You say you would like to work DX but you don't have a beam for the higher bands? Here's an easy, inexpensive solution.

A DX Antenna for 15 Meters

BY PAUL CARR, * N4PC

Well, we have reached that time again. We are headed for the peak of the eleven-year sunspot cycle, and it is becoming progressively easier to work DX on the higher bands. You say you would like to give it a try but you don't have a beam for the higher bands? Don't give up. There is an easy solution to your problem. You need the right antenna for the job. Here is an antenna that requires no more room than a dipole, requires no transmatch, is inexpensive, and produces a low-angle pattern even when mounted at or near ground level. Furthermore, it is easy to build and match. It is "The Half-Square Antenna," and it works!

A Brief History of The Half-Square Antenna

The half-square antenna was designed shortly after WW I by Woody Smith, W6BCH. Woody had experimented

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Where is that DX antenna? A good stealth antenna, you can barely make out the balun against the tree at the far left. (Photo by the author)

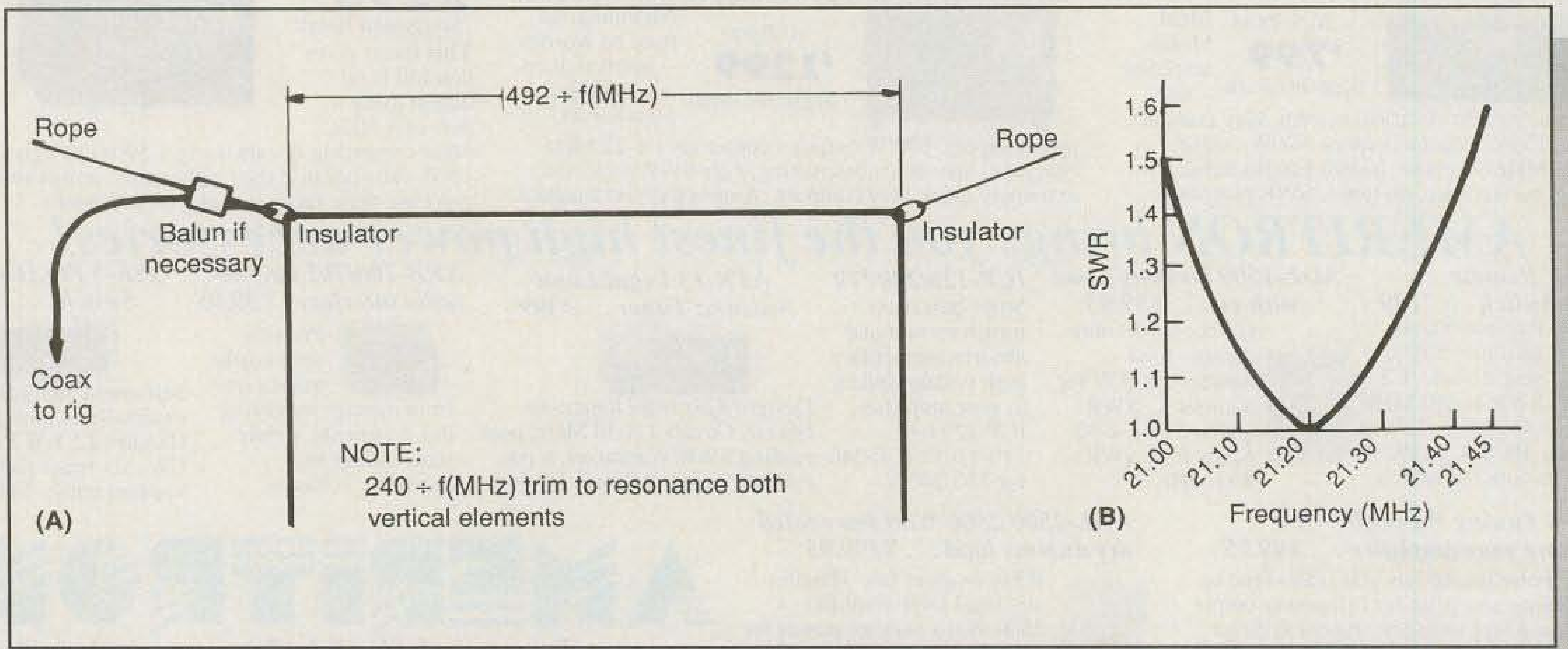


Fig. 1– (A) The 15 meter half-square. (B) Resulting SWR curve.

