The Rooster-Tenna

Fully functional weathervane conceals an efficient 2-meter base-station antenna. Your Neighbors and HOA won't know it's there and they will love the rooster-vane.

By John Portune W6NBC

The formula for an antenna that won't gather complaints is, make it "look like it belongs." Weathervanes are almost always welcome on rooftops. You only need to know that your weathervane "just happens" to also be a high-performance 2m antenna, Figure 1. A neighbor asked me where I got mine; she wants one. My mobile home park recreation center sports a similar-looking vane. A Rooster-Tenna is great disguise.

Figure 1: Concealed 2m antenna. The Rooster-Tenna

In QST August 2005, I presented an earlier rooster-vane antenna. This new version is much improved, Figures 1&2. The antenna is now a wide-spaced parallel-fed horizontal folded dipole bent into a flattened cube – technically, a skeleton slot. It's' built around two horizontal square aluminum tubing rings, 11½ in. on a side, separated by 5½ in. (tubing center to center) and electrically connected by three vertical interconnect sections.

The rings are bent from rigid ½ in. OD aluminum tubing. Hardware-store soft copper or aluminum tubing is okay but is not as durable. Local metals dealers, DX engineering, metalsdepot.com and onlinemetals.com stock it. At the corners, the rings are held apart by four ½ x 5 in. square acrylic posts, which also mount the vane's N-S-E-W letters. The posts are tapped lengthwise for 10-24 screws through the rings. The mast is 1 in. thin-wall (.063 in.) aluminum tubing. Only the size and spacing of the rings, shown in Figure 2, need what is shown. The other dimensions are only suggestions.

The vertical sections that connect the rings, are made from ¼ in. soft aluminum tubing. The plain ones, left and center in Figure 3, are the ends of the folded dipole. There is no RF current in the rings between the ends.

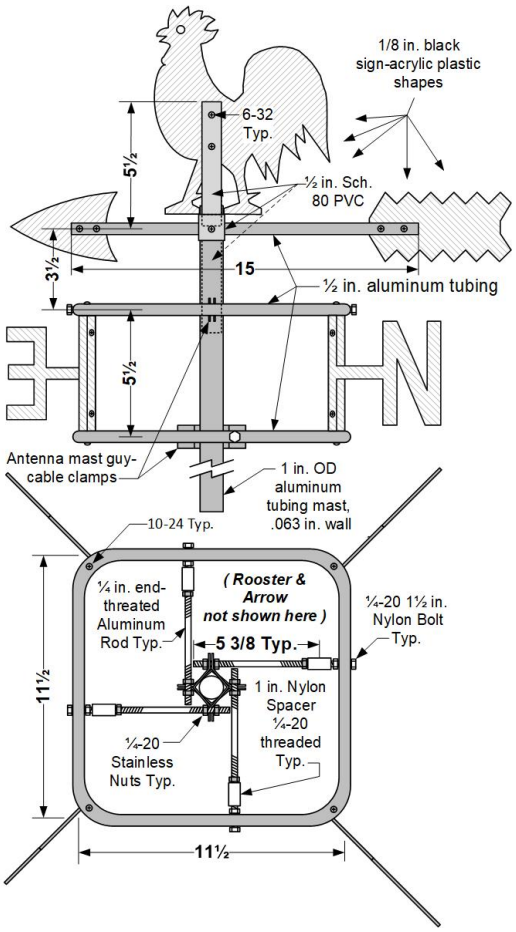

Figure 2: Dimensions and materials

One adjusts the antenna's SWR by moving the vertical section on the right, the one that contains the feedpoint. The operating frequency is adjusted by moving the section on the left. See Figure 7 for construction details.

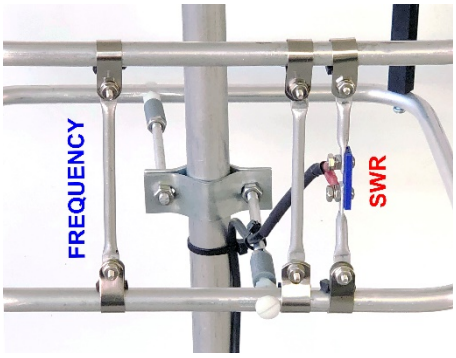

Figure 3: Vertical interconnect sections, Left: Frequency adjustment. Right: SWR adjustment (feedpoint).

