Take advantage of the summer months to string some wire after you read N4PC's article on loop antennas.

The Full-Wave 80 Meter Loop Antenna—Revisited

BY PAUL D. CARR*, N4PC

Very few antennas in recent years have created as much controversy as the full-wave 80 meter loop. I built my first full-wave loop based on Dave Fischer's article in *QST* ("The Loop Skywire," November 1985, pp. 20–22). It was inexpensive, went up easily, and performed just as Dave said it would. My antenna was a 272 foot loop placed in almost a square configuration (the southwest-northeast diagonal was about 5% longer), and I fed the antenna in the southwest corner with 450 ohm balanced feedline. The antenna was supported by branches of pine trees at about 50 feet.

Preliminary Tests

During evaluation I noticed I could work just about everything that I could hear and seemed to copy everything other stations in my geographic area did. All my operation is either QRP (output of 5 watts or less) or at a maximum output of 100 watts. When I used the antenna at 20 meters and higher, I did not find the antenna to be the "cloud burner" high-angle radiator the skeptics had claimed. I found it to be a low-angle radiator with gain.

I had decided the 80 meter loop when used at 20 meters and higher was an efficient, low-angle radiator with gain. But how much gain? I set out to answer this question.

I chose the 12 meter band for my tests because it is fun to operate, and my comparison antenna would be relatively small and easy to build. I chose a four-element extended double Zepp collinear as my comparison antenna. The extended double Zepp has been around for many years and its gain characteristics are well known. Most published gain figures are listed at about 6–7 dB. As I said earlier, the major axis of my antenna was southwest-northeast and the results were

