About this time in the sunspot cycle 40 meters begins to look really good. N4PC describes the perfect antidote for the sunspot doldrums.

A DX Antenna For 40 Meters

BY PAUL CARR*, N4PC

Well, we've reached that time again. We're headed for the bottom of the eleven-year sunspot cycle, and it's becoming progressively more difficult to work DX on the higher bands. But don't give up. There's plenty of DX to work, but we need to look to the lower frequencies, and we need the right antenna for the job. Here's an antenna that requires no more room than a dipole and does not require a transmatch. It's inexpensive and produces a low-angle pattern even when mounted at or near ground level. Furthermore, it's easy to build and match. It's "The Half-Square Antenna." Believe me; it works!

A Brief History of The Half-Square Antenna

The half-square antenna was designed by Woody Smith, W6BCX, shortly after WW II. Woody had experimented with an inverted ground plane before the war, and he planned to extend the concept to two or more elements. After the war his plan became a reality. The two-element version consisted of a full-wavelength wire bent a 90-degree angle one-quarter wavelength from each end and mounted in an "upside down U" configuration. This is what we know as a half-square.

A problem arose. Before Woody could build the antenna, he had to move. He tried to interest some of his friends in building and testing the antenna. He met with rejection. The response was "nothing that simple could be any good or other people would be using it!" Well, Woody's friends were wrong.

Perhaps a more complicated design would attract attention. Thus entered a second design. This design consisted of a full-wave horizontal element with three quarter-wave vertical elements attached at half-wave intervals. This design was known as "The Bobtail Curtain," and Woody had an article on it published in the March 1948 issue of *CQ* ("Bet My Money on a Bobtail Beam"). The response was great. Reports began coming back that the antenna was a great DX performer, especially at distances of over 2500 miles. Some people reported that their antenna performed well, although they could build only two vertical elements. I'm sure Woody smiled.