Performance

Figure 4 shows the antenna's bandwidth – less than 2.5:1 across the entire 2m band. Figure 5 is the free-space EZNEC elevation, azimuth and 3D radiation patterns with gains (dBi). For a comparison, a half-wavelength vertical dipole or J-pole has an azimuth gain of roughly 2.1 dBi. The Rooster-Tenna, being more nearly isotropic, has less horizontal gain but higher overhead gain, which can be useful for satellite work. The antenna is omni-directional in azimuth and as a horizontal slot it is vertically polarized – best for accessing repeaters and mobiles.

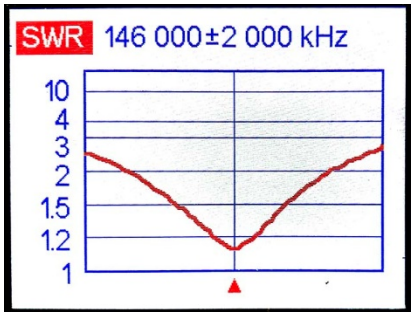

Figure 4: SWR 144-148 MHz, measured with a Rig Expert A1400.

Mounting

Four ¼ in. partly-threaded aluminum rods – two for each ring at 90 degrees mount the antenna on the mast. The rods attach to the mast by two nuts at the ends of common TV antenna guy-cable clamps (Radio Shack on-line and many local electronics parts stores). 1 in. threaded nylon spacers and

nylon bolts insulate the rods from the antenna rings. You will need to thread 1½ in. and 1 in. of the rod ends respectively with ¼-20 threads. I used an

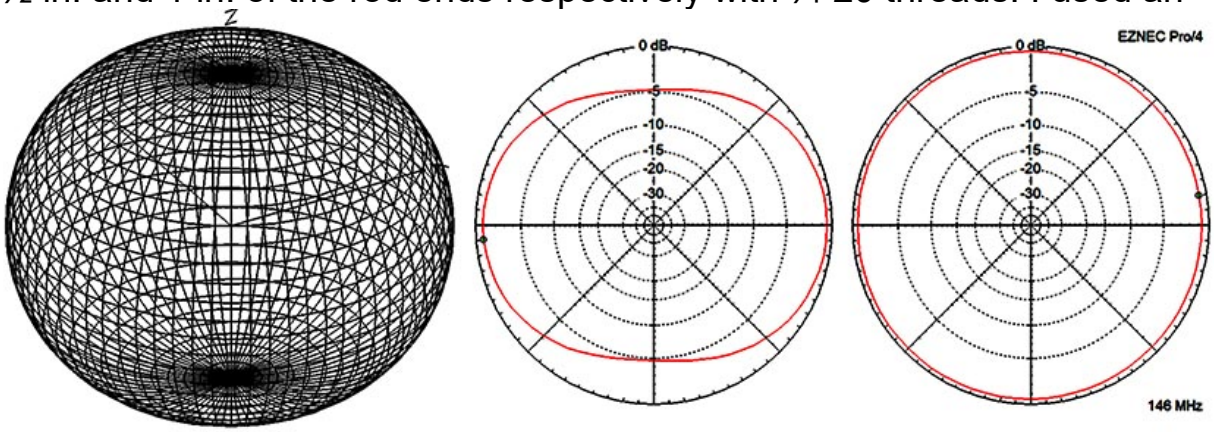

Figure 5: Left to right: Free-space 3D radiation pattern, elevation (vertical) pattern and azimuth (horizontal) pattern. Gains in dBi.

inexpensive common hardware-store threading die. Aluminum all-thread rod may also be used.