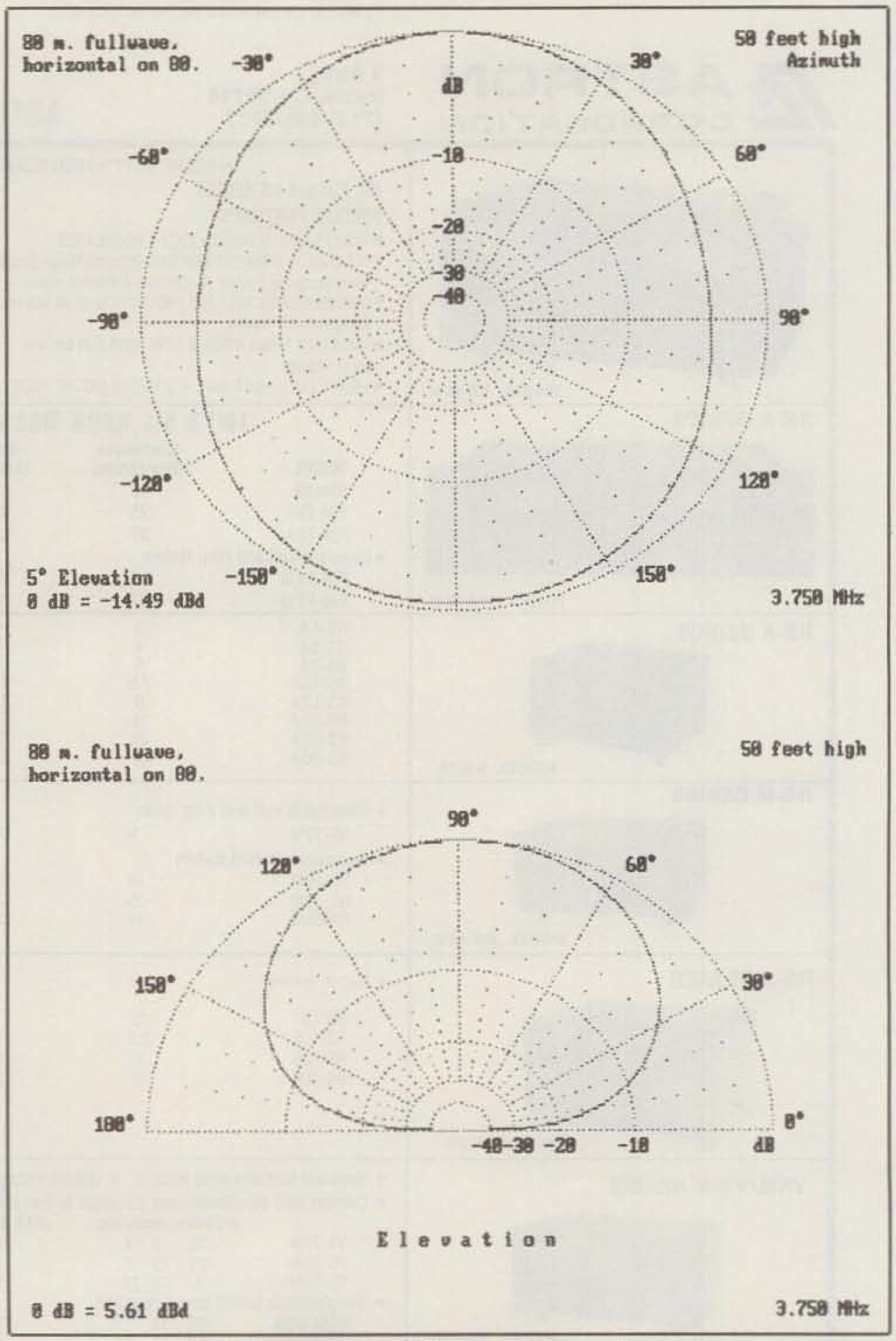

Fig. 1– Computer modeling of an 80 meter loop antenna.

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slightly better in those directions, so I positioned the Zepp to favor them. Both antennas were at 50 feet and fed with balanced feedline.

Now for the test. I began to work stations in Europe and New Zealand with regularity. Two friends, Tony, ZL2ANT, and Jock, ZL1ACW, provided most of the comparisons. Since both gentlemen are antenna enthusiasts, I valued their reports very highly. In better than 90% of the test cases the loop was stronger than the Zepp. I also noted the same results on the receive path. Jock suggested that perhaps the antenna was acting as a small rhombic at this frequency. That suggestion paved the way for one more experiment.

If the antenna was acting like a small rhombic, then I would make it into a small rhombic and again compare it to the Zepp. Down came the loop, and I modified it by opening the loop at the corner opposite the feed point. I now had a small bi-directional rhombic. The same tests were conducted with Tony and Jock, and the results were the same. In more than 90% of the cases the rhombic (loop) provided superior results. I now had empirical data on the gain for the 12 meter band.