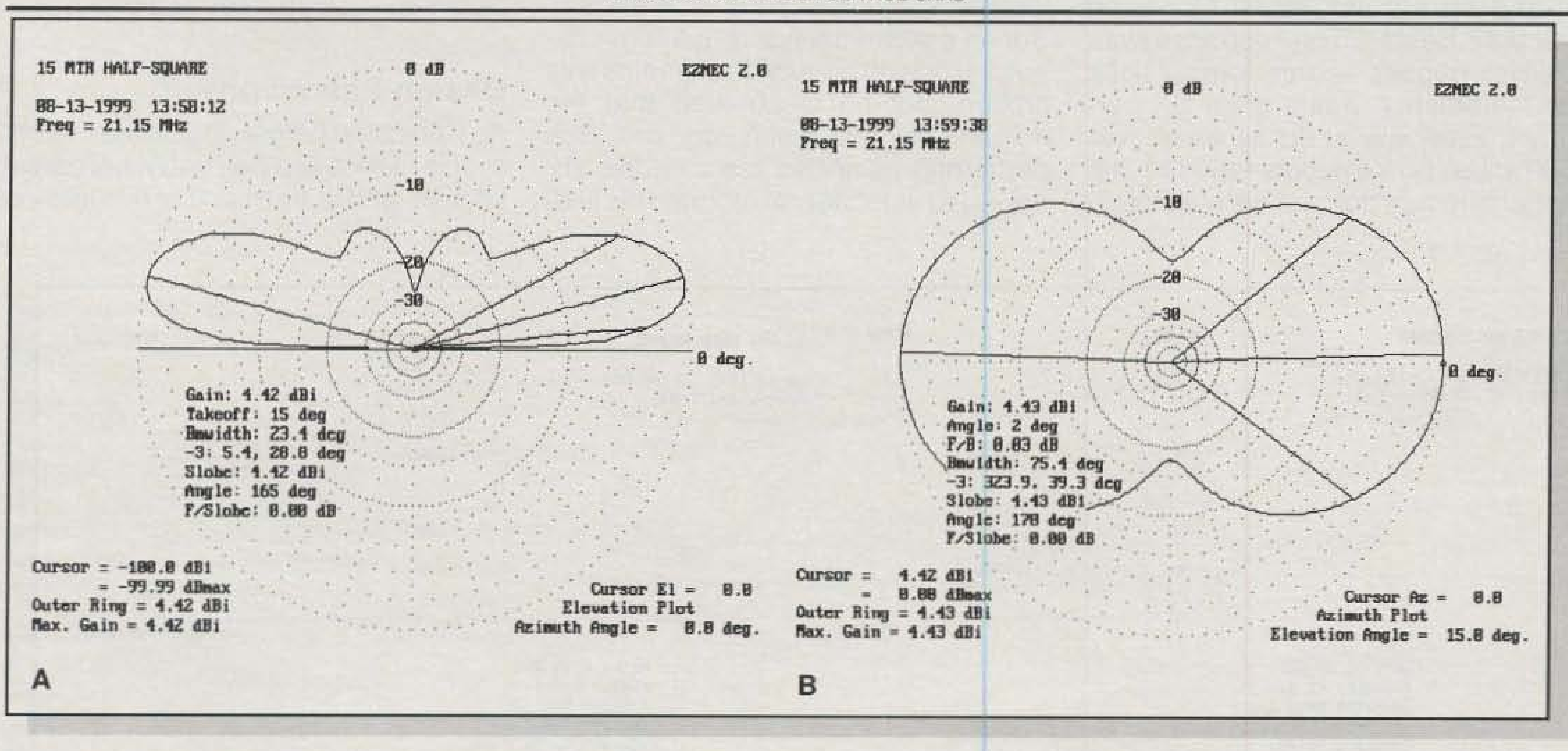


Fig.– 2(A) Elevation pattern with horizontal wire at 19 feet. (B) Matching horizontal pattern. Note the pattern is slightly off-center due to the corner feed.

