The Small Wonder 2m Antenna

A tiny 2m roof-top base-station vent-pipe antenna
with the gain of a J-pole that your neighbors will never notice.

by John Portune W6NBC

The secret of stealth, whether for magic shows or ham radio antennas, is “hide it in plain view.” To the neighbors, ham antennas are “eyesores.” CC&R covenants often forbid them. Yet vent pipes, fireplace flues, and air conditioning ducts – just as visible as antennas – are somehow invisible to wandering eyes. When’s the last time you noticed your neighbor’s roof vents? If a ham radio antenna can be made to look like a normal roof-top dweller, no one will ever see it.

Figure 1: My home-brew J-pole next to the vent-pipe roof-topper.

Here’s just the ticket, a tiny 10½ in. high 2m roof-topper that looks like a vent pipe. But though it’s small, it has the gain of a J-pole. Compare the two in Figure 1 and 5. Which one will your neighbors notice?

Design and Construction

This small wonder is made from a short length of common 4 in. DWV ABS plastic pipe and some heavy-duty 2 in. aluminum duct tape, Figure 2. Besides what’s needed for the antenna (10½ in.), you may want to add some additional for a possible angle cut to match your roof and/or to glue the antenna to a flat surface for mounting.

The completed vent antenna is then painted matt black or covered with matt self-adhesive vinyl. I merely set mine over an existing vent pipe (not a hot one).

Figure 2: Vent antenna before painting. Note outlined shorting tapes.

The aluminum tape is 3.6 mil Scotch 3311 aluminum duct tape or similar. It is readily available on the internet in small rolls. Thinner tape, or household aluminum foil and glue may be used but are somewhat more difficult to apply.

Construction

Begin by applying a temporary wrap of masking tape with its top edge 10½ in. down the pipe. Next, attach the 8 in. vertical tape segments. Figure 3 shows the layout. Note that the vertical tapes alternate, one up, one down, and that they overlap the horizontal tape segments. This lets them make a good RF connection by capacitive coupling. The adhesive on the tape is not a problem.

In flat view, the antenna is easy to see. It is a staggered slot antenna. What's that you say? Read the side bar for a more complete description of slot antennas. The most important feature is that this antenna is vertically polarized. It's a unique quality of a horizontal slot antennas. It's what we need for a 2m base station antenna.

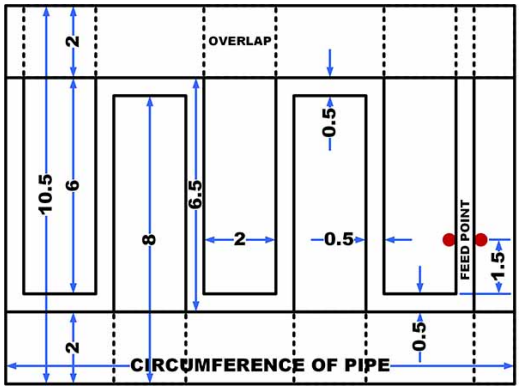

Figure 3: Flat view showing aluminum tape segments and locations. Note the tape overlap and the feed point. Shorting tape lengths and positions shown will vary with your situation.

I used the printed markings on the ABS pipe to get the first vertical tape segment straight. Note that the last vertical segment is narrower than the

others and is 10½ in long. Complete the tape application by adding the two horizontal segments. Both are full wraps with an end overlap.

Feed Point and Balun

Make up a coax pigtail. RG-58 is satisfactory for short runs. Separate the braid and the center conductor and add ring terminals for 6-32 screws. Also apply weather proofing. Drill two 9/64 in. holes near the edge of the slot as shown in Figure 4, for attaching the pigtail from the inside of the pipe. Use brass or stainless hardware. Run the coax out the bottom.

If you are using RG58, allow 18 in. extra for a 6 turn 1 in. diameter coax balun inside the pipe. See Figure 4. Mix 61 ferrite beads are also very suitable. I fabricated two small 1/8 x 3/8 x 1 in. aluminum L brackets to route the coax at a right angle from the feed point. The brackets are drilled and tapped for 6-32 threads. Nuts may be used if preferred.

