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HOMING IN

Radio Direction Finding

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Let's Build a Quad

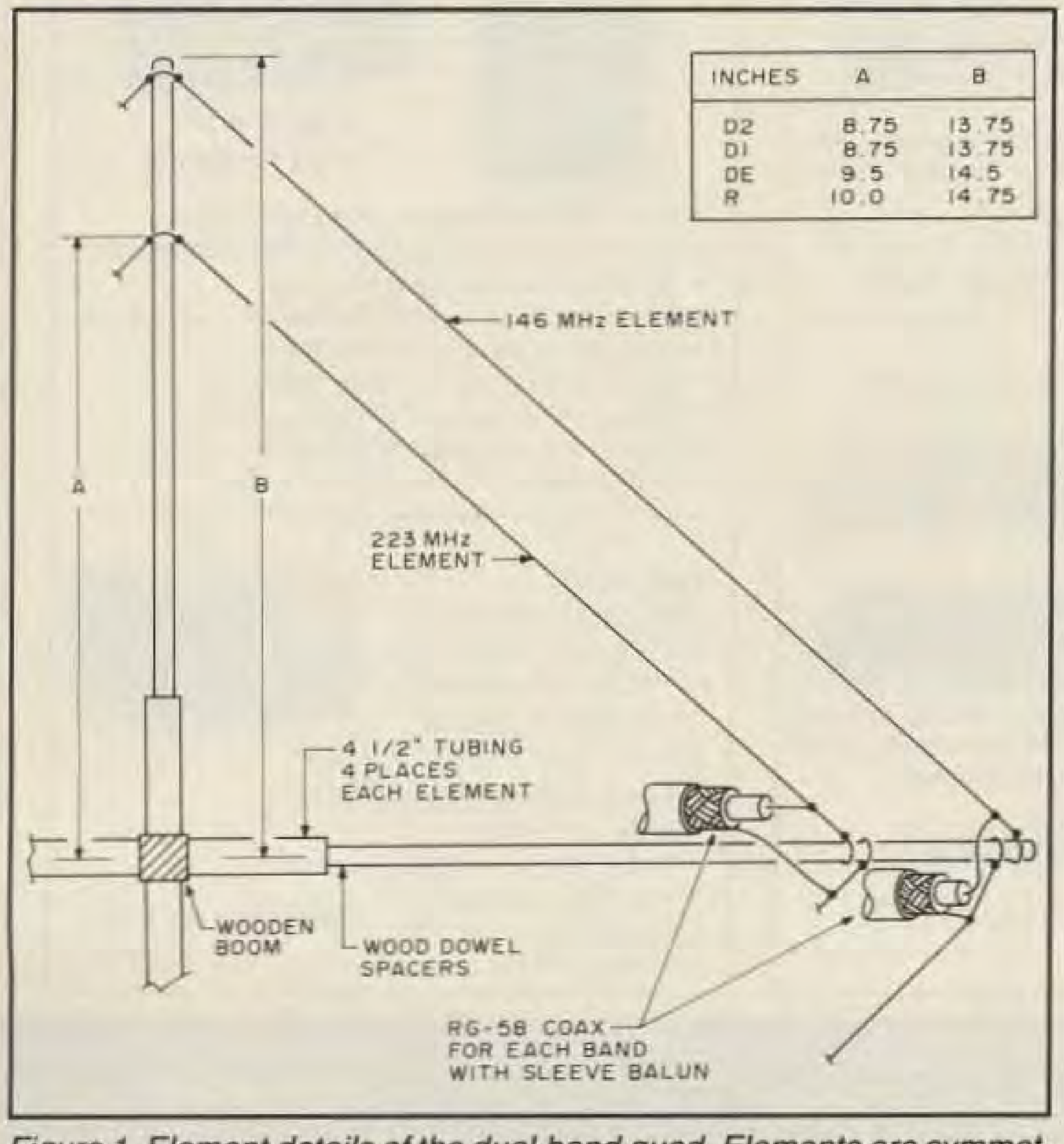
Last month I explained why gain antennas such as yagis and quads are preferred by the best southern California transmitter hunters over all other methods for competitive hunting on the 2 and 1-1/4 meter bands. Gain antennas save the day when the signal is weak, as it is when the hider runs low power from the valleys, canyons, and (occasionally) the sewers of the Los Angeles basin.

Despite all its advantages, a quad DF setup isn't expensive—in fact, it's dirt cheap and you can lash it up yourself even if you're the kind of ham who has buildophobia. Parts are no problem even if you're miles from a radio store because you get them from your local lumberyard or hardware emporium.

This dual-band quad was developed for hunting by the late Ray Frost WA6TEY, and documented by K6BMG, N6JSX, and others. It uses 18 or 19 AWG wire strung in a diamond configuration like the photo in last month's column. If you aren't interested in hunting both bands right now, install the elements for only your band of interest.

There is an endless variety of ways to put together a strung-wire quad. WA6TEY used a wooden boom (1-3/4 X 1-3/4 X 28 inches long) and spreaders of 5/16 inch wooden doweling held in place with 4-1/2 inch lengths of 3/8 inch hard aluminum tubing from an old TV antenna. Others have built their quads with PVC pipe booms and fiberglass rod spreaders. Just remember that the boom and spreaders should be non-metallic and the mast/boom coupling should allow boom rotation to select horizontal or vertical polarization, if both are used in your area. Figure 1 shows the coax connected for vertical polarization. For horizontal polarization, the feed should go to the bottom corner.

