A 2-METER SLEEVE-DIPOLE ANTENNA

◊ My car (a Geo Tracker) is a small SUV with a convertible top. The only place I could easily attach a standard mobile whip and have metal all around it was on the front hood, a position that had several disadvantages. I considered a cowl-mount antenna bracket, but that would put the antenna adjacent to passengers and require a hole in the car.

While preparing for a public-service event, N9REP showed me a 450-MHz ground-plane antenna he had made from welding rod for base operation. Inspiration struck and I made a similar ground plane antenna on a seven-foot mast strapped to the bicycle rack at the back of the car. The seven-foot mast was necessary to keep the ground radials above the heads of pedestrians but it also it gave me a 15-mile simplex range with my H-T.

While this antenna was good for work as a chase car at bicycle events, it had two disadvantages: I could not open the tailgate or enter a garage when this ungainly contraption was attached to the rear of the car. I pondered my options and studied the various spare parts lying around my garage. My solution is a sleeve dipole attached to the spare-tire mount on the rear of the car.

The sleeve dipole is simply a dipole antenna where one leg is a tube so that the feed line reaches the feed point through the tubular element, instead of at right angles to the elements. The antenna has been previously described as an easily transported portable antenna when made from a piece of coax cable. An amateur base-station version is the AEA Isopole antenna. My finished sleeve dipole is shown in Figure 1.

This sleeve dipole has several features: All parts were obtained at hamfests or a local hardware store. Only common hand tools were used for construction. It requires no vehicle ground plane. It can be easily scaled for other frequencies.

Design and Construction

The key to a sleeve dipole is the feed-point hardware. I used a RadioShack #21-961 feedthrough/adapter. (Let's call it the "feed point" for short.) It is essentially a bulkhead-mount SO-239 with the center conductor connected to a 3/8×24 stud as is common in whip-antenna hardware. The part comes with a lockwasher, a plastic shoulder washer and a 3/8×24 female coupler to secure it. Similar connectors are used with a metal flange to mount mobile antennas on vehicle drip rails, hood and trunk lips. Here, I used the connector to mount the whip and simultaneously connect to the antenna's other leg, a large copper sleeve. The feed point with its lock washer, shoulder washer and coupler are the parts near the end cap in Figure 2.

The ARRL Antenna Book[1] chart shows how much to shorten an antenna based on its slenderness. Considering that this is a whip of approximately 1/8-inch diameter and a sleeve of approximately 2-inch diameter, I chose to use 96% as a compromise. For a frequency of 146 MHz, this yields an element length of 19.4 inches.

For the sleeve, I used a piece of 2-inch copper drain line and a matching copper end cap. Rough cut the sleeve several inches longer than needed for the antenna leg. Drill a 3/8-inch hole in the end cap to fit the feed point (that's 3/8-inch for the 21-961), then solder the end cap to the pipe.

Look closely at your feed point. Where does the path of the center and shield conductors diverge? That is the actual feed point of the antenna and the point from which the antenna-leg lengths are measured. Depending on the feed point you use, the point to measure from may be near the center of the cap, or could be an inch above that. The 21-961 makes the connection at the top surface of the copper pipe cap. Measure the sleeve length from the feed point, across the end cap, then along the length of the pipe to 19.4 inches and cut the sleeve to length. Drill a clearance hole for a sheet-metal screw (builder's choice; mine is #8×1/2-inch) about 1/4-inch back from where the sleeve was just cut.

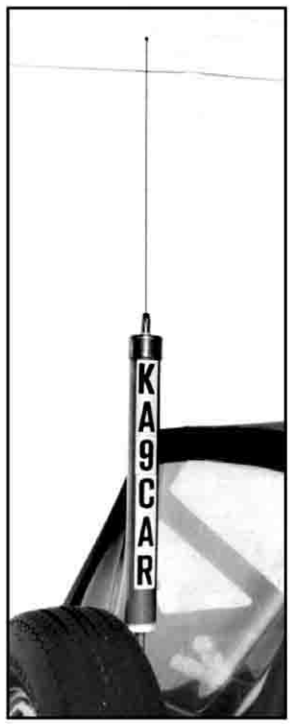

Figure 1—KA9CAR's sleeve dipole mounted on his vehicle.

