A Wire Antenna Combination for DX

KTØNY takes two vintage flat-tops with tuned feeders, adds a wire Yagi and gets DX performance suitable for the 21st century. Will it work at your location?

Tony Estep, KTØNY

Many hams are faced with cold realities that force a compromise antenna installation. This article is dedicated to amateurs who are in that situation, but still want to be competitive in DX pileups. It describes one amateur's approach to a low-visibility antenna setup that covers a lot of directions, gives acceptable gain, and works on a wide range of frequencies. As you'll see, my scheme involves switching among three inconspicuous antennas. Two are combined into an "over-and-under" two-radiator long wire-dipole combination and the third is a Yagi that lies flat on the roof.

In my neighborhood, a tower is out of the question. Even an end-fed vertical won't do, since there's no way to have a radial system in my yard. Fortunately, however, antenna supports in the form of trees are conveniently provided. Looking at the two trees that are close enough to my shack, I tried to sketch out something that would give me a chance of a reasonable signal to DX locations. I wanted to get decent performance in as many directions as possible, with a low-visibility installation. Moreover, I want to work all bands from 80 to 10 meters.

I could readily see how I could put up at least one pretty good wire antenna between trees, but it appeared that my geographical coverage would be limited. The wire would run North-South, so I'd be shooting a good signal to Africa and Australia, but Europe would be 45° off of the perpendicular, and Asia would be right off the end of the wire. I didn't want an antenna that would give good gain in one or two directions while leaving the rest of the world unreachable. After scratching my head over this dilemma, I invested in Roy Lewallen's *EZNEC*[1] antenna analysis software. The $89 was some of the best money I've ever spent in ham radio.

The KTØNY Solution

I started with the most obvious choice, a center fed dipole running from the north tree to the south tree. I chose a length of 56 feet, equal to an extended double Zepp on 15 meters. This antenna gives a figure-8 pattern pointing East and West. Its 20 meter pattern is shown in Figure 1.

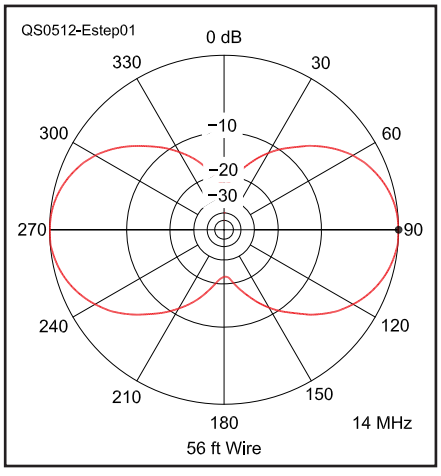

Figure 1—20 meter pattern of a 56 foot wire, oriented N/S and center-fed, at 40 feet; the low-angle radiation is E/W. (Important note: All patterns shown are for 8° take-off angle.) The length is chosen because this forms an extended double Zepp on 15 meters. This dipole will give limited directional coverage at low angles on 40, 30, 20, 17 and 15 meters.

Some tinkering with *EZNEC* gave me an idea for a way to supplement this pattern. Consider Figure 2. But the two antennas can't occupy the same space—or can they? I quickly concluded that they could. I sketched out the arrangement shown in Figure 3.

Both antennas are fed with tuned feeders. Figure 4 shows the support details. At first I brought the feeders into the shack and tuned them with a balanced tuner. At present, the lines lead to 4:1 current baluns right outside the shack window; a 6 foot length of coax brings them in to a standard unbalanced tuner. Both systems work, but I prefer having only coax inside the shack. My Ten-Tec 238A antenna tuner has a convenient antenna switch that lets me select my directional pattern—the poor man's rotator!

The idea is that I can switch back and forth between antennas, so that one of the major radiation lobes will be pointed (more or less) at the DX I'm trying to work. When you put the two patterns together, the coverage is as shown in Figure 5.

This looks good. The gain is a little higher to SE and SW than to NE and NW, which is the opposite of what I would like, but that's an unavoidable consequence of feeding the longwire 13½ feet from the north end. Of course, at your station the wires may have to run in a different direction. No matter. You should be able to cover many compass points, however your house and lot might be oriented.