The Rotating Rooster and Arrow

The top assembly, with the rotating directional arrow and rooter, is a separate unit that turns inside the 1 in. thin-wall (.063 in.) aluminum tubing mast. The inside diameter of the mast is a close butt free fit for the ½ in. PVC water pipe that mounts the rooster and arrow. White Sch. 40 PVC is acceptable; Grey Sch. 80 is stronger and less visible.

Cement the upper and lower PVC pipe sections into a ½ in, PVC coupling and drill a ½ in. hole through from the side for the arrow. A second 6-32 screw and nut at 90 degrees secures the arrow. The bottom PVC pipe section should be roughly 12 in. long so that the top assembly will stay in the mast under high wind conditions. Cut a 1/8 in. slot in the top end of the top pipe for mounting the rooster, using 6-32 screws and nuts. Do the same in the ends of the arrow shaft for the arrowhead and feathers. Use stainless steel or brass fasteners throughout this project.

Making the Antenna Rings

I used a tubing bender, available at amazon.com that makes precise 1½ in. radius bends in ½ in. tubing, Figure 6. This tool has proven handy for several new antenna designs. Similar models are available for other tubing sizes. A less-expensive method, suitable for soft aluminum tubing, is to use bending springs. They are readily available on the internet and from local hardware stores. A short length of larger diameter pipe, held in a vice, provides a bending mandrill for use with the springs.

Figure 6: 1/2 in tubing bender for 3 in. radius bends.

Alternately, you may make the rings as four separate straight sections. Flatten the ends and drill holes for 10-24 screws, 3/8 in. from the ends. The screws that attach the acrylic posts and N-S-E-W letters (above) will now also connect the four ring sections together. The rings should be 11½ in. on a side, tubing center-to-center. The tubing ends should meet in the middle of one of the ring sides. Connect the ends with a short metal link or heavy wire, secured by screws and nuts.

Making the Interconnect Sections

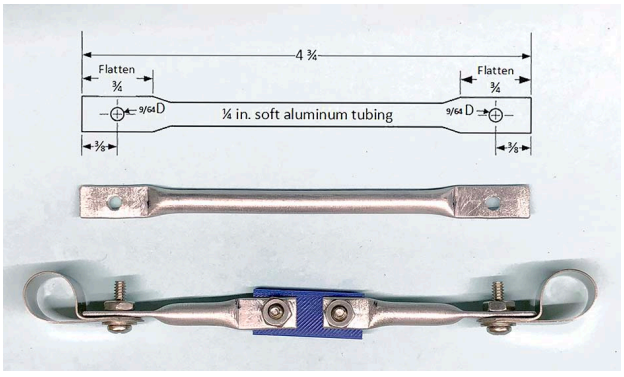

Figure 7: Vertical interconnect sections. Lower section with clamps.. Note plastic insulator in the feedpoint section (lower).

Cut three 4 3/4 in. lengths of ¼ in. soft aluminum tubing. See Figure 7. Flatten 3/4 in. at both ends. Be careful to flatten the ends in the same plane. Then drill 9/64 in. holes 3/8 in. from the ends for 6-32 screws.

Next remove 3/8 in. from the middle of one of the sections for the feedpoint and flatten the ends. Fabricate a small plastic insulator for the gap and secure it with 6-32 screws and nuts. These screws become the connection terminals for the feed coax.

Rubber-insulated stainless-steel cable clamps provide an easy way to attach the vertical sections to the antenna rings. They also permit adjustment of tuning and matching. On-line sources, as well as many local electronic parts stores offer these clamps. They are, however, a little large to create a good connection to the rings. Therefore, leave roughly 3/8 in. of the rubber insulation on the clamp to insure a tight connection.

Plastic Antenna Hardware

If you have access to a 3D printer, a complete set of .stl files for printed plastic parts is available at arrl.org/qst-in-depth and w6nbc.com/wxvane. ASA filament is best for its UV resistance. The antenna shown here uses conventional home-workshop construction methods and materials. Templates for hand cutting the plastic parts are also available at the above along with AutoCAD .dwg files. A local sign-making shop was able to laser cut the letters, rooster and arrow parts for me at modest cost from these files. Sign-acrylic plastic is an excellent material as it is nearly totally impervious to the UV in sunlight.

