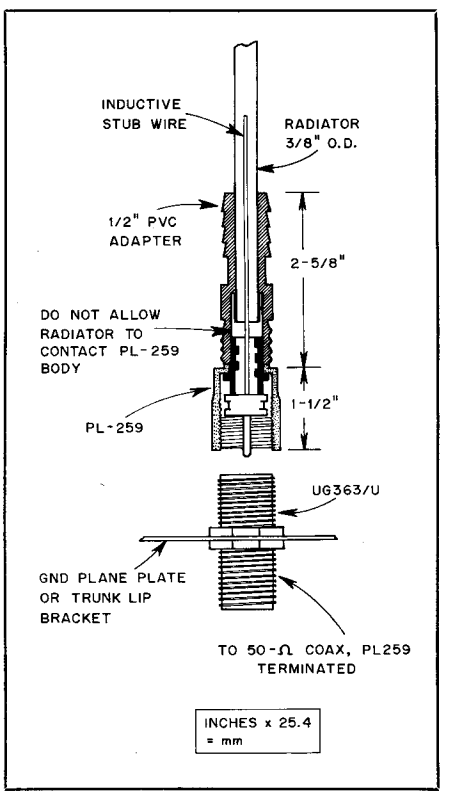

Fig. 2 — This drawing shows a cutaway view of the antenna assembly. A PVC pipe adapter allows simple and inexpensive construction.

[1]Notes appear on page 23.

the radiator to the adapter using a good adhesive. If epoxy is used, it would be advisable to roughen the inner surfaces of the plastic adapter to provide some "bite." It has been my experience that the bond between epoxy and PVC is marginal. Insert the radiator no more than 2 in. (51 mm) into the adapter and allow the adhesive to cure.

Solder approximately 28 in. (700 mm) of no. 18 solid, insulated wire to the pin of the PL-259. Larger wire may be used here, but the optimum length required for matching will be found to be somewhat longer. The inner diameter of this particular whip is 3/16 in. (4.8 mm) at this point and will easily accommodate no. 12 insulated wire.

Fig. 2 shows a UG-363/U connector being used as the junction for the radiator, ground plane and transmission line. This connector is expensive, so one might prefer to use the less expensive SO-239 connector.

Testing

Temporarily assemble the radiator/insulator assembly to the plug/wire portion, attach a ground plane and check the VSWR at two well-separated frequencies. The results will show whether the stub is too long or too short. It should be possible to get the VSWR below 1.5:1 across the repeater portion at the upper end of the 2-meter band. Shortening the stub to move the maximum VSWR point higher in frequency is easy. Should you overshoot, it is simple to start over again with a new piece of wire. Once you are satisfied with the results, the PL-259 can be cemented to the insulator. That's all there is to it. See you on 2 fm! QST

Notes

[1]Pentecost, "5/8-Wavelength Vertical Antenna for Mobile Work," *Ham Radio,* May 1976.

[2]Fair Radio Sales, P. O. Box 1105, 1016 E. Eureka St., Lima OH 45802, G01-51048 telescoping whip antenna.