The Horizontal EWE Antenna

The original EWE shepherd goes in a new direction for low noise reception.

Floyd Koontz, WA2WVL

This antenna was designed to solve a major reception problem at this location by maximizing the received signal to noise ratio (SNR) of 75 meter phone signals coming from Europe.

Background

In 1999 I had up a six element switchable vertical array hung from some of the many 100 foot pine trees in my yard. The array appeared to have good directivity but never received the good signal reports I expected. Eventually I put a dipole between trees at 80 feet elevation as a reference antenna. On nearly every contact the dipole was 10 dB better than the 6 element array. Even though the vertical array wires were 20 feet or more from the trees, the trees seemed to be absorbing the signal. In northern locations, the trees drop their sap to the roots in the winter (DX season on the low HF bands) and many stations have good luck with verticals hung from trees. Here in Florida the sap stays up all year round and the trees are quite conductive (and longer than $\lambda/4$ at 75 meters). Vertical polarization simply doesn't seem to work in my yard.

Recently I decided to look at the EWE antenna[1] in a horizontal plane and discovered that it worked very well. With vertical EWEs, a single element has a deep null off the back. A single horizontal EWE, on the other hand, would have that null at 0° elevation instead. Over real ground, the single horizontal EWE has a front to back ratio (F/B) on 75 meters as shown in Figure 1 for 30° elevation. The low angle gain increases with height above ground, as with most horizontal antennas, but the pattern remains nearly the same at 10 to 30 foot heights. The size can be chosen to fit the available space but four supports (trees, towers, house, etc) are needed to hold up the corners.

Of the different sizes and shapes that can be used, one is optimum. It is a square, $\lambda/8$ on a side (a total of $\lambda/2$ around). For this size (30×30 feet for 75 meters), the feed is nonreactive and can be matched with a simple broadband transformer. The calculated feed impedance was 1337 Ω and was matched with a 26:5 two-winding transformer. The F/B was more than 11 dB on 75 meters and 15 dB on 160 meters.

Two Element Design

As noted, a single EWE antenna gives a modified cardioid pattern with a usable, but not dramatic, front to back ratio. The front to side ratio is only about 4 dB so a two element design was established to improve the back and side rejection. Available trees allowed a spacing of 100 feet. Figure 2 shows the layout of this array including the location of the feed points and terminations. Figure 3 is the modeled pattern of the two element array, again at 3.8 MHz and 30° elevation. As is evident, the two element array resulted in a sharpened beamwidth and a significantly improved F/B. While the pattern for 30° elevation is shown, it is similar with lower output at lower elevations.

The antenna was to be 25 feet off the ground. This was determined to be the maximum height that I could safely reach from my 24 foot extension ladder. Vinyl insulated

[1]Notes appear on page 38.

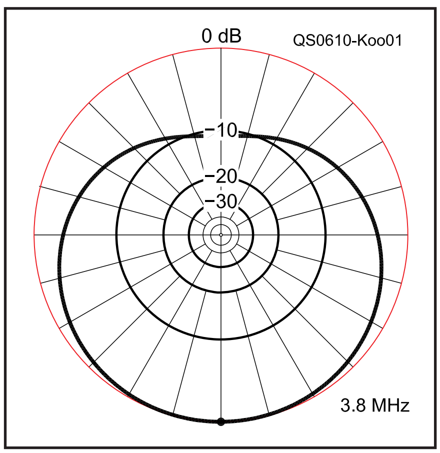

Figure 1 — *EZNEC* modeled pattern of a single element horizontal EWE at 3.8 MHz and 30° elevation.

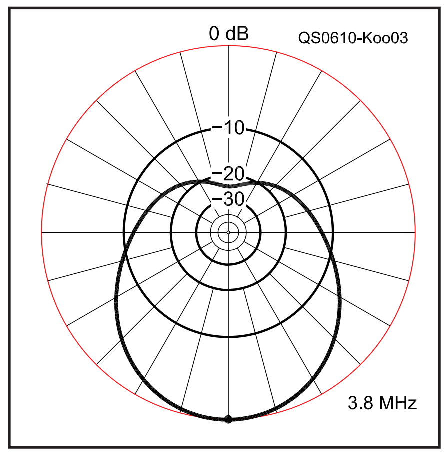

Figure 3 — *EZNEC* modeled pattern of a two element horizontal EWE configured as in Figure 2 at 3.8 MHz and 30° elevation.

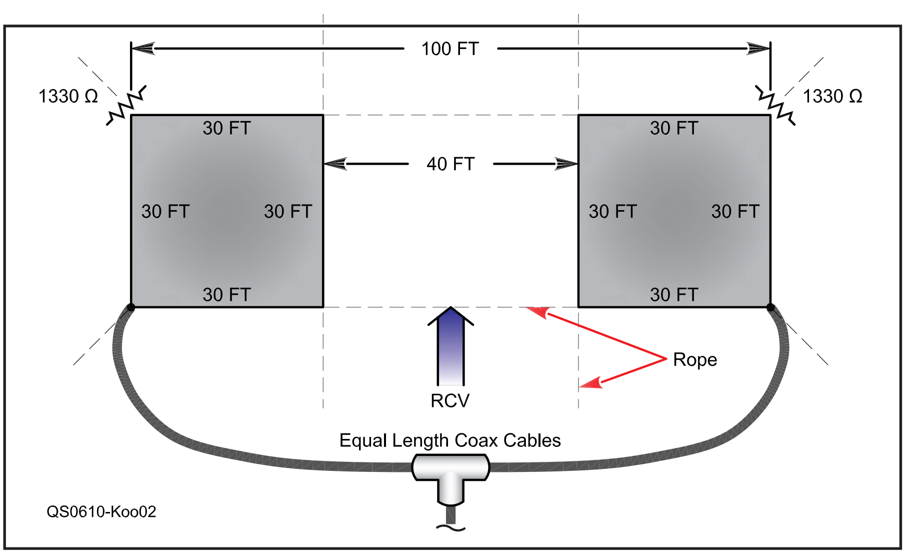

Figure 2 — Orientation of the two element horizontal EWE antenna array.