The story is not quite as favorable as Figure 5 depicts, however. Using *EZNEC*, I modeled the actual shape of the system, including the droop in the center, the effects of transmission lines in the radiation field, and the interaction between the two antennas. These effects reduce the gain somewhat.

This is unfortunate, but can't be helped. Figures 6 and 7 give a realistic appraisal of

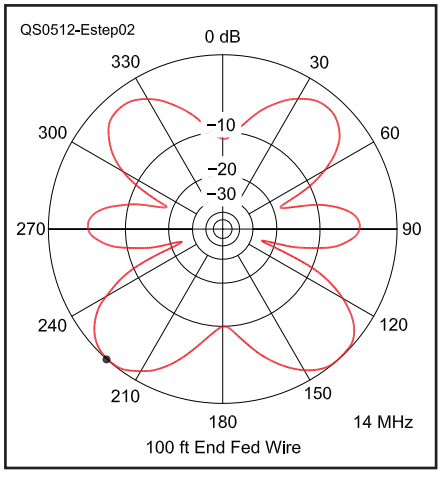

Figure 2—20 meter pattern of a 100 foot N/S oriented long wire, fed 13% from the north end, at 40 feet. This gives coverage that nicely complements that of the center-fed dipole.

[1] *EZNEC* software available from **www.eznec.com**.

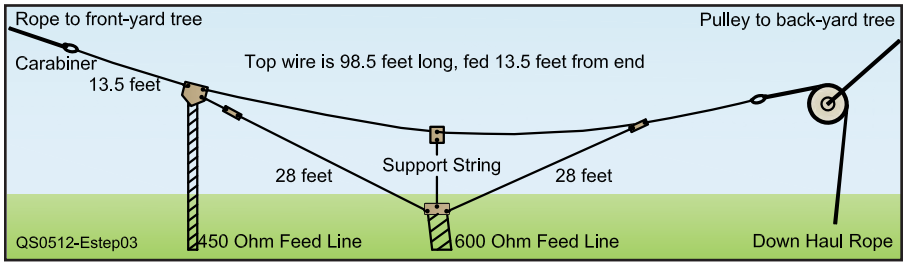

Figure 3—As constructed, the KTØNY "over-and-under" antenna consists of an off-center-fed 98.5 foot wire with a 56 foot center-fed dipole hanging below it. The ends are at about 42 feet, the low point (at the center of the dipole) is at about 32 feet.

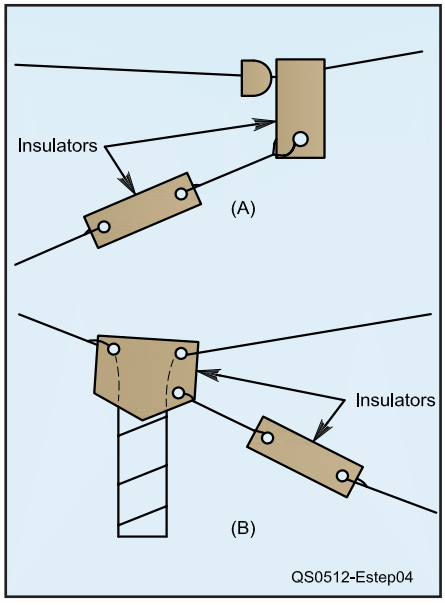

Figure 4—Details of the fittings for hanging the dipole below the long wire. Parts are made of ⅜ inch thick Delrin. At (A) right end support, at (B) left end support.

the gain achieved. Very roughly speaking, on both 20 and 15 meters, the gain of the antenna system in the direction of its favored lobes is almost as good as that of a 2 element Yagi at 25 feet as shown in Figure 8.

Due North

The composite pattern figures reveal that the antenna so far puts little signal directly north. This bugged me, because some truly juicy DX (4S7, XW, XX9, and others) lie right in that northerly null. So I hit on a desperate idea for one last DX antenna. It is good for only one direction, on one band, but on the plus side it is almost completely invisible.