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 at 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.

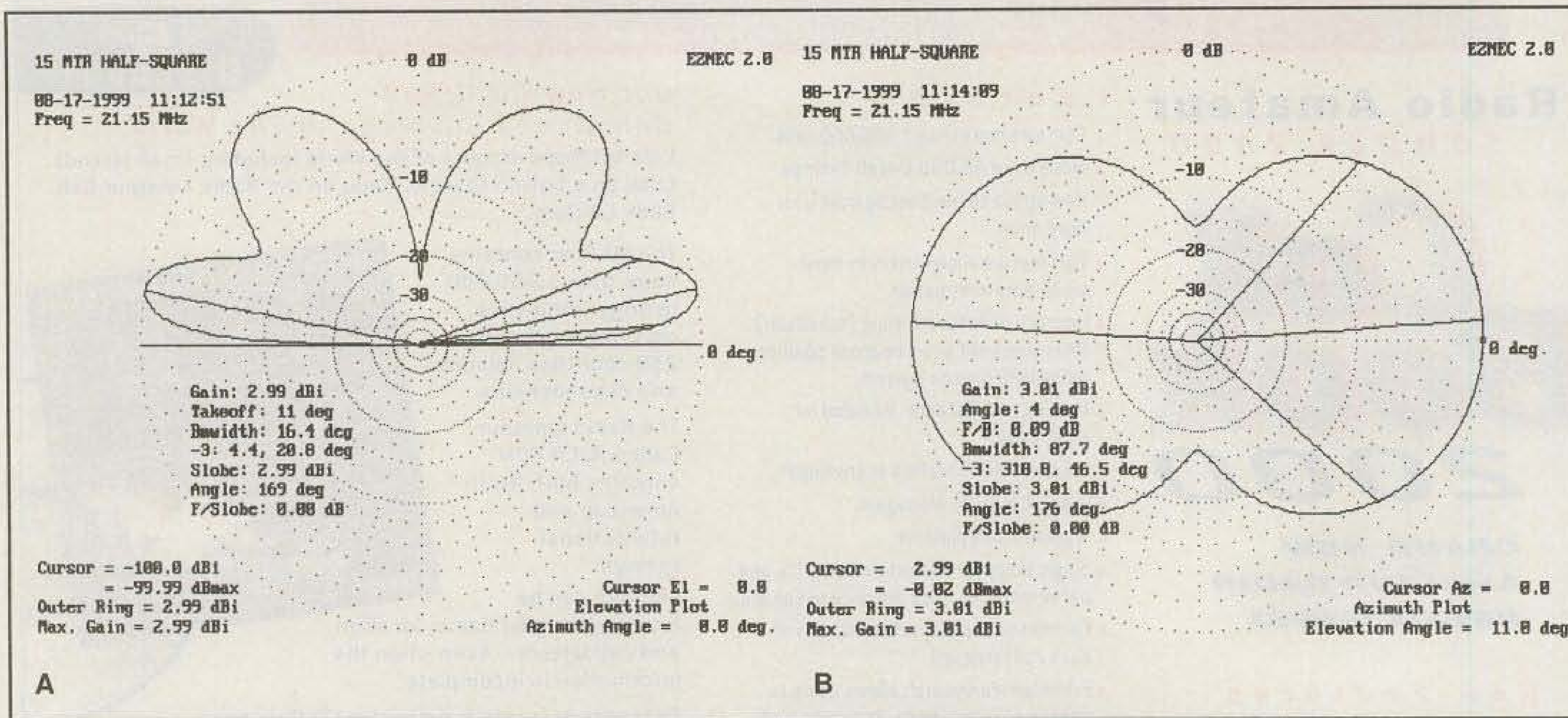


Fig. 3(A)– Elevation pattern with horizontal wire at 28 ft. (B) Matching horizontal pattern.