A piece of 1/2-inch EMT (electrical conduit) has approximately the same outside diameter as the sleeve of a PL-259 connector. In my case, the EMT serves as a mast, extending from the feed point to where I mounted the antenna on my vehicle's spare-tire carrier. The mast length varies among installations. An EMT coupler at the top of the mast holds the PL-259 that attaches to the feed point. Secure the coupling to the mast's upper end.

A bushing centers the copper sleeve on the mast; it also serves as an insulator between them. In the plastic-pipe section of the hardware store, I found a coupling for 1 1/4-inch plastic pipe to be a good fit inside the 2-inch copper pipe. A plastic bushing (reducer) that adapts 1 1/4 to 1/2-inch threaded pipe fits over the mast after a little work with a

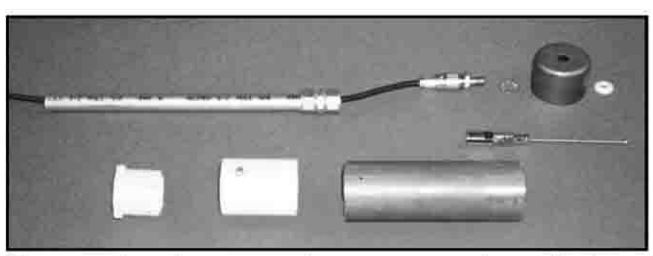

Figure 2—Sample parts used to construct a sleeve dipole.

[1]Dean Straw, N6BV, Ed., *The ARRL Antenna Book* (Newington: ARRL, 2000) Order No 8047, $30. ARRL publications are available from your local ARRL dealer or directly from the ARRL. See the ARRL Publications ad elsewhere in this issue or check out the full ARRL publications line at **www.arrl.org/shop/**.

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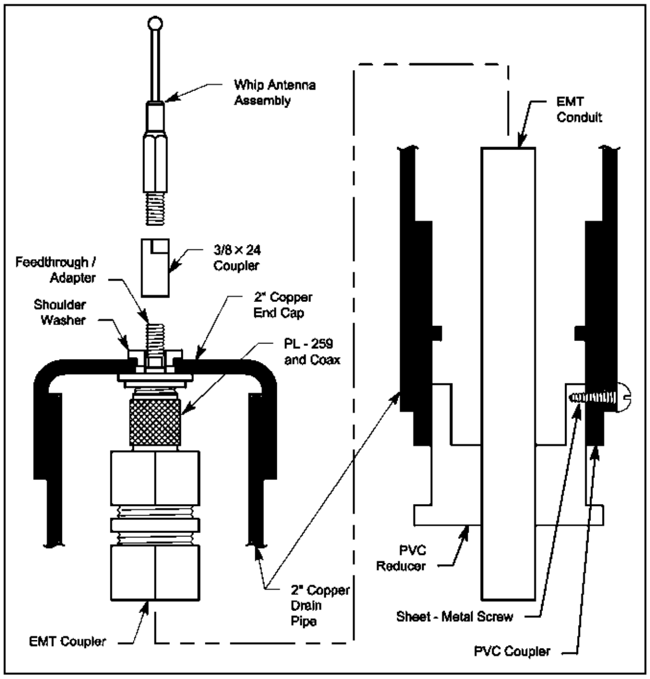

Figure 3—Construction details of the KA9CAR sleeve dipole.

rattail file. Temporarily slide the coupler-bushing assembly into the copper sleeve and drill a pilot hole for the sheet-metal screw.

Place the bushing on the mast, run the coax up the center of the mast, through the EMT coupler and then attach the PL-259. Secure the PL-259 to the feed point, then slip the PL-259 back inside the EMT coupler and tighten the coupler onto the connector sleeve. Now place the lock washer on the feed point, slip the copper sleeve over it, place the insulating washer and tighten down the nut. Be careful that the shoulder washer remains in place. Details of this assembly are shown in Figure 3.