Alternately, ready-cut acrylic letters are available on the internet as well as from some craft stores. A further possibility is to cut the shapes from the flat sides of a large rectangular plastic trash can. These are generally made of heavy polyethylene plastic, which is also UV resistant and easily cut with tin snips.

Feed Coax and Balun

For the feed point, separate roughly 2 in. of the center conductor and braid of a 6 ft. RG-58 or Mini-8 coax pigtail. Weatherproof the ends with heat-shrink tubing. Crimp-on #6 ring terminals for the feedpoint screws. Add a connecter at the other end. Beyond the pigtail, it is best to use larger coax to avoid the high loss of small diameter coax at VHF.

You should provide the antenna with a 1:1 current choke balun. It may be a small stack of VHF-mix ferrite beads on the coax pigtail or a small 4-6 turn coil wound with the coax of the pigtail, bundled and secured with zip-ties. Attach the balun to the mast with zip-ties just below the antenna.
Included also for 3D printing is a quick-form for a coax balun using small diameter coax, Figure 8,.

Tuning and Matching

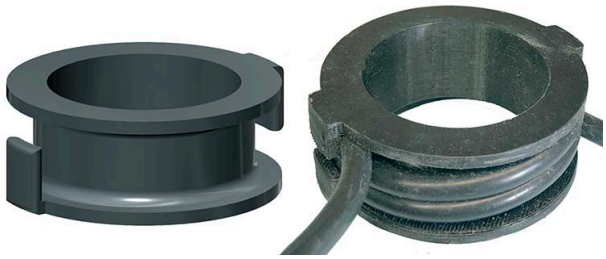

Figure 8: 3D printed quick-form for a VHF balun using RG-58 or Mini-8 coax.

Begin adjustment with the feed point section roughly 1 in. from the middle section and the other roughly 6 inches away. The three sections may also be moved as a group if required during tuning. For better stealth, the feedpoint section is best placed near one of the fiberglass supporting rods on the bottom ring. Zip-tie the coax to the rod and main mast.

Adjust the SWR first, using an antenna bridge or analyzer. Once the SWR is low, it will change only a little when the frequency is adjusted. Therefore, pay no attention to frequency until you obtain a low SWR. Fine tune both with the antenna mounted in its permanent operating location.

Your neighbors or homeowners' association won't likely loudly exclaim, when they first see this attractive antenna, "Not again, that ham is putting up another ugly antenna." Even if they notice it, a weathervane is usually welcomed. Your HOA may even actually approve of it an antenna if you ask. They already officially permit satellite dish antennas and even small TV receiving antennas.

The author will be pleased to correspond: jportune@aol.com, (805) 406-6176 or through w6nbc.com. A kit of essential hard-to-get parts and a ready-built version of this antenna may soon be available at Greyline Performance: flagpoleantenna.com and/or w6nbc.com.

Bill of Materials

≈10 ft.	Rigid ½ in. OD aluminum tubing	Local or on-line metals dealer
≈18 in.	1/4 in. soft aluminum tubing	Hardware source
1	Mast, 1 in. OD thin-wall (.063 in.) aluminum tubing	On-line antenna tubing supplier
2	TV antenna guy-cable mast clamps	TV antenna hardware source

≈6 ft.	Coax pigtail with connector	Electronics source
	6-32 stainless screws and nuts	Hardware source
	10-24 stainless screws	Hardware source
	¼-20 stainless hex nuts	Hardware source
	¼-20 nylon bolts and nuts	Hardware source
	1 in. nylon spaces, ¼-20 threaded	Hardware source
	Plastic parts	arrl.org/qst-in-depth, w6nbc.com/wxvane, craft store, sign-making shop
≈20 in.	½ in. square acrylic or other plastic rod	Internet plastics source
≈30 in.	¼ in. aluminum rod	Bicycle safety flag mast
	Tie-wraps (UV stable variety)	Hardware/electronics source
1	1:1 choke balun, ferrite or coax	(see text)
6	3/8 in. stainless cable clamps	(see text)