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. The design known as "The Bobtail Curtain" was published in the April 1948 issue of *CQ* and was entitled "Bet My Money on a Bobtail Beam." The response was positive. 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.

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. Woody's antenna was now in print.

I have built many half-square antennas in the past, and I am happy to say that I have never been disappointed with their performance. They are very good low-angle radiators and really begin to show their outstanding performance at distances of 2500 miles or greater.

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

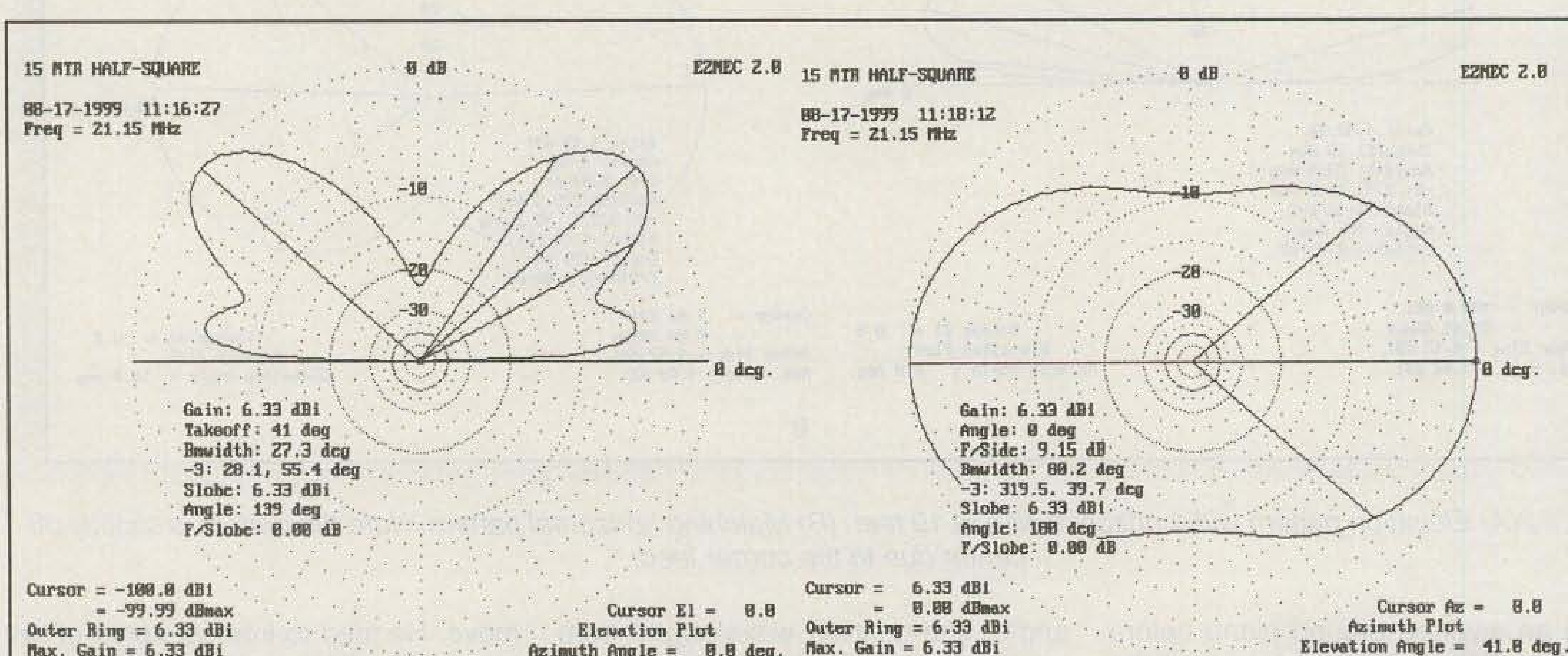
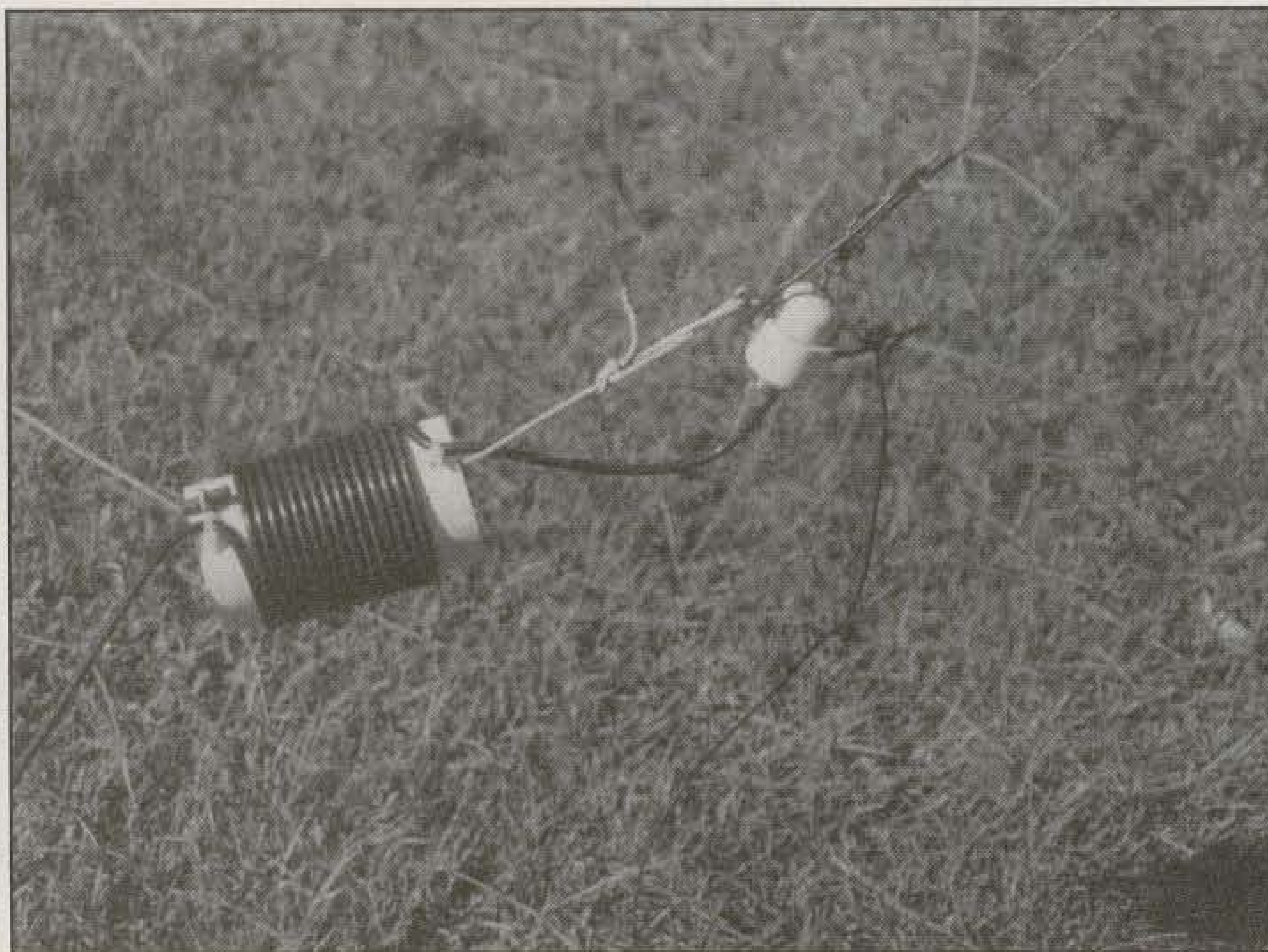


Fig. 4(A)– Elevation pattern with horizontal wire at 36 ft. Don't place the antenna too high. (B) Matching horizontal pattern.