14 gauge "speaker wire" was used, but any wire strong enough to be pulled tight without stretching could be used.[2] The loops were tied at the corners (every 30 feet) by ⅛ inch Dacron ropes. The knots were taped with black electrical tape to prevent the knots from coming untied. The input matching transformer was mounted on a 2 × 4 × ¼ inch piece of UHMW material.[3] The feed coax (RG-58A/U) was woven through three tight holes vertically in line about ⅝ inch apart to support its weight.

The termination was also mounted on a 2 × 4 × ¼ inch piece of UHMW. Both types of boards had lifting holes at the top for attaching the ropes. After all the soldering was completed, the boards were coated with silicone window sealing except for one of the 50 Ω transformer connections. The two loops must be fed in phase to develop the pattern. I had a 50% chance of getting it right. If I guessed wrong, the pattern would have a 30 dB null off the front and receiving performance would be poor. I was successful the first time and did not have to reverse the connections, so I proceeded to coat these connections as well.

During the assembly process the wire is lying on the ground in the space where it will be pulled up. In my case the SE loop enclosed only one tree while the NW loop has three trees inside the loop. A ladder was placed against the trees to be used for supports and a small hole was drilled in each tree. A screw eye was installed as high as I could reach at each support point. A piece of the ⅛ inch Dacron line was fed through each screw eye and pulled back to ground and tied to another screw eye at 4 feet. After doing this on eight trees, I was now ready to lift the antenna in place without further climbing.

Both feed points had equal length coax cables attached. The length was determined by the location of the ninth tree to which both coax cables would go (I used 100 feet for each run length). I ran the cables overhead at about 12 feet from tree to tree. A BNC T was used to parallel the 100 foot coax cables and the third port connected to the coax that went to the shack.

Antenna Output Level Considerations

The calculated gain of the two element horizontal EWE (at 20°) at 3.8 MHz was about –18 dBi (a λ/4 vertical has a gain of about 0 dBi). For a height of only 10 feet the gain drops to –24 dBi. Most modern receivers and transceivers have sufficient sensitivity so that even at this level there is sufficient gain that the signal to noise ratio is limited by external noise.

If the noise level doesn't increase by at least 10 dB when replacing a dummy load with the receive antenna, you will need to have additional gain to get full benefit from this antenna. In order to directly compare the performance of this antenna to your transmitting antenna, you may want to add gain so that the signal levels are similar and the S-meter moves in the same way. A preamplifier with a gain of 18 to 25 dB should be just what you want for 80 meters, more if you use the antenna on 160.

A suitable amplifier for 160 meters was included with a recent antenna article.[4] A dual band amplifier was also published in an earlier issue of *QST*.[5] Gary Nichols, KD9SV, has assembled preamps for either 160 meters or 160 and 80 meters available through Radio-Ware.[6,7]

It also might be that switching your receiver's preamp on provides just the amount of gain required to bring the signal level up to that from your transmitting antenna, and that is a suitable way to equalize the gain. Whatever preamp option you take, make sure that the preamp is protected from pick up of RF from your transmitting antenna. In many cases, the receive antenna will bring it directly into the preamp, if provisions aren't made to the contrary.

Operation with this system has been gratifying with the SNR often being improved by 10 to 20 dB on 75 meters compared to my reference antenna. On 160 meters, many SSB stations can now be copied that were below the noise before.

Notes

[1] F. Koontz, WA2WVL, "Is This EWE For You?" *QST*, Feb 1995, pp 31-33, and "More EWEs For You," *QST*, Jan 1996, pp 32-34. Available on **www.arrl.org**. The antenna gets its name from its resemblance to an inverted U.

[2] "Speaker wire" is available from Home Depot in 250 foot lengths.

[3] Ultra High Molecular Weight (UHMW) Polyethylene is available from plastics suppliers for less than $15 per square foot.

[4] D. Stroud, W9SR, "An Effective Receiving Loop," *QST*, Jun 2006, pp 35-38.

[5] D. DeMaw, W1FB (SK), "A Preamplifier for 80- and 160-Meter Loop and Beverage Antennas," *QST,* Aug 1988, pp 22-24.

[6] G. Nichols, KD9SV, "A Variable Gain 160-Meter Preamp," *Ham Radio*, Oct 1989, pp 46-48.

[7] Click **KD9SV Preamps** at **www.radio-ware.com**.

Floyd Koontz, WA2WVL, is a retired electrical engineer with 40 years' experience designing communications systems, radio transmitters and antennas. He was first licensed in 1955 as WN9JQA and has been WA2WVL since 1961 He has written numerous QST *articles about antennas over the years. An ARRL life member, he can be reached at 8430 W Park Springs Pl, Homosassa, FL 34448, or* **wa2wvl@tampabay.rr.com**.

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