K8UR shows us how to modify* a *sloping dipole to make* an *effective contest antenna.

The K8UR Low-Band Vertical Array

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For many years DXers and contesters have been trying all sorts of antennas to get an edge on their competition. On the low bands most antennas have been made of wire. Dxers have tried sloping dipoles, delta loops, quad loops, vertical arrays, and everything else that would load up. The 1/4 -wave vertical has always been popular, but it requires an adequate ground screen. Ground planes reduce the ground-screen requirement, but both usually require a dedicated radiator support, usually made of expensive aluminum tubing.

What I have found to be a very effective alternative to a self-supporting vertical is a "vertical dipole" that is suspended from a tower. Efficiency has been excellent without the use of ground radials, and it is a true vertical radiator without exhibiting any high-angle component. The feed impedance is an easy-to-match, nominal 55 ohms. Four can be positioned around a supporting tower structure and phased to provide directivity in four directions at the flip of a switch.

The K8UR vertical antenna started out looking like a half-wave sloping dipole. For years on 75 meters I had successfully used four of these antennas hung from a120 foot tower in four directions. The sloping dipole does work well as a DX antenna, but it is only marginal in its ability to provide a suitable front/back ratio, and it does exhibit a high-angle component as well as low-angle radiation.

Fig. 1 is the old tried-and-true sloping-dipole pattern that results from hanging a half-wave sloper from a 120 foot tower at an angle from vertical of 30 degrees. Frequency here is 3.8 MHz. Notice how the high-angle radiation is only a couple of dB down from the low-angle peak radiation and that radiation off the back is down roughly 8-1 0 dB providing some FIB. Fig. 2 is a physical side view of this antenna.

A simple modification of the sloper results in a cancellation of most high-angle components. This modification only requires the folding back of the bottom half of the sloper, back toward the tower (see

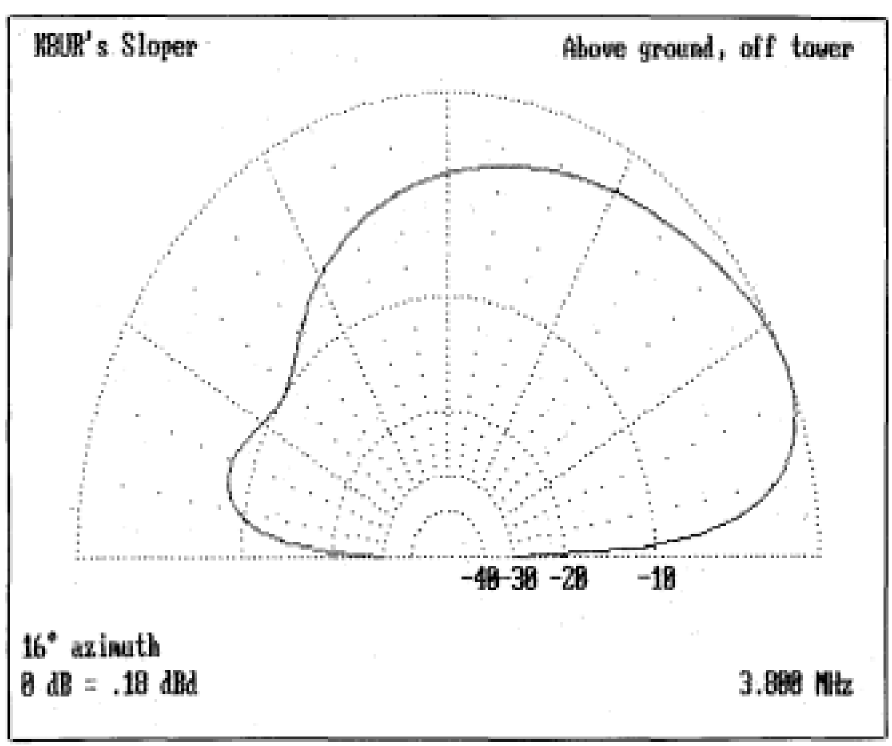

Fig. 1- *Sloping dipole polar plot of radiation angle with* 120 *foot tower support.*