After the loop was converted to a rhombic, I rechecked the performance

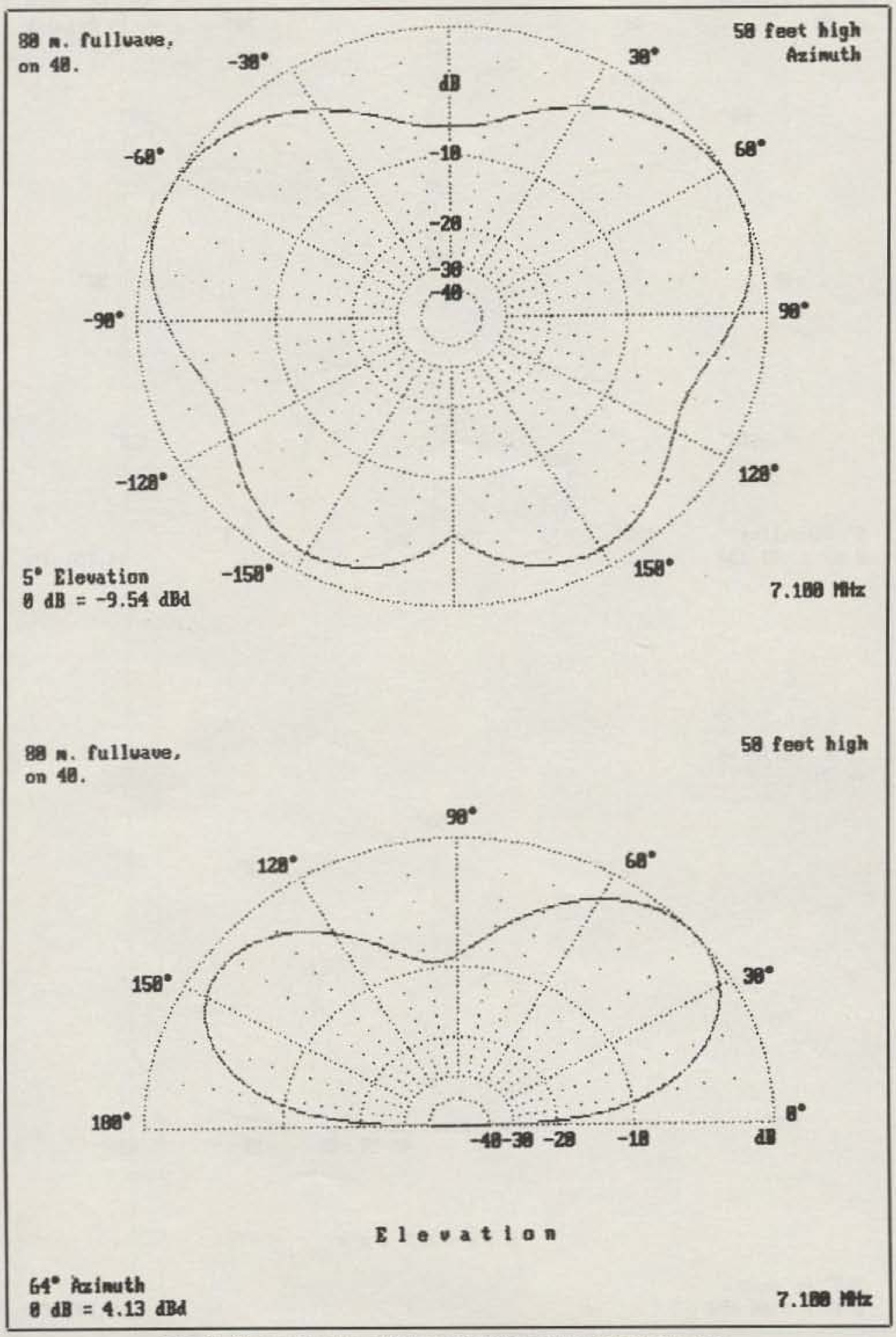

Fig. 2– Computer modeling of a 40 meter loop antenna.

an all bands 80 through 10 meters, and I could detect no difference in performance. One bonus did come from the "open loop" configuration: it now seemed to be a fairly efficient radiator on 160 meters. After all, the length is approximately a half-wave dipole for 160 meters. True, the pattern will be distorted because the antenna is folded back on itself, but most antennas for 160 meters that will fit on a city lot will have a compromise of some kind.

Further Evaluations

I was excited about my preliminary test results and discussed the results with my friend Lew McCoy, W1ICP. We agreed that computer modeling could provide further useful information about the loop's behavior at various frequencies.

As can be seen in fig. 1, the loop on 80 meters is basically an omni-directional "cloud burner." This is great for local nets, but its DX performance is highly lacking. The antenna is really a quad with the ground providing the function of the reflector and radiating the signal straight up.

Once you leave 80 meters and go to 40 meters and higher with this same antenna, the system produces multiple lobes that have gain. It is a completely "different" antenna from the one on 80 meters (see fig. 2). The predicted angle of radiation also lowers to about 40 to 45 degrees, and perhaps we get a bit of gain.

At 20 meters (see fig. 3) the lobes and nulls of the antenna become more pronounced. The angle of elevation now appears to be about 20 degrees and the gain figure is also greater.

At 15 meters (fig. 4) still more pronounced lobes appear. The angle of elevation now seems to be about 12 to 15 degrees, and the gain I observed during my field test appears to be confirmed by the computer model.

The gain figures should not be taken as gospel, because they depend on perfect ground and other factors. However, while the *true* gain figures are less, the maximum lobes do have gain when compared to a dipole.

Construction

As I indicated earlier, the antenna is easily built and erected. Cut the wire to length—272 feet for a closed loop or two pieces 136 feet if you are building an open loop. Place insulators on the wire so the side insulators can "float" or move a few feet to facilitate removing slack when the antenna is raised into the air. The in-

