the double bi-square array

The ressurection of an old classic that provides high performance on the high-frequency bands

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The bi-square antenna was originally described in the April, 1938 issue of *RADIO* magazine by Woody Smith, then W6BCX and editor of the magazine. I was working for the magazine at the time and thought I would build one some day. Now I have, more than 31 years later!

The original configuration with one point downward is necessary for the single pole mounting, but the same antenna is shown in W6SAI's "Quad Handbook," with one side parallel to the earth as used in the conventional quad arrangement. This is called the XQ antenna, meaning Expanded Quad.

The bi-square array, a derivation of the Lazy-H, has a broadside gain of about 5 dB with a bi-directional pattern. It is twice the size of the conventional quad element, as each side is a half-wave long. This means that it is hardly practical to rotate except on 10 meters. On that band some have been built with a reflector or director with a resultant unidirectional pattern and gain of around 9 dB. KV4AD has had a big signal on 10 meters with a variation of this rotatable arrangement.

A 10- and 15-meter pair of bi-square arrays may be mounted concentrically; with another similar pair mounted at right angles. Instant switching of direction and frequency may be accomplished at the operating position as shown in **fig. 2.**

construction

The dimensions of the bi-square array are not too critical as the simple matching method shown here resonates the antenna sufficiently when tuned for minimum swr. Each side of the 10-meter array is about 16½ feet long, and each side of the 15-meter array is about 22½ feet long. The open-ended stubs are 8½ feet long for 10 and 11½ feet long for 15.

This is not a high-powered antenna as shown here. The plastic insulators are unavoidably at points of high rf voltage and RG-58/U coaxial feed line is used for convenience. This is satisfactory in my case since the longest feed line is less than 20 feet, and the maximum power is that attained by a 500-watt PEP (input) trans-

ceiver. High powered operation will call for better insulation and RG-8/U feedline.

The whole system is hung on a lightweight wood pole consisting of a pair of 12-foot 2X4s spaced with blocks of 2X4 as a fixed base unit. A 2X3 is butt-spliced to a 2X2 top section. The bottom of the antennas at the plotted distance down the pole.

The pulleys are small aluminum types with nylon rollers, with eyebolts you put on and enough bolt length to go through the pole. The nylon line is a utility type that comes in 100-foot hanks and has a diameter of slightly less than 3/16 inch.

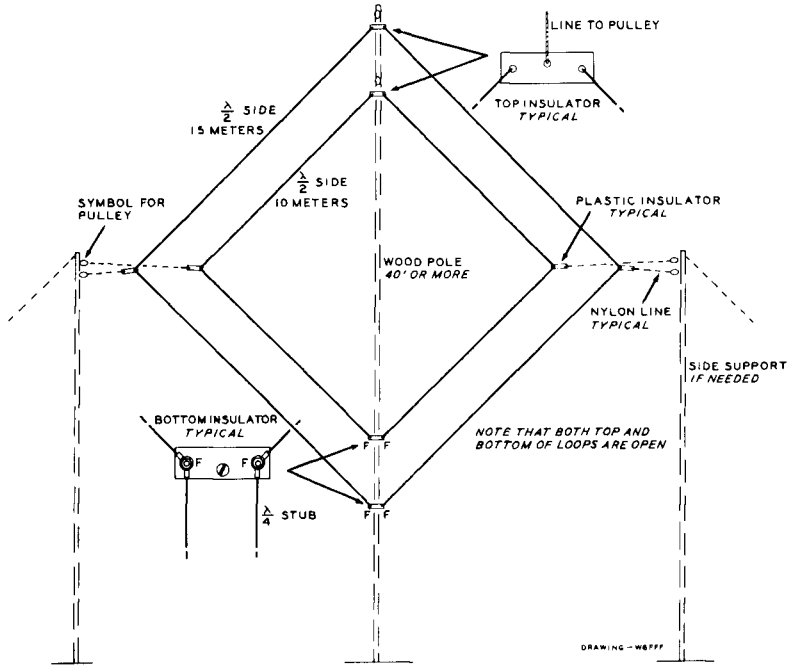

fig. 1. Bi-square array for 10 and 15 meters for one bi-direction. For doubled directional coverage a similar array is hung on the same pole at right angles.