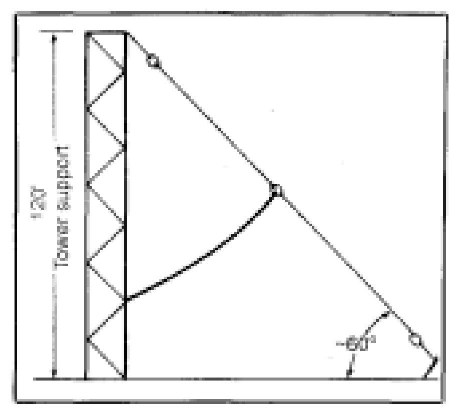

Fig. 2- *The sloping dipole side view with tower support.*

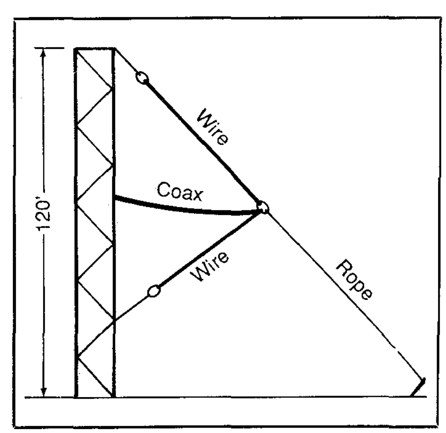

Fig. 3- *K8UR vertical (modified sloping dipole), side view. (Note: Support can be 80 to* 90 *feet tall for* 75 *meters.)*

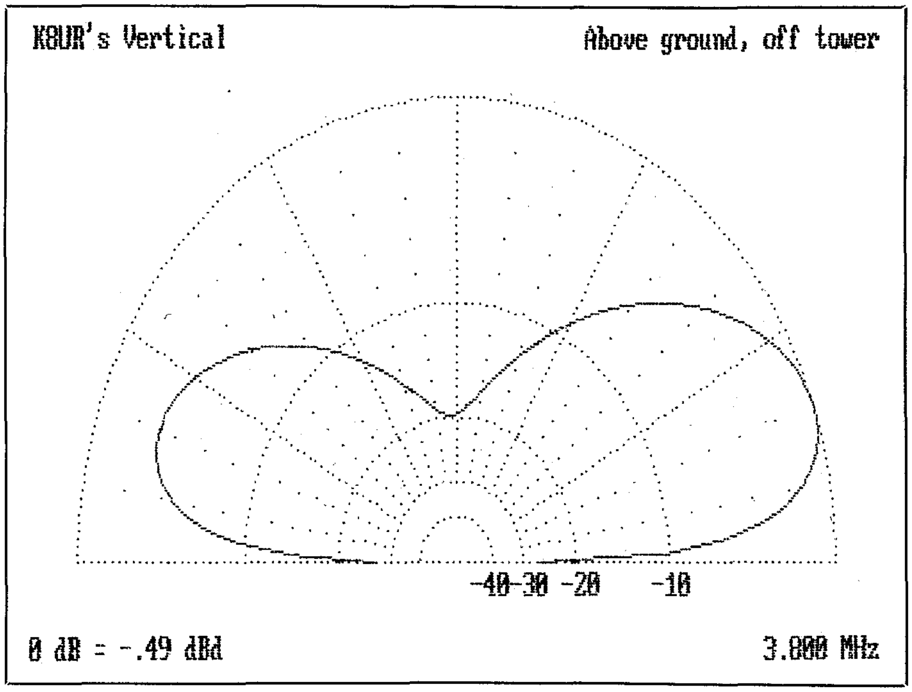

Fig. 4- K8UR vertical polar plot of radiation angle with 120 foot tower.

fig. 3). By folding back the bottom half of the sloper, you have essentially cancelled the horizontal components which fall in line with the plane formed by the antenna halves and therefore 'eliminated most of the high-angle radiation. Fig. 4 shows this is confirmed by the MININEC computer program. The vertical pattern can be made to be omni-directional, as a standard vertical, by making the supporting tower not resonant in the band of interest. The pattern shown in fig. 4 includes the effects of a 120 foot tower, and therefore has a slightly directional characteristic. This can be eliminated.

The instantaneous current vectors for this new antenna are shown in fig. 5. It can be seen that the vertical components add while the horizontal components are cancelled.

When the K8UR vertical is compared to a ground plane with four 1/4-wavelength radials .06 wavelengths (15 feet on 75 meters) above ground, there is little difference (see fig. 6). Low-angle radiation is identical. High-angle is cancelled