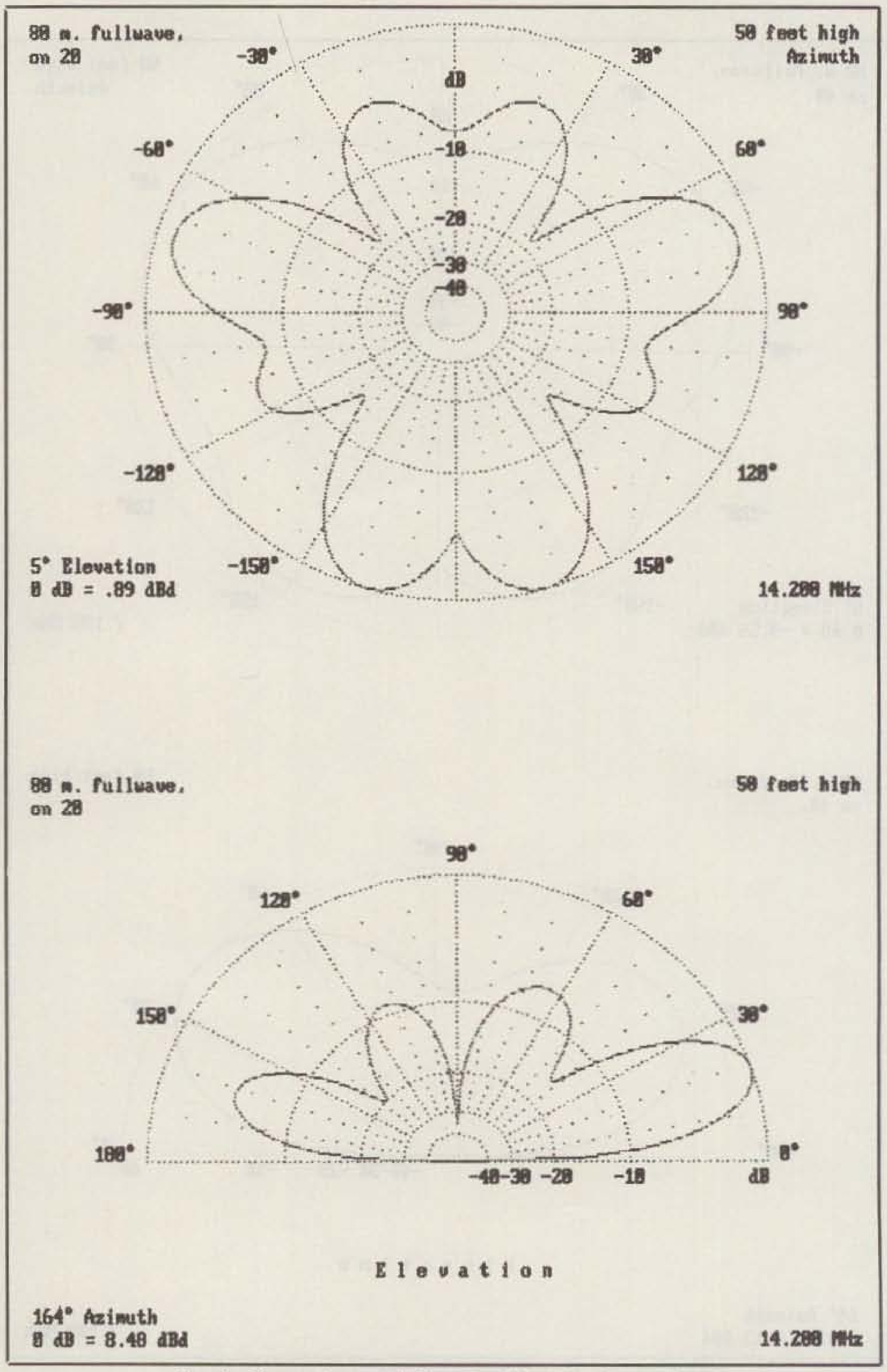

Fig. 3- Computer modeling of a 20 meter loop antenna.

sulators at the feed point and the opposite corner are stationary. Next attach the feedline. I fed the antenna with a balanced tuned line (also know as open-wire feeders). This type of feedline is essentially lossless at HF and can take a very high SWR with no adverse effects. A good line to use is the popular 450 ohm type twin-lead which is available from Certified Communications or Nemal Electronics (see *CQ*'s advertisers index). The antenna is now ready to go into the air.

Try to get your antenna 40 or more feet into the air. I am blessed with nice southern pines, and they make excellent supports. Specifically, this is the way I get my halyards into the trees. I use a closed-faced spinning reel taped to a wrist rocket with a half-ounce lead sinker attached to the 8 pound test monofilament line. The lead sinker can now be fired across a convenient branch on the tree. *One word of caution:* Be sure to trip the line release before firing the lead sinker. After you fire the lead weight across the tree branch, reel up the weight until it is near the branch and trip the line release. This will allow the sinker to fall to the ground close to the tree. Use the monofilament line to hoist a halyard. Notice how close the halyard is to the tree! This technique really works, but practice makes perfect.

Raise the antenna into the air and route the feed line into the shack using normal techniques for balanced feed lines. The antenna can be loaded through a transmatch. You should find the antenna loads well on all bands 80 through 10 meters for the closed loop or 160 through 10 meters for an open loop.

If space is at a premium at your QTH, you can use a length of 142 feet for a closed loop or two 71 foot lengths for an open loop. The closed loop will work 40 through 10 meters, and the open loop will work 80 through 10 meters. The gain will be reduced and the radiation will be higher, but it is still a good antenna.

