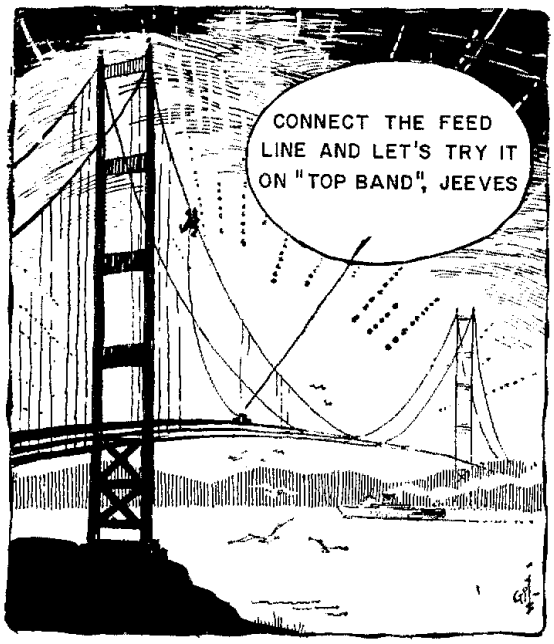
The "K4YF Special" Antenna



Need a compact, broadband antenna for 80 and 160 meters? If size is an overriding consideration, this antenna will provide good performance in a minimum of space.

By John L. Wilson,* K4YF

My 70-ft × 20-ft backyard[1] is far too small to accommodate an 80-meter dipole or ground-plane antenna. Operation on 160 meters appeared entirely beyond consideration. I wanted a good match over the entire 80-meter band, with a low radiation angle to work DX. Early experiments with an inverted L for 80 meters evolved into the present configuration. Only an accident revealed the possibility of using it on the newly expanded 160-meter band.

Construction Details

On 80 meters, the radiator of the K4YF Special is a closed wire rectangle, 60 × 4 feet, fed at a corner by the center conductor of a 52-ohm coaxial cable. The cable shield is connected to two radials. The radiator is supported near its center by a PVC-pipe spreader, mounted at right angles to a 40-foot mast that is bracketed to the side of the house. The radiator forms a narrow inverted V.

Fig. 1 shows the details of my installation. The two end spreaders and the center support are pieces of 3/4-inch PVC pipe. This material is available from most hardware and building supply stores. Holes are drilled 4 feet apart in each end of the spreaders, and the antenna wire is threaded through the holes. The center spreader is 5 feet long, to hold the antenna about a foot away from the house. The 4-foot spacing is not critical, and even a 2-foot spacing gives good bandwidth on 80 meters.

I keep the V tightly closed so that most radiation will be vertically polarized. The use of 1-foot lengths of PVC pipe at the apex to slightly spread the top of the V might be useful. Tie the antenna off at a corner rather than at the center of each end spreader. Otherwise, it will twist "slowly, slowly in the wind."

The Ground System

It would have been desirable to have an extensive system of 1/4-wavelength radials, but that was not feasible. I was surprised to find that something far less involved will work well on 80 meters, and acceptably on 160 meters.

I "made do" with two 70-foot radials. They are not extended in a straight line, as would be preferred; rather, they follow a convenient path around the side of the house and along the fence of my yard. Prior experience taught me that earth grounds using metal stakes are not generally satisfactory for grounding antenna systems. These radials provide a reasonable ground system for the antenna.

The angle between the ground radials and the feed line affects the antenna input impedance. A gentle 30° droop below horizontal produced a matched condition between the feed line and the antenna.

160-Meter Operation

One evening, a temporary splice in the antenna wire broke. Since the antenna would no longer work on 80 meters, I commenced tuning the newly expanded 160-meter band. To my surprise, the antenna was nearly resonant. The radiator was now a 130-foot wire, albeit bent in a peculiar fashion.

Currently, to operate on 160 meters, an spdt relay breaks the rectangle at the corner next to the feed point and adds 20 feet of wire to that end. This resonates the

[1]Notes appear on page 27.

