Rubber duck portability with quarter-wave performance!

By Don Morgan W7ACI

This article describes an application of Tucker's design which results in the most satisfactory two meter portable antenna this author has ever used.[1] What makes the design so attractive is that it can be easily stowed for travel, yet is a significant improvement over a duck or a quarter-wave vertical. In addition, it doesn't require radials or a ground plane. A possible disadvantage in the minds of some might be that, because tuning is required, a visual readout device is called for.

Not Much To It

This system is a half-wave vertical fed by a resonantcavity. By visualizing the radiator turned to the horizontal, and an open wire quarter-wave transmission line substituted for the cavity, and a coax feed line tapped in at the 50 point on the open wire line, you can see the classic Zepplin antenna design.

The cavity is simply a tin can (coffee or dog foodcan recommended) approximately 5-6 inches high by about 3 inches in diameter. These dimensions are much shorter than a quarter-wave, but the antenna will be capacitively loaded to the resonance. After painting the outside (only) of the can a colour of your choice, bore or ream the proper holes for a coax bulkhead connector. One and one-half inches up from the bottom is about right. The center rod is made from any collapsible whip which will extend to 44 or more inches. It should be attached to the bottom center of the can, either with the whip-mounting screw (some whips come with this), or by soldering it with some sort of bracket. Tucker recommends a UG-177/U hood. Whenever attempting to solder to chrome plated brass, it is best to sand off the plating first.

Before installing the whip section, mount the 50 pF capacitor (see Figure 1). We used an air variable cap, but a piston trimmer might do the job if the transmit power is very low. The cavity is a high-Q device capable of developing some surprising voltages. Don't use compression and ceramic trimmers because their configuration makes hand capacitance unavoidable while making adjustments.

We designed this antenna to use with an HT - if you use more than a few watts, don't place your finger in the opening of the can while transmitting. Doing so exposes you to a zap and severely detunes the cavity. The outside is "cold" at all times.

Use an SWR bridge for initial tune-up. The three variable quantities to optimize are: the tap point of the feed, the capacitance loading, and the length of the whip. A tap point about one and one-half inches up from the bottom is the place to start. Extend the whip to 38 inches above the top of the can. While feeding RF into the cavity, tune the variable capacitor to about half mesh and watch the SWR meter drop to near zero. If it doesn't, move the tap point up or down a fraction. Once the correct tap point has been found, it will thereafter remain fixed (soldered or clamped) and the variable and whip section can be returned to pre-marked positions each time the antenna is extended for use.

I prefer, however, to retune the capacitor with some sort of readout device, such as a neon bulb or RF sniffer, because it is quite critical. A germanium diode across a 50 or microammeter makes a dandy sniffer. Merely tune for maximum deflection (output). Again, Tucker stresses that good bonding of the capacitor rotor tot he cavity is an absolute must to avoid hand capacity. A short length of coax from the cavity to the transceiver completes the job. Weighting the can or using magnets and a plastic lid are possible improvements.

Light Comparison

A low-powered handheld using a rubber duck antenna was positioned in front of a field strength meter (set a maximum sensitivity) to make the meter read exactly full scale. The distance measured was 17 inches. The antenna described in the text was then substituted for the duck, and the procedure was repeated. The distance for a full scale reading increased to 27 inches. The square of the ratio of the two distances, converted to dB, is a fair indication of the "gain" of the half-wave vertical. In this case the half-wave indicated about a 6.7 dB improvement.

If you like to build things that produce outstanding results, this project is for you. 73

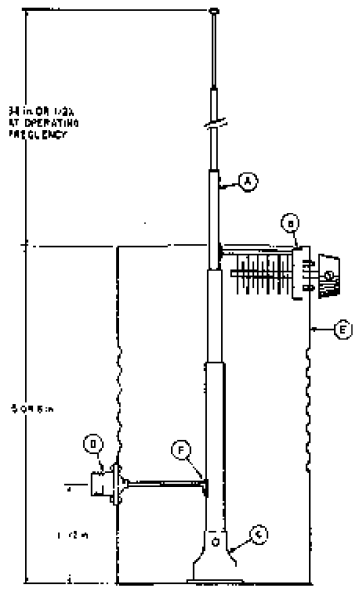

Figure 1. Configuration for the re-entrant cavity antenna. Points A-F are: (A) whip antenna, (B) 50 pF variable capacitor, (C) SO-239 hood, (D) coax fitting, (E) coffee can, (F) tap point {clamp or solder}.

Reference

1. William Tucker W4FXE, "Re-entrant Cavity Antenna For the VHF Bands." appeared in May 1981 issue of *Ham Radio Magazine* (pp. 12-25) and treats the subject in substantially greater detail.