Position the plastic parts in the copper sleeve to align the holes drilled previously and secure them with a small sheet-metal screw. Be sure that you don't short the sleeve to the mast with this screw.

Attach a whip to the feed point. Remember to measure and set the 19.4-inch whip length from the same point you measured the sleeve.

Matching

A dipole is a theoretically 72-Ω device. Most amateur transceivers are 50-Ω devices. I considered three ways to deal with this mismatch:

1. Use 75-Ω line for a good match to the antenna and tolerate a mismatch at the radio.
2. Use 50-Ω feed line cut to a length that a Smith chart shows should be a reasonable match.
3. Use a random length of 50-Ω feed line and see how well it matches.

I chose option three. Using a friend's VHF analyzer to check the match, I found the SWR to be 1.7:1 across the 2-meter band. This won't hurt the transmitter, and the feed-line length is short enough that additional losses resulting from the SWR are not important. You should use a method that you like.

Mounting to the Vehicle

On my SUV, there is enough room to attach the mast to the spare-tire mount between the tire and the tailgate. On some other vehicles, one might simply attach the mast to the spare-tire rack with hose clamps. On a car with a plastic body, one might devise a way to mount the mast to the frame or a trailer hitch. For fixed or portable operation, this antenna can be attached to a wood or metal balcony railing. Whether operating mobile or fixed, you should be sure that it is mounted so that it does not physically and electrically endanger people or risk contact with electric lines.

Results

Standing on the front porch with my H-T, communication through a repeater 12 miles away is marginal. When using this antenna held over my head, I received Q5 reports. Reports from the car using the mobile radio indicate that this antenna meets my needs well.—*John Dewey, KA9CAR, 37 Faringdon Dr, Crystal Lake, IL 60014-7811;* **ka9car@arrl.net**

A 2-METER MEMORY PLAN

◊ If you have a 2-meter or dual-band transceiver with at least 100 programmable memory channels and you live in an area that uses 20-kHz repeater frequency spacing, there is an easy way to quickly access nearly every repeater pair in your part of the 2-meter world.

The repeater output frequencies in the 145.110 to 145.490-MHz segment of the band all have odd digits in the 10-kHz position. Therefore, they can be programmed into the odd numbered memory channels from 11 through 49.

The output frequencies for the 145.620 to 146.980-MHz segment all have even digits in the 10-kHz position. These repeater pairs can be programmed into the even numbered channels from 62 through 98.

The 147.020 to 147.380-MHz repeater output frequencies have even 10-kHz digits, and they fit neatly into the even memory channels from 2 through 38. The 147.000 output can occupy channel 100.

This pattern allows you to access each repeater by selecting the memory channel corresponding to its 100 and 10-kHz digits. For example, the 146.900 repeater is in channel 90, the 145.150 repeater is in channel 15, and the 147.140 repeater is in channel 14. Not only that, there are still left over channels for your favorite simplex frequencies (including channel 52 for the 146.520-MHz national calling frequency) and the few repeaters that may not fit the pattern.

Since my mobile radio (Kenwood TM-V7A) has an alphanumeric display, I program the CTCSS tone for each repeater into that area of the respective memory channels.

This is not a very technical hint, but it surely does make finding a repeater easy. It also allows me to use the memory scan and individual channel lock-out for listening to only selected repeater frequencies, rather than scanning a whole band segment on the VFO.—*Rick Melcer, N5KAO, 1103 S China St, Brady, TX 76825-6139;* **n5kao@arrl.net**

ELIMINATE PL-259 HASSLE

◊ I recommend taping the PL-259 coupler sleeves to the coax when installing UHF connectors at both ends of a piece of cable. This reduces the possibility of one of them falling off during installation.—*Zack Lau, W1VT, ARRL Lab Engineer;* **zlau@arrl.org**

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