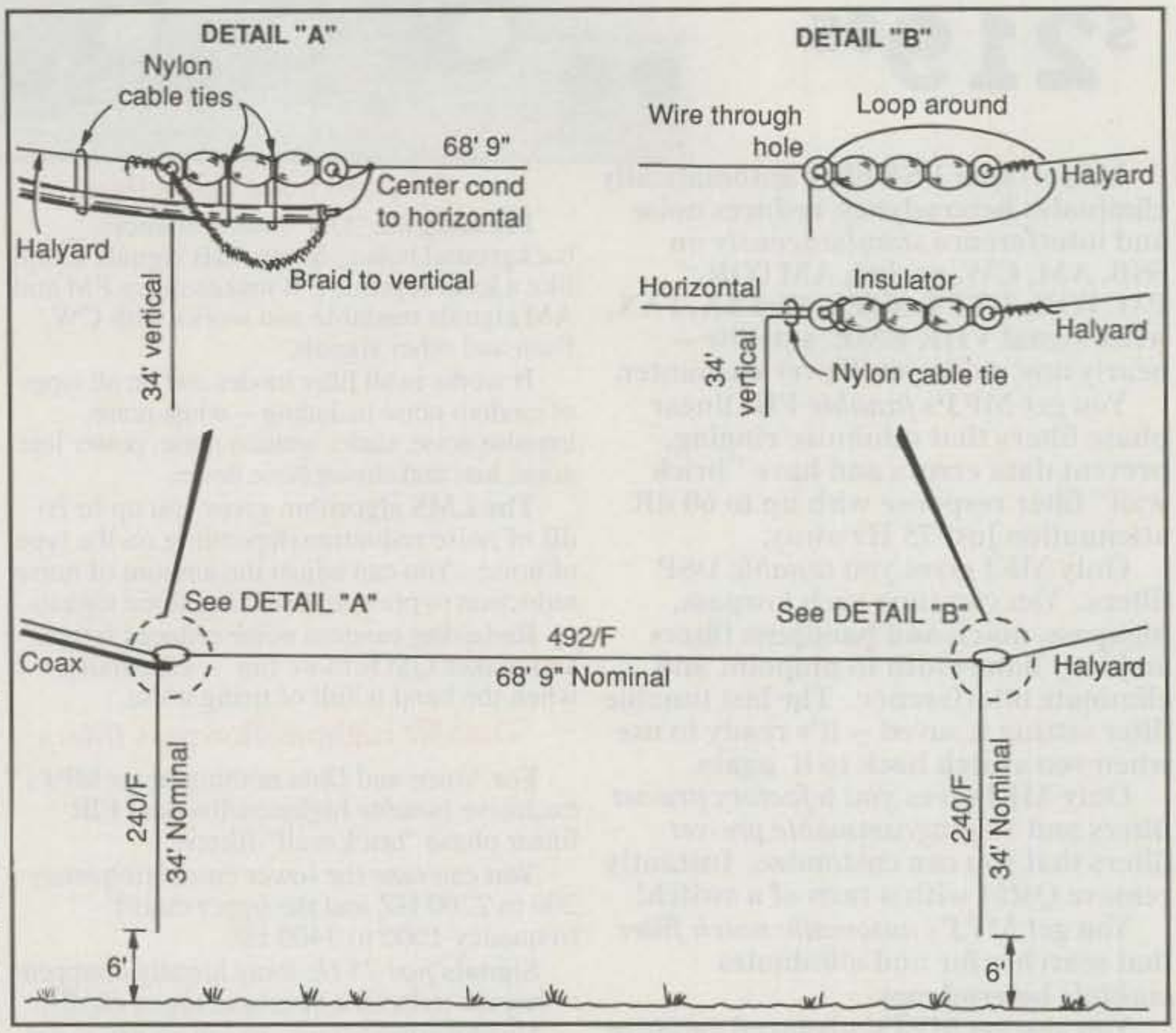

Fig. 1– Details on how to build the half-square antenna.

I became aware of the antenna through a March 1974 article in *QST* written by Ben Vester, K3BC, and entitled "The Half-Square Antenna." Ben had been using an 80 meter Bobtail Curtain to maintain a DX schedule, and Mother Nature played a trick on him. During a storm the horizontal wire connecting one of the outside elements was broken, but he discovered that the antenna still performed very well. Ben performed extensive tests on the abbreviated antenna and reported his findings in the *QST* article.

My first Half-Square antenna was built as a comparison antenna for "The N4PC Loop" antenna (*CQ*, December 1990). I fed the antenna at the junction of a vertical element and the horizontal phasing line with TV ribbon and matched the feedline to the transceiver with a transmatch. I found the Half-Square to be an excellent performer, and this paved the way for a two-band version for the 12 and 17 meter bands. The article appeared in the September 1992 issue of *CQ*. Since the sunspot cycle is heading down, I think it's time for a design for 40 meters.

Design Philosophy

As I indicated before, the design is very simple. There is a half-wave horizontal section, and at each end of this section there is a quarter-wave vertical section attached. The formula to determine the length of the horizontal section is l = 492/f, where "f" is the frequency in MHz. If you do not have room for the full length, you

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may shorten the horizontal section and increase the length of the vertical sections. The antenna does not seem to care if the horizontal section is exactly 180 degrees long; it works just fine if you're close to that length. The formula that I use to calculate the length of the vertical sections is l = 240/f, where "f" is the frequency in MHz. This length is too long for resonance in most cases, but it's easier to remove wire than to add wire to achieve resonance. Now for the specific construction details.

Construction Details

Start by cutting 103.5 feet of wire for the horizontal and one vertical section. The wire can be 16 gauge or heavier, and stranded wire is a bit easier to work with. Measure about 34 feet, 3 inches from the end of the wire and fold the wire back on itself. Push the folded wire through one eye of a standard insulator, form a loop, and then loop the wire around the insulator to form a cinch knot. This technique saves a solder joint, and the wire will hold very firmly when pressure is applied. Attach the other end of the horizontal section to another insulator with a cinch knot (see fig. 1).

Cut another wire to a length of 34 feet, 3 inches. This will form the other vertical element. Route this wire through the remaining eye of the insulator and secure the wire with a cinch knot. Next connect the coaxial feedline (I used 50 ohm) with the center conductor connected to the horizontal phasing line and the shield to the vertical element. Be sure to waterproof the end of the coax to prevent moisture from entering. Secure the coax to the insulator with nylon cable ties. Attach a halyard to each insulator, and the antenna is ready to hoist into the air.

Place the antenna in the air by tossing the halyards over a convenient tree branch, and raise the antenna until the vertical elements are at a convenient height for trimming. Try to keep the coax