Acknowledgements

I would like to thank Lew McCoy for the computer analysis and for his encouragement. To Tony and Jock, my friends from New Zealand, thanks for your help and keep building antennas.

Afterthoughts

I have heard there are only three antennas for any amateur—the one you had, the one you have presently, and the one you plan to build. This antenna has helped to postpone the one I plan to build. CQ

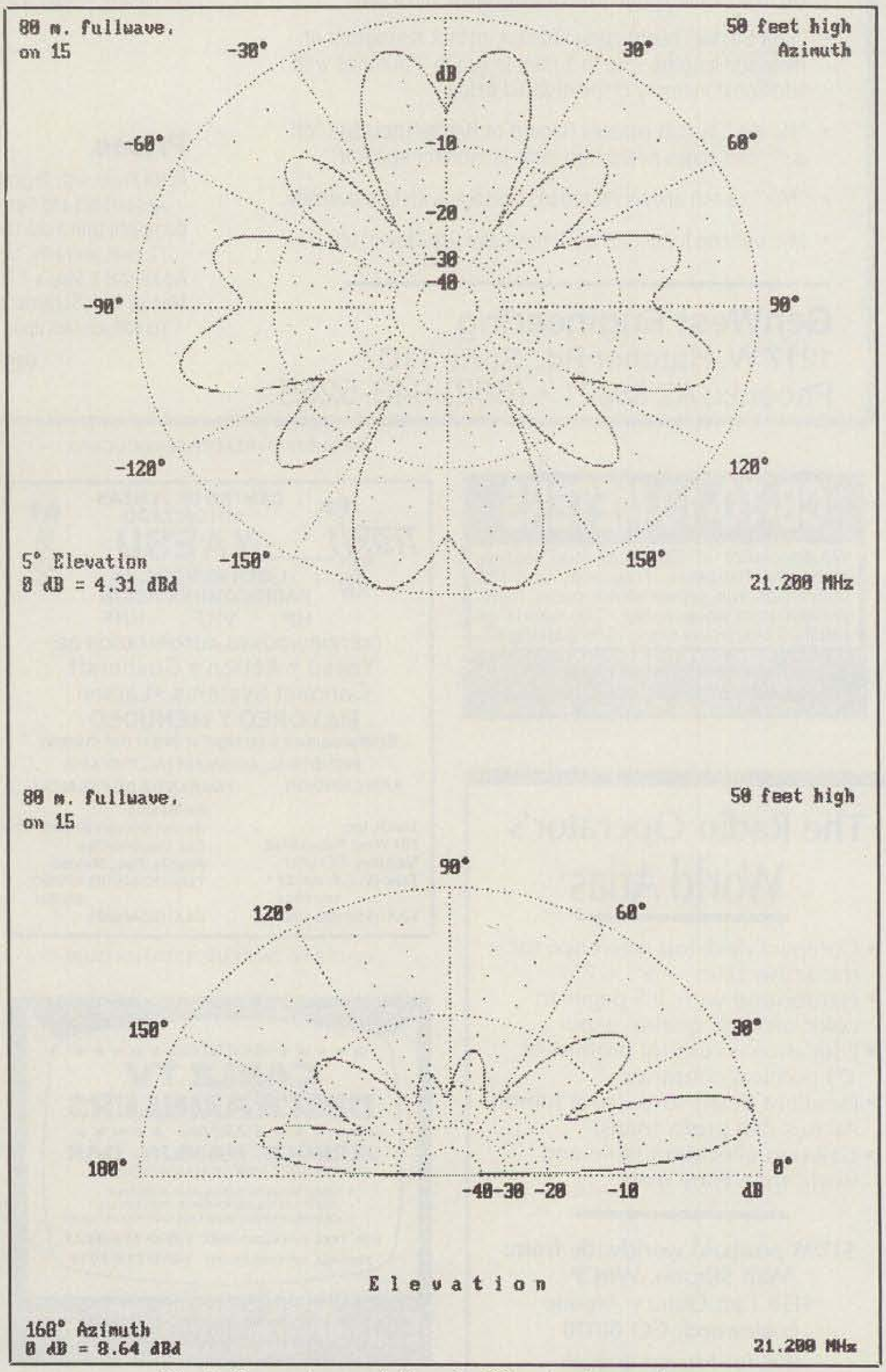

Fig. 4- Computer modeling of a 20 meter loop antenna.