2X3 is inserted between the 2X4s and fastened with two bolts. With one bolt in to act as a hinge, the whole upper part is pushed up, and the second bolt put in to secure the mounting.

Four nylon lines, about 2/3 up the pole will suffice for guys during installation. After the arrays are in place they will serve as the final guying.

It is a good idea to make a scale drawing of the antenna to locate the placement of pulleys for symmetrical rigging. Those for the 15-meter antennas at the top should be offset a few inches vertically and on adjacent sides of the pole to avoid entanglement. The same applies to the pulleys for the 10-meter

The top 15-meter antenna goes up first, the sides are pulled out, the bottom placed, and the whole thing pulled snug. The others follow in the logical order.

(The drawings in the antenna books always show perfect squares with side guys going out to an invisible fence or ground stake. However, with my 50 foot wide lot the best I could achieve with fences was a skinny diamond. Some 20-foot sections of tv mast squared up the arrays.)

Now the stubs may be installed, straight out and tight, trying to keep the 4 stubs as close to 90 degrees from each other as possible. Install the coaxial feedlines and tune up.

tuning

Tuning up is simplicity itself. Slide the coaxial line connector to the point of minimum swr near the center of the band and that's it. This will hold pretty well over the whole band with acceptable swr since this is a fairly low-Q antenna.

Further sophistication may appeal to some, such as resonating the whole antenna with a shorting bar and then finding the spot for attachment of the feedline, perhaps with some type of balun. After several months use I put simple bazooka quarter-wave sleeves on two of the antennas, but as no difference was noted, good or bad, I just left them on.

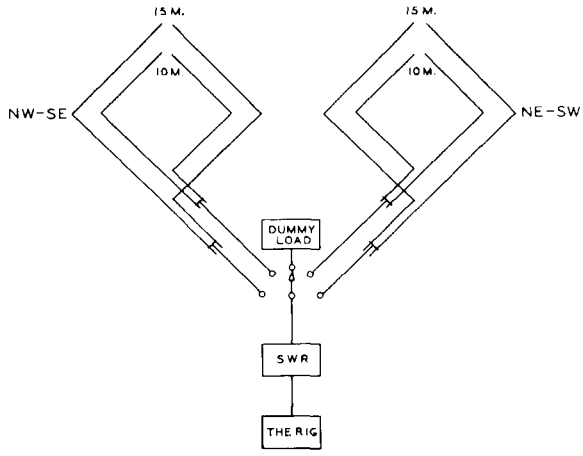

fig. 2. The full array. This is four separate antennas; any single one may be used since there is no dependence on any of the others.

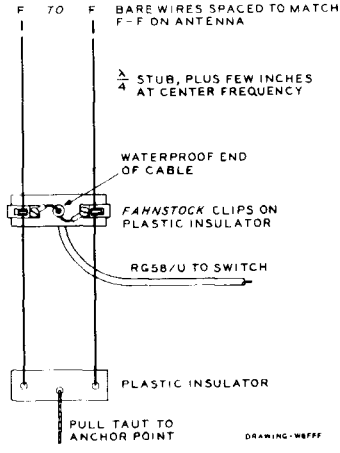

fig. 3. The movable feed point. After positioning the clips may be soldered to the wire and the whole thing covered with a waterproof cover.

performance

After a year's use a pretty good evaluation of the antenna is possible. The instant switching of directions is interesting as it often shows a 5 or 6 S-unit difference between the antennas, both locally and distant. The 10-meter antennas show more discrimination than the 15, probably due to better electrical spacing above ground. The exact center between beam paths doesn't seem too lively, but that may be due to areas of lesser ham activity, as I have received some good reports along those paths from Antarctica, South Africa and VK9.

My particular setup of SW-NE, through New Zealand and Spain, and NW-SE, through Japan and Argentina, seems to favor those areas.

A good long-term check on this antenna has been possible through almost daily contacts over the past year with ZL3LE on 10 meters, and with ZL3KA on 15 meters through all sorts of conditions. Both Bill and Jack agree that I am competitive with any of the W6s except for certain well known big antenna operators, and they of course are also running 2 kW PEP which helps a bit.

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