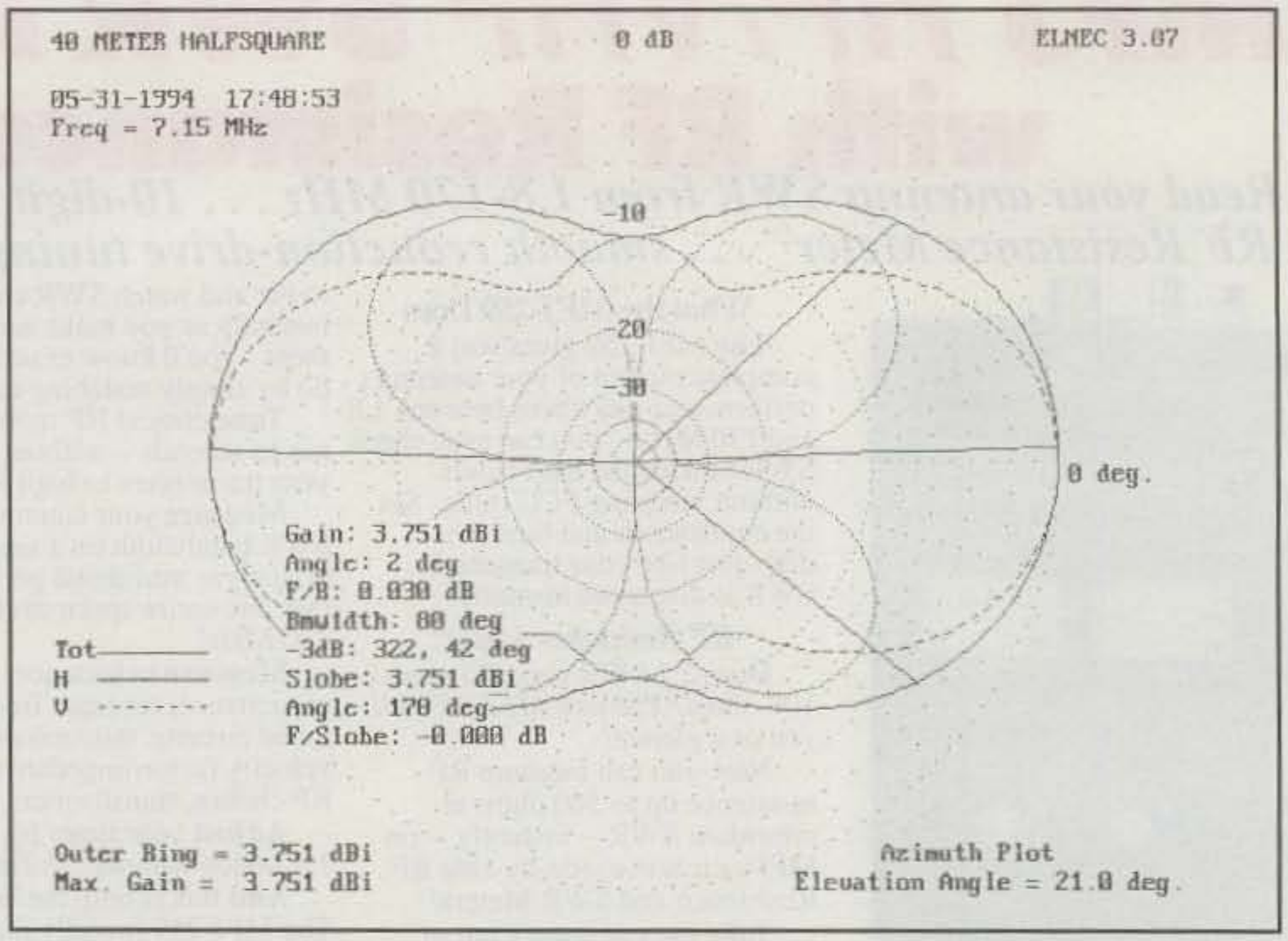

Fig. 2– The horizontal pattern for the antenna.