I built a single-band, single-direction wire Yagi, for 20 meters only, consisting of two wires lying right on the roof. They are about 20 feet above the ground, one on either side of the peak of the roof (in other words, the interaction between the elements takes place through the roof). Because the feed line has to exit to the south, I had to use a driven element/director combination, which is not as good as a driven element plus reflector. But it does work, and the resulting 20 meter pattern is shown in Figure 9.

A little experimentation with *EZNEC* will reveal that the pattern and gain deteriorate rapidly as you go above the optimal frequency. Therefore, the best setup is to tune the antenna for the high end of the 20 meter band. The SWR and gain will be acceptable across the whole band. I discovered that there are some tricks involved in actually constructing this antenna. After some trial and error, I found a simple procedure that worked well. (It will be much easier if you have an antenna analyzer.)

Make the two elements as shown in Figure 10, and cut them a bit oversize (note that dimensions are for insulated 14 gauge wire). Take them up to the roof, along with a short length of coax and your analyzer. Lay out the driven element, hook it to the analyzer, and find the frequency at which it displays lowest SWR. Trim it until the lowest SWR is at 14.300, even if you plan to operate mostly CW.

Now lay out the director right next to the driven element, and cut it to be 15 inches shorter. Then install it 13½ feet in front of the driven element. You now have a full-size, wide-spaced 20 meter Yagi.

The SWR curve will probably be pretty flat across the band. The *EZNEC* modeled curve has a fairly pronounced dip, so the "improvement" is due to losses caused by proximity to stuff in the near field. If you're going to put the antenna right on the roof, this can't be avoided. Coupling to the household wiring is a bad thing, of course, and the more you can elevate the wire Yagi, the better it is likely to perform. But low and lossy as it is, mine gives a boost of up to 10 dB over my long wire on signals coming from due north.

DX Results

The total setup is unobtrusive. Few notice it. From the viewpoint of the neighbors, all that is really visible is some window line running up into the front yard tree. The rooftop

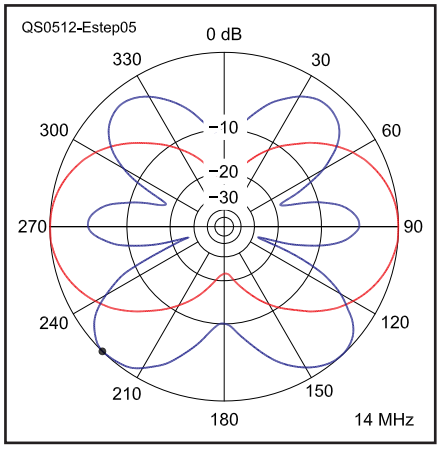

Figure 5—Total coverage of theoretical wire combination on 20 meters. Patterns on 15, 17 and 30 meters have generally similar shape.

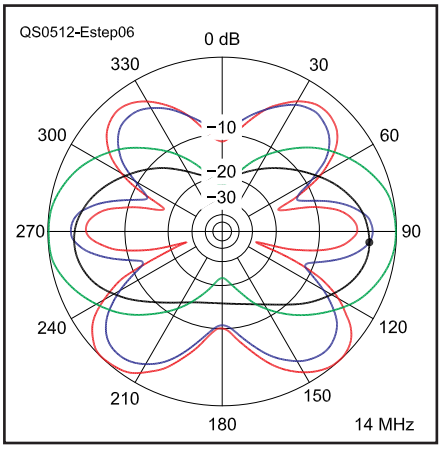

Figure 6—Ideal 20 meter patterns (green, red) and predicted pattern (black, blue) superimposed. The droop in the middle and the effect of interactions degrade the results, especially for the center-fed dipole.

Yagi is almost impossible to see.

And, yes, it does work DX. After a long period of inactivity, I put up my first version of this antenna and became active in February 2004. In the ensuing 12 months, operating after work in the evenings, usually with limited power, I've worked 251 countries. I have snagged DXCC on phone, cw and digital, and I just completed DXCC on QRP. My wires have propelled my signal through the pileups on just about every DXpedition that has been on since I've been active. And best of all, I have managed that most elusive of my personal goals, WAZ.