Figure 4: Internal feed point and 6 turn, 1 in. diameter, coax balun

Tuning and Matching

First measure the initial resonant frequency (the tune) and also the SWR (the match), with an antenna analyzer. The frequency will initially be low and the SWR high, in that the slot is 4 in. longer on both ends than needed. To adjust the frequency, short circuit the non-feed end of the slot with a small length of aluminum duct tape. In like matter, short the feed end to adjust the SWR. Note the shorting tapes in Figure 2. Completely cover the unused slot with the shorting tapes. They will vary in length and position as

shown depending on you situation. However, by proceeding in small increments, a good tune and match can always be achieved, but go slowly; the adjustments interact.

Final Considerations

To complete the disguise, paint the completed antenna with a plastic-base paint, such as Krylon Fusion. Alternately it may be covered with matt black self-adhesive vinyl from a local craft store or sign shop. As mentioned above, you may wish to cut the bottom of the pipe for your roof angle, and/or to glue the antenna to a flat sheet for a more permanent mounting. Common RTV silicone sealant will safely attach it to roofing tiles. Happy vent-pipe stealth.

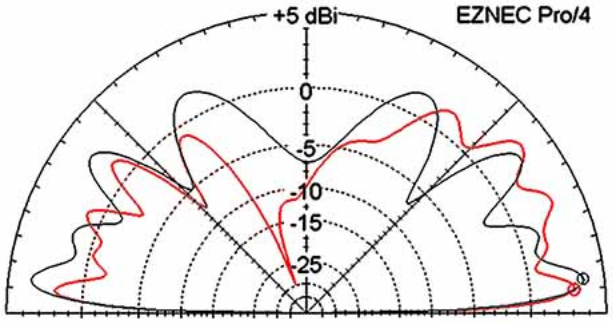

Figure 5: Comparative elevation radiation patterns and gains, Vent Antenna (black), J-pole (red)

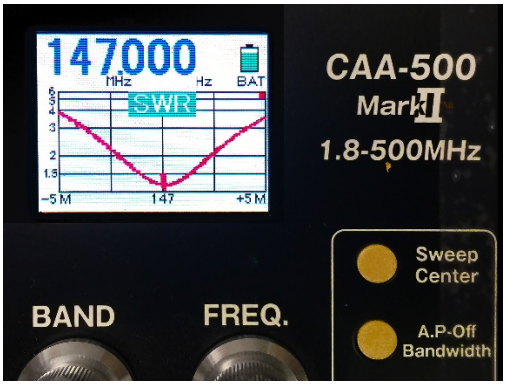

Figure 6: SWR and Bandwidth on a Comet CAA-500 MKII Antenna Analyzer

The author will be pleased to correspond: jportune@aol.com. 519 W Taylor St. unit 111, Santa Maria, CA 93458. (805) 406-6176.)

Abraham Lincoln on 2 Meters

Following Part 1, here again is a staggered horizontal slot antenna, this time as a wearable novelty top-hat antenna with high visibility for hams helping at public events.

By John Portune W6NBC

Arm bands or yellow vests help identify hams helping at parades, bike-a-thons and other public gatherings. This novelty eye-catching taste of showmanship, reminiscent of Abraham Lincoln, goes one step farther. It's a wearable 2m hat antenna, that will also greatly extend your HT's range, Figure 1.

Figure 1: Lincoln-style aluminum stovepipe hat antenna

What ham hasn't imagined a 19 in. 2m whip on top of a metal hard hat just for fun? But this nineteenth-century look-back has no spike whatsoever. In Figure 2, notice the half-wavelength staggered 2m slot antenna.

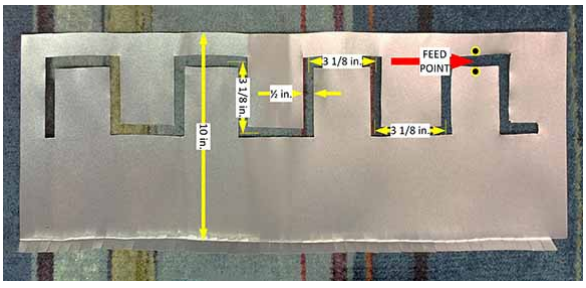

Figure 2: Half wavelength staggered 2m slot antenna cut in aluminum flashing. Bent-over tabs (½ in. x ½ in.) at the bottom attach the stovepipe section to the hat's brim with aluminum duct tape.