Detail of the balun, halyard, and corner coax connector.

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 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 are 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 is easier to remove wire to achieve resonance than it is to add wire. Now for specific construction details.

Construction Details

Start by cutting 35 feet of wire for the horizontal section and one vertical section. The wire can be 16 gauge or heavier, and stranded wire is a bit easier to work with. Measure about 12 feet 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 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 12 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.

Build A Simple Coax Connector

There is an easy way to build a very functional coax connector. I went to my local hardware store and found two schedule 40 PVC end caps that would nest nicely into one another. I also purchased three small "eye bolts" to provide strong connecting points for the wire and halyards. I soldered a wire about 6 inches long to the center connector of an SO-239 coax connector and a second 6 inch wire to a solder lug to mount to the shield side of the connector. I then drilled the PVC caps and mounted the hardware. I extended the wires through holes drilled in the side of one of the caps. Then I coated one of the caps with PVC cement, pressed the two caps together, and allowed the cement to dry. Where the wires extended through the caps, I sealed the places with silicone cement and allowed everything to dry. That's it. Believe me, it's easier to build than it is to write about!

Next I connected the coaxial feed line (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 (rope) 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 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.)

What About a Balun?

A balun may not be necessary, but here is an easy way to tell. As you are taking preliminary SWR readings, move the coax a few feet. If the SWR reading changes, there is probably RF on the shield and it needs to be isolated. I built a simple balun by winding several turns of coax around a piece of 4 inch schedule 20 PVC, but any convenient coil form of that diameter will suffice. Be sure the material is lightweight, because it will be supported on the halyard.

Final Tuning . . .

Next hoist the antenna into the air and 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 probably will be slightly below the lower band limit. I trimmed the wires until the antenna was resonant at the low end of the band as indicated by an MFJ 259 antenna analyzer. I then folded the antenna wire back on itself and taped it in place to attain final resonance at 21.2 MHz. If I ever decide that I want the antenna to resonate at a lower frequency, it is a simple matter to lengthen the vertical elements. When completed, the antenna should have an SWR of less than 1.4:1. The SWR on my antenna varied from 1.5:1 at 21.0 MHz to 1.6:1 at 21.45 MHz with a 1:1 resonant point at 21.2 MHz. Remember, these were my test results and your situation will be different. So much for the construction. How about the predicted results?

Predicted Results

As can be seen in fig. 2, the vertical pattern is what you would expect from a vertically polarized antenna. The vertical angle of radiation is predicted to be 15 degrees even when the antenna is very close to the ground. (I used a height of 19 feet for the horizontal phasing line for this computer model.) The horizontal pattern is about the same as you would expect from a dipole—namely, perpendicular to the horizontal phasing line. It is very close to the classic "bow-