The complete configuration is shown in Figure 11. There are limitations and frustrations, of course, but they are a lot less than I expected when I first contemplated a wire antenna. I hope that this article contains some ideas that may be helpful to others in similar situations.

Tony Estep, KTØNY, was first licensed in

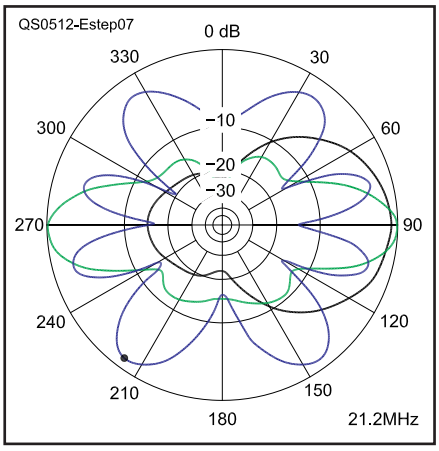

Figure 7—On 15 meters, the radiation in favored directions is roughly comparable to a 2 element Yagi (black) at 25 feet.

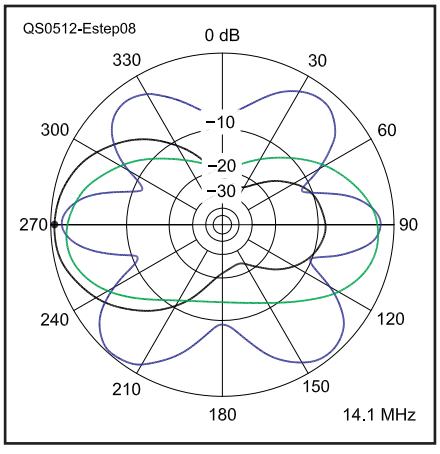

Figure 8—On 20 meters, the best gain is again similar to a low 2 element Yagi. It doesn't have much gain over a dipole, but covers more territory. On 40 and 80 meters, coverage is essentially omnidirectional. On 12 and 10 meters, it's mainly NE/SW and NW/SE.

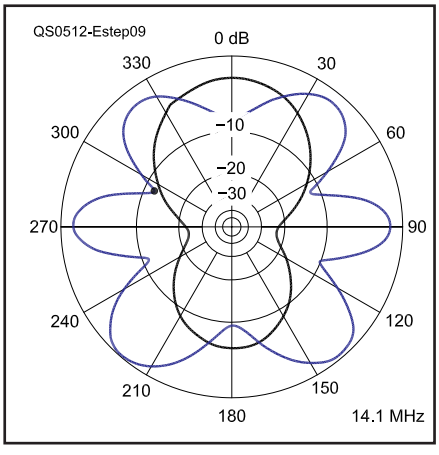

Figure 9—The wire Yagi on the roof works only on 20 meters, and only in one direction (black), but it fills in the null left by the other antennas, in the direction of the DX I need most! For construction, see Figure 10.