Figure 3 shows the coax connection and two horizontal stiffeners, both a sandwich of aluminum sheet and thick corrugated box cardboard glued in with hot glue. On the top stiffener, the aluminum is glued to the outside. The bottom stiffener has all but 1 in. of the cardboard cut out to allow access to the feed point. The aluminum here is not glued to the cardboard, but held in place by two tabs of aluminum tape.

The tape is Scotch 3311 heavy duty, 3.6 mill aluminum duct tape. Other similar brands are available on the internet or at local hardware stores. The bottom of the hat is completely shielded. It provides greater isolation from RF than from an HT with a rubber ducky.

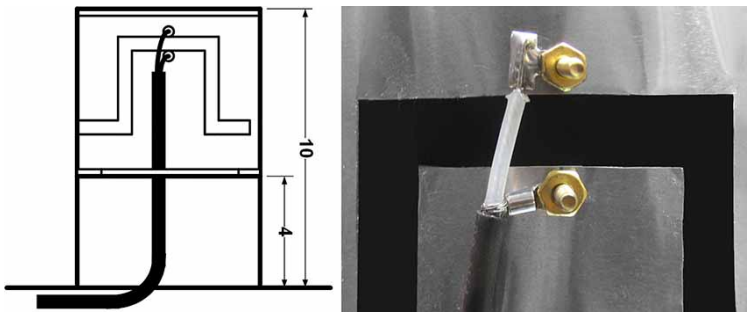

Figure 3: Cross-section, showing cardboard/aluminum stiffeners and coax connection

Perhaps surprising to some, this largely horizontal antenna is vertically polarized.– ideal for special-event simplex or repeater. For a more complete explanation of slot antennas, read the accompanying sidebar. The hat is omnidirectional and has a gain equal to a J-pole.

Constructing the Hat

Stovepipe section, brim and stiffener aluminum are cut from thin (.0078 in.) flashing aluminum found at most local hardware store or roofing suppliers.

It’s a light-weight springy alloy that holds its shape well and can be cut with heavy scissors. I purchased a 10 ft. x 14 in. roll online:

The width of the stovepipe section (not given in Figure 2) depends on your hat size. To determine it, measure around your head and add ½ in. for the overlap of the aluminum plus another ½ in. for an internal soft headband.

For comfort, the opening in the brim and your head shape need to match. If your hat size is less than 7 in., shorten the horizontal portions of the slot a little and lengthen the vertical, keeping the total length of the slot the same. I had my wife photograph me from straight overhead and then transferred the picture to a drafting program (Visio) for scaling to size. I then added the brim, making it 2 in. wider on all sides than my head outline. The drawing became the template for cutting out the brim.

Roll the main hat section into the stovepipe shape, and hold it temporarily in place with masking tape. Fit it to the inside the brim and glue the aluminum overlap with hot glue. Next, using the ½ in. x ½ in. tabs, tape the stovepipe section to the underside of the brim with aluminum duct tape. Then, hot glue in the cardboard/aluminum stiffeners and attach the coax. Figure 3.

Tuning and Matching the Antenna

First measure the initial resonant frequency (the tune) and SWR (the match), with an antenna analyzer. Initially, the frequency will be low, as the total length of the slot is 2½ in. too long on both ends. To adjust the frequency, short the non-feed end of the slot with a sort length of aluminum duct tape, completely covering over the excess slot. To adjust the SWR short the feed end. By proceeding in small increments, a good tune and match are easy to obtain, but go slowly as the setting interact.

Supporting the Slot

Notice that the slot almost entirely separates the top and bottom of the hat. Support is needed. I considered plastic bars and screws, but discovered that heavy clear vinyl tape, also sold at hardware stores, as waterproof

tape, is quite adequate. Apply a strip around the inside across the middle of the vertical sections of the slot. Remove the adhesive in the slots on the outside with solvent.

Final Considerations

As mentioned above, you'll need a soft headband for comfort. My local craft store yielded 1/8 in. foam sheets for two narrow inside strips.

Lastly, I created a decorative sign with Photoshop and cardstock, and coated it with clear spray in case the weather spirits decide to "rain on my parade." The band can be changed, appropriate to the event. The final touch is a decorative wrap of colored electrical tape around the top. "Be artistic!" Remember, this is a fun project for hams who enjoy showmanship.

The author will be pleased to correspond: jportune@aol.com. 519 W Taylor St. unit 111, Santa Maria, CA 93458. (805) 406-6176.)