The directors and reflectors are continuous wire loops. Break the driven element loops at the feed points and connect them to the shield and inner conductor of the coaxes as shown. To decouple the feed line, use a sleeve balun made of braid from an old piece of coax. Remove the outer jacket on the 2 meter coax 13-1/4 inches from the driven element end and solder one end of the sleeve there. Smooth the shield sleeve down over the jacket of the coax and trim it off a quarter inch from the driven element end. For 220 MHz, use a similar sleeve connected 8-5/8 inches from the driven element end. Put tape or shrink sleeving over each balun.



INCHES	A	B
D2	8.75	13.75
DI	8.75	13.75
DE	9.5	14.5
R	10.0	14.75

Figure 1. Element details of the dual-band quad. Elements are symmetrical and only one quadrant is shown. Holes to string the wires are at distances A and B from boom center on each spreader, per the table.

Be prepared to spend some time tweaking your antenna for best performance. Don't permanently fasten the spreaders to the boom or install the jumpers holding the element wires to the spreaders until you have completed your adjustments. Install the director loops first, then connect the driven element loops to the feedline, and adjust their lengths for best SWR on each band by moving the connection points of the feed line. Install reflector loops and adjust reflector and driven element lengths for best SWR.

Now set up the antenna on your vehicle in a wide open field or large, empty parking lot. Use a signal source a hundred feet or so away and check for left or right bias in the antenna pattern when DFing the source. If the quad points to the right of the source, redistribute some of the wire of the driven element for that band to the right side of the spreaders. If the pattern is biased left, redistribute wire to the left. After you have eliminated the bias on both bands, attach the element wires and secure the spreaders in place inside the aluminum tubing with crimping, setscrews, or glue.

Seal off the ends of the coax and paint your completed quad a dark color. That protects the elements and makes the setup inconspicuous on night hunts. When hunting on 2 meters, be sure to terminate the end of the 220 MHz coax with a 50Ω load, and vice versa. Otherwise, element interaction may skew the pattern.

Beams Aren't Perfect

It should come as no surprise that there's no VHF DF system that's best for all situations. Beams do have their disadvantages on mobile hunts. They're cumbersome, particularly if you have to get out of the mobile and hunt on foot to close in. That full-size yagi or quad can get pretty heavy after a few hundred yards!

Beam hunters must remember to swing the beam in a full 360 degree circle regularly, or they may miss a sudden shift in signal to the rear as the hidden T is passed. For this reason, beam hunting works best when there are three hunters in the car. The driver concentrates on the road, the DFer swings the beam and gets bearings, and the navigator watches the maps.

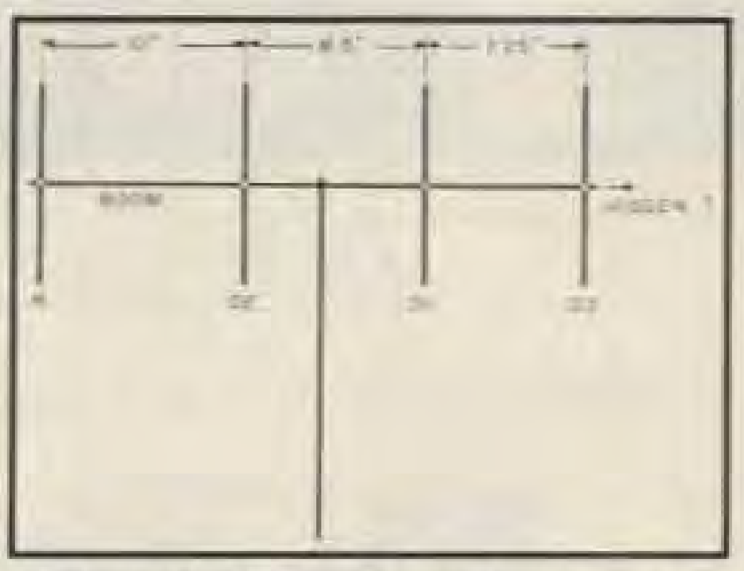


Figure 2. Side view showing how the elements are located on the boom. Elements are the reflector (R), driven element (DE), and two directors (D1 and D2).

Beams have good directivity and front-to-back characteristics only over a relatively narrow frequency range. A 2 meter quad won't work well for aircraft search and rescue on 121.5 MHz or on the VHF marine band. You need a separate beam for each band where you want to hunt.

Most mobile hunters use three or four element yagis or quads on 2 meters because longer ones get too unwieldy at high speeds. The trade-off is that short beams are too broad to give high resolution. The 3 dB beamwidth of a four element quad is more than ± 30 degrees, requiring careful aiming to determine where the exact signal peak is. It's even harder when there are mobile fluctuations.

There are even a few hunting situations when the beam/S-meter method works so poorly it can drive you crazy. A good example is the hunt put on at the 1986 ARRL National Convention in San Diego.

Instead of transmitting continuously, the fox went on for a half-second, then off for a half-second, over and over. As if that were not tough enough on hunters trying to get signal strength readings with a bouncing S-meter, the automatic transmitter controller set the output power to a different randomly-selected level (from a hundred milliwatts to a hundred Watts) for each half-second burst.

When signal strength information is more confusing than helpful, a RDF system which does not depend on relative amplitude is needed. Such systems exist, and they have other advantages as well. We'll begin discussing them next time.