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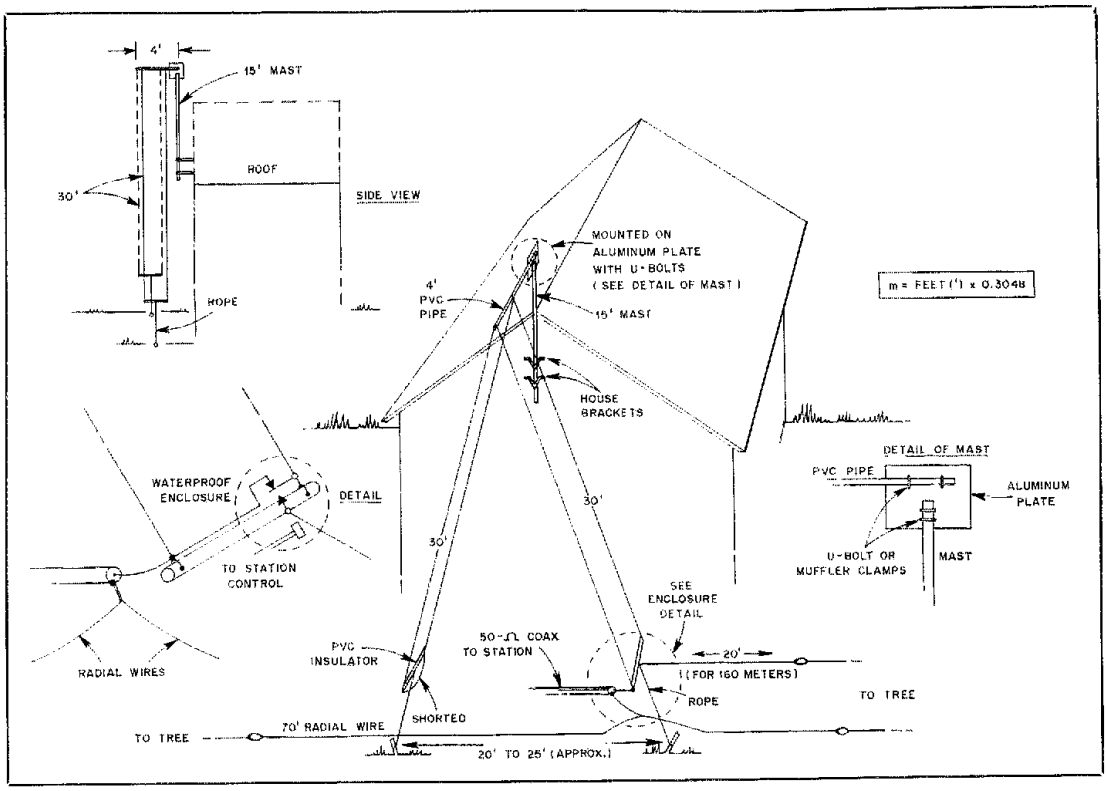

Fig. 1 — Construction and mounting details for the K4YF Special.

system at 1805 kHz. I mounted the relay in a waterproof box fastened to the end spreader.

Tuning the Antenna

I recommend the use of an antenna noise bridge to adjust the length for resonance at your favorite operating frequency on 160 meters. For best results, this also requires the use of an electrical 1/2 wavelength of coaxial cable, inclusive of the velocity factor (approximately 180 feet). A noise bridge permits accurate measurement of the resonant frequency and the impedance of the antenna. When antennas are high and in the clear, textbook formulas and an SWR indicator may suffice; but when the antenna is crowded and the ground system is makeshift, the noise bridge is quite helpful.

On 80 meters, the antenna has a feed-point impedance of approximately 60 ohms at the resonant frequency of 3575 kHz. It has an SWR of less than 2:1 over the entire 3.5- to 4-MHz range. The antenna also has a feed-point impedance near 60 ohms at the resonant frequency on 160 meters (1805 kHz), but the SWR rises rapidly beyond ±40 kHz from that frequency.

Performance

As expected, the antenna exhibits a low radiation angle because of the mostly vertical configuration. The antenna works quite well on 80 meters for paths over 2000 miles.[2] It is not as good as a full-size ground-plane antenna, but seems better than a dipole at 50 feet. Like most verticals, the K4YF Special is noticeably poor for daytime operation. The first time I used the antenna on the 160-meter band, I managed to work stations in Idaho and French Saint Martin. This antenna does not appear to work as well as a 160-meter dipole at 50 feet, or a top-loaded vertical — but then it fits into my yard.

If space and height are not severely limited, the performance of the K4YF Special may be appreciably improved by treating it as a 1/4-λ sloper. This would be easy to construct, puts the current point high above ground, and radiates a maximum signal in the direction of slope.

With a 60-foot tower, the radiator rectangle would slope down from near the top of the tower at a 30° angle with the vertical. No center spreader is needed in this case. The shield of the coaxial cable should be grounded to the tower. The antenna will exhibit broadband characteristics on 80 meters, which distinguishes it from a simple 1/4-λ, ground-plane antenna.

If you break the rectangle at the feed point, this antenna can be used on 40 meters as a full-wave loop. It will have a feed-point impedance of about 200 ohms, and so will require a matching system for use with 52-ohm coaxial cable. This would involve a more complex switching arrangement. Since I have no need for another 40-meter antenna, I did not undertake this work.

If your antenna space is limited, try a K4YF Special. Experiment with different configurations. Perhaps you can improve the performance, but one thing is for certain: It works better than no antenna at all.

Notes

[1]m = ft × 0.3048.
[2]km = mi × 1.6093.