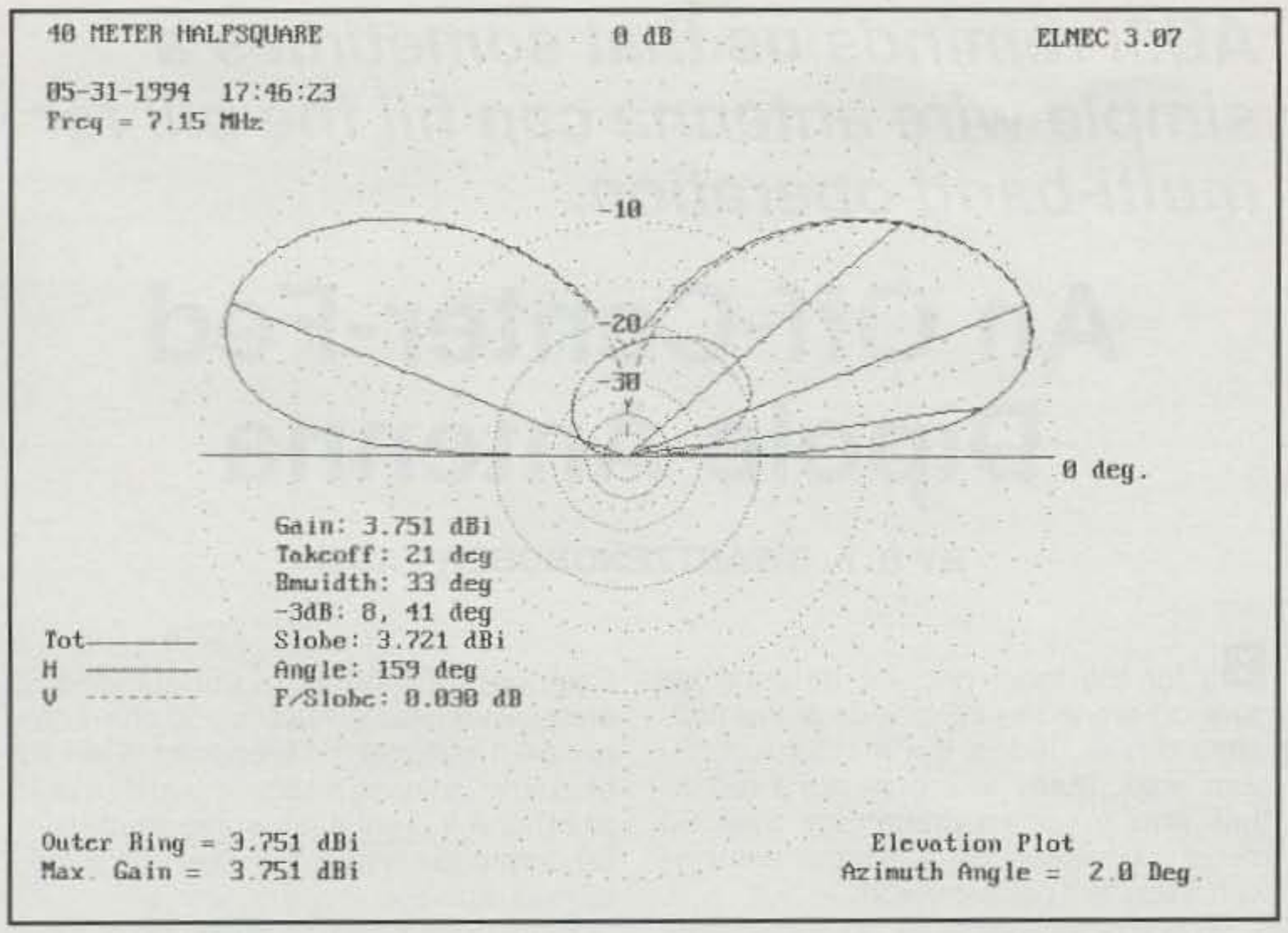

Fig. 3– The vertical pattern for the antenna.

away from the vertical element by about one-quarter wavelength. This will ensure that the coax does not adversely affect the SWR readings. (If you have room, route the coax along the halyard for the necessary distance.)

Next trim for best SWR. As I indicated earlier, the vertical elements are going to be too long in most cases, so the point of resonance will probably be slightly below the lower band limit. If you are a little shy about cutting the excess wire, just fold the wire back on itself and tape it in place with electrical tape. The amount folded back will be greater than the amount removed, and the wire on the end where the coax is attached will have more effect on changing the resonant frequency than the other vertical wire. When completed, the antenna should have an SWR of less than 1.4:1. I found a bandwidth of slightly more than 300 kHz for the 2:1 SWR points as measured with an MFJ 249 SWR analyzer. That's not bad for something that simple! So much for the construction. How about the predicted results?

Predicted Results

As can be seen in figs. 2 and 3, the vertical pattern is what you would expect from a vertically polarized antenna. The vertical angle of radiation is predicted to be 21 degrees even when the antenna is very close to the ground. (I used a height of 40 feet for the horizontal phasing line for this computer model.) The horizontal pattern is about the same as you would expect from a dipole—perpendicular to the horizontal phasing line. It's very close to the classic "bow-tie" pattern. Remember that this will not be an omnidirectional pattern, since we have a pair of phased verticals.

On-The-Air Results

I have been very pleased with the performance. Even when using my QRP rig (the Forty Meter Fun Machine, 1.5 watts out), it is not uncommon to receive 559 to 589 reports. During one late-night operating session I heard a DU in the Philippines. With sweaty palms, I began to call him. I was not successful. I guess that was a bit too much for the antenna and a QRP rig. However, after 38 years of operating, I welcome any experience that makes my palms sweat.

Afterthoughts

I would be remiss if I did not include a bit about safety precautions. Never place an antenna over a power wire. Furthermore, try to place your antenna so that a power wire would not touch the antenna should the power wire fall. If you place the antenna close to the ground, be sure to take precautions so that animals or pedestrians cannot touch the end of the antenna. Remember, the end of the antenna is a high impedance, and very high voltages can be developed even when operating at low power levels.

If you would like to build the antenna but you are at a loss for a source of materials, Antennas West sells these antennas (see their ads in *CQ*.)

If you have questions that I have not answered in this article, give me a call. My phone number is 205-435-3642.

Put a little spice back in your life: try DX on 40 meters. You won't be sorry. ■