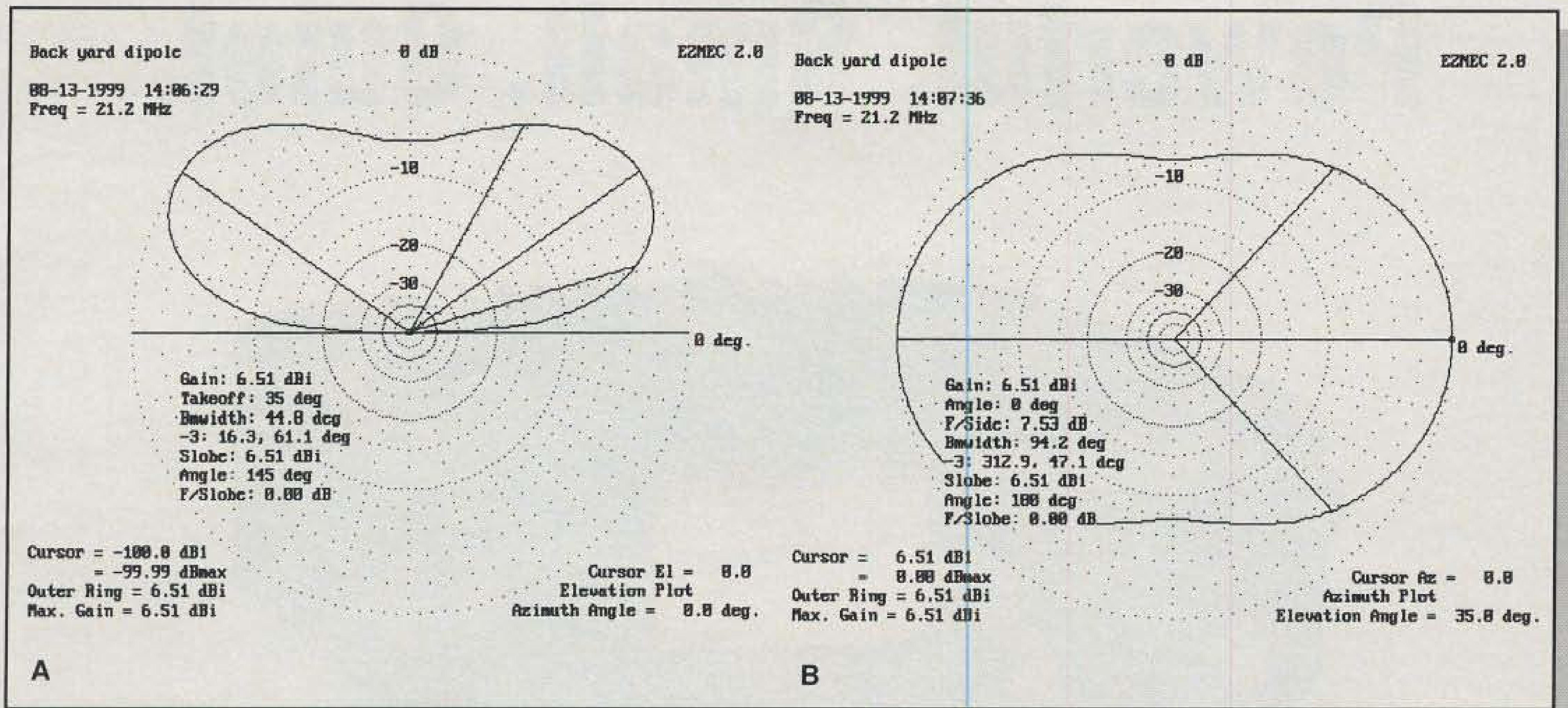


Fig. 5(A)– Elevation plot for a half-wave dipole placed at 22 ft. (shown for comparison). (B) Matching horizontal pattern for the half-wave dipole.

tie" pattern. Remember, this will not be an omnidirectional pattern, since we have a pair of phased verticals. If you desire an antenna for both high and low angles of radiation, raise the height of the horizontal section to about 28 feet. This gives a second lobe that is considerably higher while still maintaining good low-angle characteristics.

As can be seen from the comparative computer model of a dipole at 19 feet, the half-square gives great performance for an antenna at low heights. At a height of 28 feet a secondary lobe appears. This is good if you desire a dual-purpose antenna (both stateside and DX). A word of caution: Do not place the antenna too high, or you will lose the DX lobe.

On-the-Air Results

I have been very pleased with the antenna's performance. My initial test was at night on SSB. While running only 80 watts PEP, my first two contacts were with Misha, RU9VA, zone 18 in Siberia, and with Alex, UN7PCV, in Kazakhstan. Needless to say, I was very pleased. Even after 42 years of operating, I still get excited over contacts such as these.

Afterthoughts

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

If you have questions that I have not been able to answer in this article, give me a call. My phone number is 256-435-3642.

Put a little spice back in your life. Try DX on 15 meters. You won't be sorry. ■