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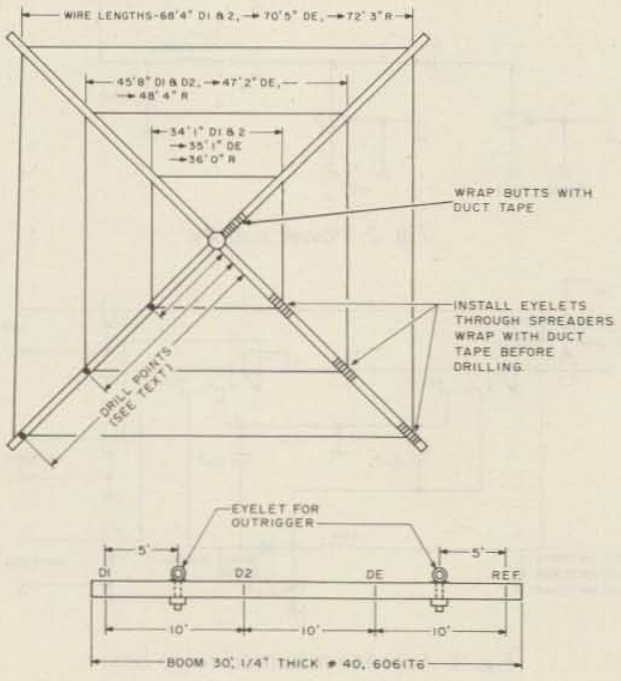
Taming the Monster Quad

—a four-element blockbuster you can build

It has been a long time since I have written an article for any amateur magazine, but after many on-the-air inquiries as to how my antenna performs and how I overcame various problems which seem to plague so many hams with multi-element quads, I decided to write a construction article.

For years I had used a four-element monobander, and after the loss of two towers, I decided to try the quad antenna. My first try was with two-elements on an eight-foot boom, but it did not compare with my four-element beam. Next, I used a four-element quad on a 20-foot boom. However, my beam still worked better. I was plagued with a low front-to-back ratio, high swr, and interaction between bands. So out came the books for many hours of research. The results were a quad with high forward gain, high front-to-back ratio, no interaction, and low swr with a wide bandwidth. (The following specifications as to gain are approximate but can be considered accurate by amateur standards.)



Four-Element Triband Quad:

boom length—30 feet;
element spacing—10 feet, all equal;
gain—13 dB;
front-to-back ratio—30 dB;
wire size—#14 enameled copper;
five-percent difference factor between elements;
design frequency—14.250, 21.300, and 28.600 MHz.

Directors 1 and 2 are the same size. I used the formula $975/f_{MHz}$. The frequency and wire lengths are 14.250 MHz—68'4", 21.300 MHz—45'8", and 28.600 MHz—34'1".

For the driven elements, I used $1005/f_{MHz}$. The frequency and wire lengths are 14.250 MHz—70'5", 21.300 MHz—07½", and 28.600 MHz—35'1".

For the reflectors, I used $1030/f_{MHz}$ to obtain wire lengths of 14.250 MHz—72'3", 21.300 MHz—48'4", and 28.600 MHz—36'0".

Spreaders:

I used one-piece fiberglass spreaders 13-feet long and screwed eyes through the arms to run the wire (see Fig. 1). This lets the arms move in the wind and not break the wire, and also lets the wire draw and sag with temperature changes and not bow the arms. A note of interest: Bamboo can be used but should be wrapped with two-inch-wide duct tape and then sprayed with krylon® or varnish.

Placement of the screw eyes is done by taking the wire length in feet for each band, dividing the result by four, and inserting that number into the formula $A = C/\sqrt{2}$, where A is the distance along the spreader from the center of the boom to the drill point and C is the length of the element divided by four.

Example: Find drill point for 20-meter driven-element wire:
14.250 MHz = 70'5"
70.5 divided by 4 = 17.625 = C
Using $C = \sqrt{2}$, $A = 17.625\sqrt{2}$, $= 17.625/1.414$, $= 12.46'$ or 12'5" from center.

Below are the drill points

for each element:

Directors 1 and 2:

14.250—12′1″
21.300—8′1″
28.600—6′0″

Driven element:

14.250—12′5″
21.300—8′3″
28.600—6′2″

Reflectors:

14.250—12′8″
21.300—8′6″
28.600—6′5″

These figures are to be used if you measure from the center of the boom out. To measure from butt of the arms, add 1 3/8″ to each figure. This way the arms may be drilled before attachment to the boom spreaders. Each hole should be wrapped with duct tape after drilling, then a small nail can be used to punch a hole in the tape. Each spreader should be sprayed with krylon® or other type of coating to increase its life and prevent the eyelets from rusting. I also wrapped the butt ends with duct tape for added strength.

Feeding the Quad

I decided to use ¼-wave stubs after burning up a one-kw ring transformer. It's no fun waiting two weeks for a new transformer before you can operate! I used 72-Ohm coax, but kW-rated twinlead can also be used.

Below are the lists of lengths for both coax and twinlead using the formula $L = 246(VF)/f_{MHz}$, where VF is the velocity factor of the transmission line used.

Stubs: RG-11A/U coax, Z = 72 Ohms, VF = 0.66. Length to match driven elements: 14.250—11′4″, 21.300—7′6″, and 28.600—5′6″. For 1-kW twinlead, Z = 72 Ohms and VF = 0.71, 14.250—12′3″, 21.300—8′2″, and 28.600—6′1″.

The stubs should be cut as close to the lengths shown as possible, a PL-259 and barrel connectors installed on one end, attached to 52-Ohm coax to the shack. I tuned each 52-Ohm feedline to the shack using my noise bridge and R-4C so I would have little swr on my feedlines.

One problem many hams have is how to string the spreaders. I drove a 2″-diameter, 4′-long pipe into the ground and attached the arm supports to this pipe. I then drove 2 wooden 3′ stakes into the ground for each arm to keep them straight. By using this type of jig, each element can be wired, removed, and then placed on the boom. I covered all nuts with General Electric clear silicone rubber, and then I sprayed them with krylon®.

Conclusion

After the antenna was installed, measurements were made. The swr was 1.6:1 at its highest point on any band, with very flat response across each band. I can operate either the CW or phone portions with the swr never going above 1.6:1. I have been using the antenna for about two years and have yet not to make it through the pileups. The work involved is well worth the time, considering the results obtained. My next antenna will be a two-element 40-meter quad.

I would like to thank Barry WA4POH. Without his help and encouragement, this project would have been scrapped. Barry also put up a quad like mine and is very pleased. ■

References

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