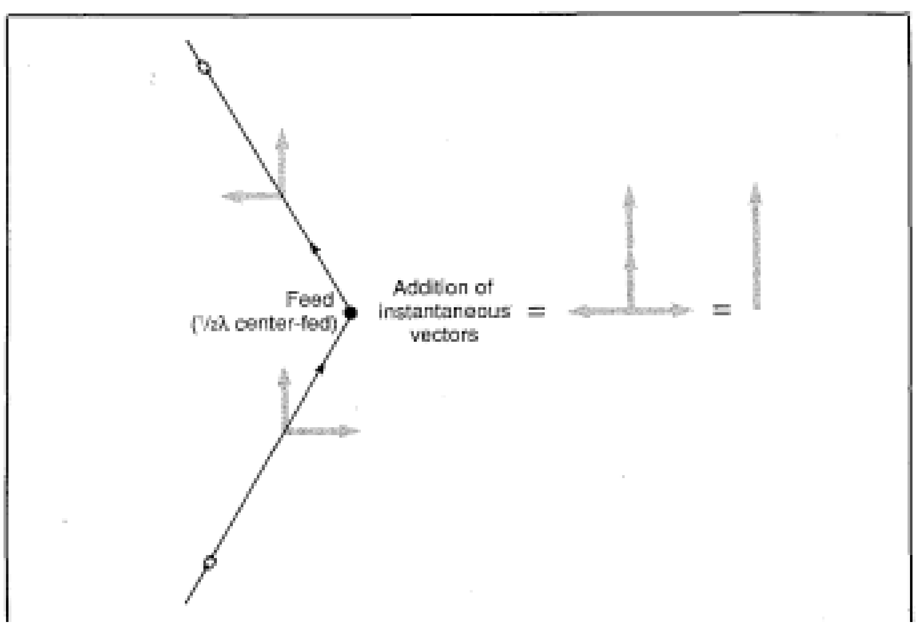

Fig. 5- Current vectors for K8UR vertical showing vertical addition and horizontal cancellation.

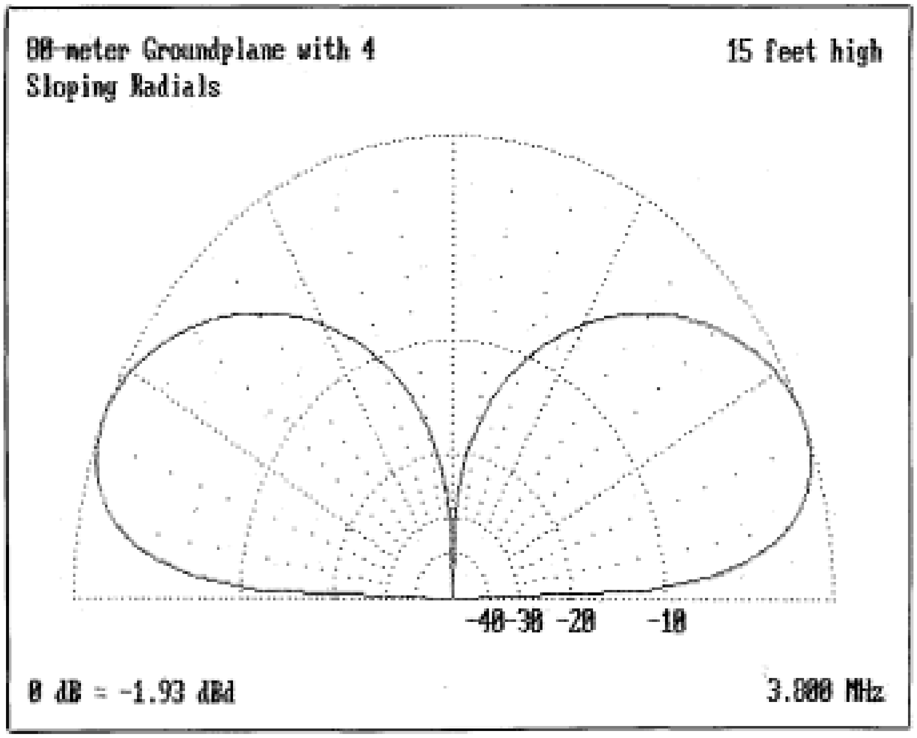

Fig. 6- *Groundplane with four radials,* .06 *wavelength above ground at base. Polar plot of radiation angle.*

slightly better with the ground plane, but at mid-high angles (60°-80°), the K8UR vertical shows a lesser response to high angles. You can also hang four of these around a single tower structure and phase all of them as a four-square array. I have been using this arrangement on 75 meters with a ComTek ACB-4 Phased Array Switch for some years now with good results.

Fig. 7 shows how the four-square arrangement is set up around a single tower. The ComTek ACB-4 phased-array switchbox provides all the necessary phasing, switching, and control functions required for a four-square array. Fig. 8