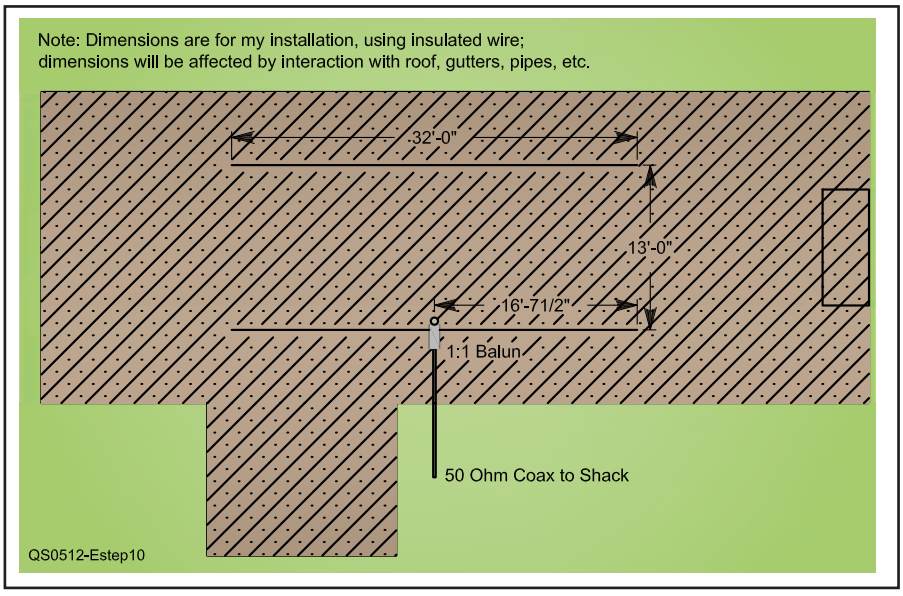

Figure 10—Two wires lying right on the roof, and running E/W at a height of 22 feet, form a fixed, single-band Yagi. The southern wire is the driven element, and the northern one is a director. To build it, make a balun-fed dipole resonant at the high end of the band, then add a director 15 inches shorter as shown. Dimensions shown are for PVC insulated wire.

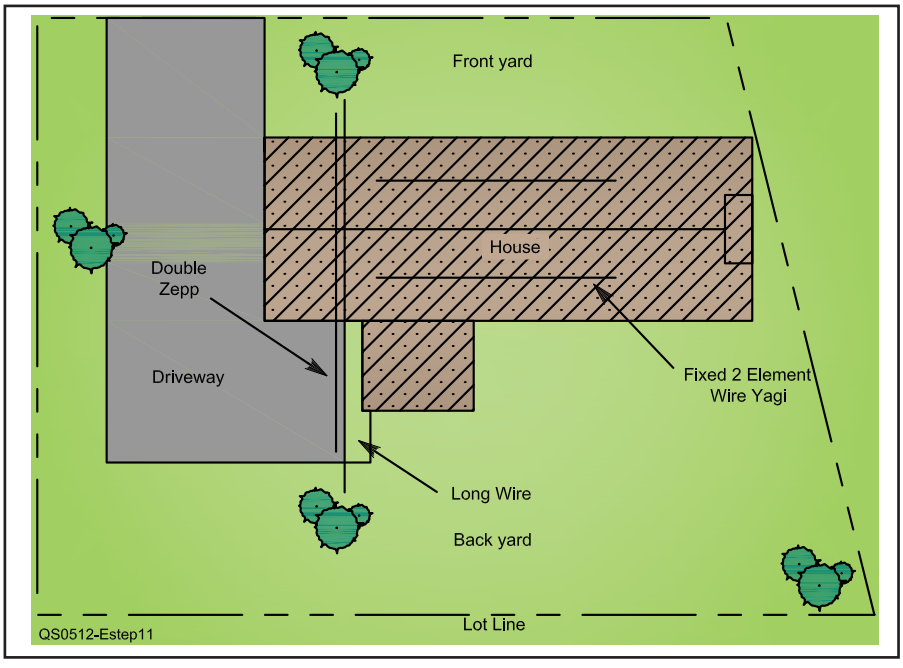

Figure 11—My house and yard are in a typical suburban configuration with neighbors on both sides. Still, I wound up with an antenna installation that performs well, without creating any neighborhood strife.

St Louis, Missouri in 1957 as KNØLTB at age 17. The sunspots were going crazy at the time, very different from today's conditions. Tony managed to complete his DXCC as a Novice with a Hallicrafters SX-96 receiver and a home-brew transmitter.

He later moved to London, where he held the call G5ANZ. When he returned to St Louis, he got his Amateur Extra class license, set up a shack, and after various tries with wire antennas eventually evolved the antenna scheme described in this article. It has accounted for WAZ, DXCC with QRP, and a lot of fun.

Tony holds a BA degree from Washington University and recently retired from a 43 year career on Wall Street, most recently as Managing Director of Bank of America Capital Management. While Tony is the author of many publications in the field of finance, this is his first in Amateur Radio. Tony can be reached at 541 Hickory Ln, St Louis, MO 63131 or **kt0ny@arrl.net**. QST