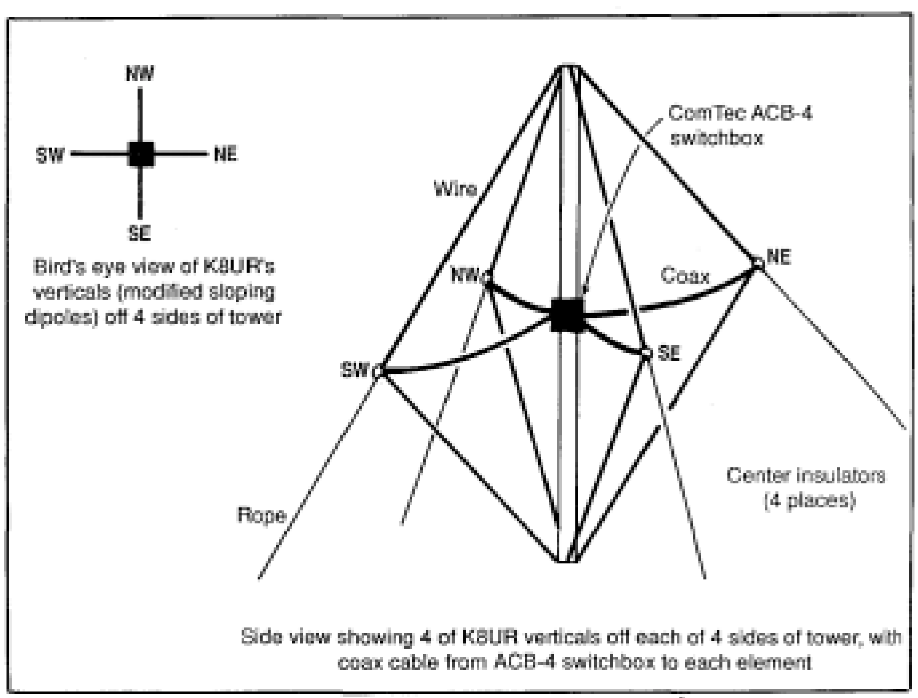

Fig. 7- *Four-square setup using K8UR verticals.*

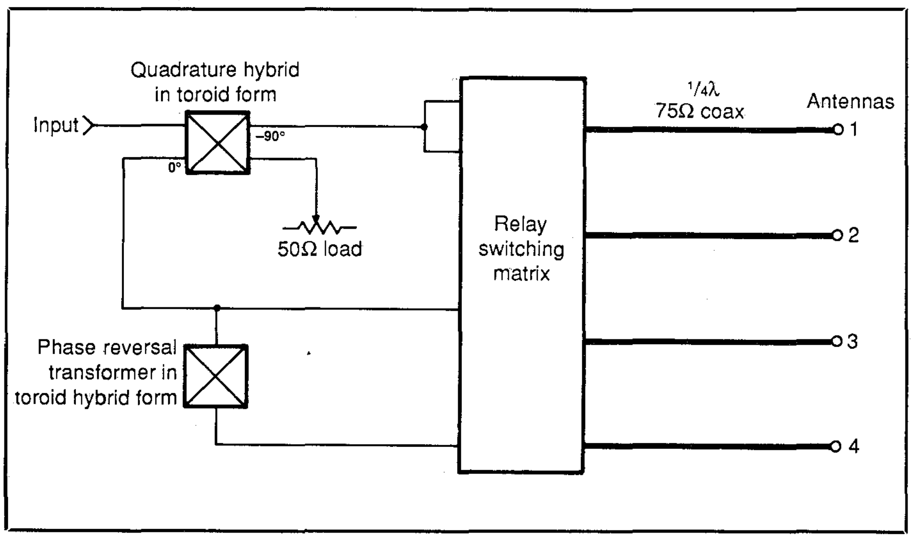

Fig. 8- *ComTek ACB-4 phased array switch schematic. (Note: ACB-4 can be used for 4-element* 4 *squares or 2-element phased arrays.)*

shows schematically the requirements to build the phasing/switchbox for a four-square array yourself. The four-square array gives added directivity and gain (approximately 6 dB gain and 15-25 dB F/B) and fires across the diagonals of the square. By using four of the K8UR vertical antennas spaced equally around a supporting tower, it works out that the spacings required for a four-square are a freebee. The distance from center insulator to adjacent center insulator is 1/4 wavelength! The problems normally associated with mutuals between elements are less because of the relative angle between each element of this array.

These arrays are now In use on 160, 80, 40, and 20 meters. They compete well against other antennas, stay up longer, cost less and are probably better on receive for DX contests where you need discrimination against high-angle signals on the low bands.

There is no best antenna, but I have described one which I have found well worth putting in my arsenal, and I hope you will, too. See you in the pileups !

References

1. D. Mitchell, K8UR, "Antenna Engineer," 73 *Magazine,* May 1980.
2. D. Mitchell, K8UR, "HP67/97 Plots Antenna Polar Pattern," *Electronics Magazine,* Sept. 3, 1979.
3. Atchley, et al, "3600 Steerable Array Technology," *QST,* Aug. 1978.
4. "Updating Phased Array Technology," *QST,* Aug. 1983.
5. Forrest Gherke, K2BT, "Phased Arrays," Parts I-VI, *Ham Radio,* May, etc.,1983.
6. John Oevoldere, ON4UN, "Low Band DXing," ARRL Publication.

Editor's Note

The author, K8UR, is the manufacturer of the ComTek ACB-4 phased array switch. You can contact him for more information on the switch.