As the song says, "Everything old is new again." Most of us, as WDØP explains, just need the motivation and curiosity, and most of all a problem that needs solving.

A Dual Polarization HF Antenna System That Reduces QSB

BY PHIL MORGAN*, WDØP

Just as the itinerant traveler gets itchy feet when he remains in one place too long, the amateur with antenna experimenting in his/her blood can only stick with one particular antenna for just so long before it must come down and a new, hopefully better, design is put up in its place.

Being terminally afflicted with the foregoing disease, and blessed with an understanding and forgiving spouse, our yard full of trees, prior to our full-time RVing years, was always strung with hundreds of feet of wire and rope. Each new antenna was carefully raised with hopes of a few more dB of signal.

In 1985, while working with directional arrays using vertical, half-wave dipoles, my attention was drawn to two magazine articles on the full-wave horizontal loop. The first, from an issue of *73* of unknown date, coined the name "German Quad" for the full-wave horizontal loop.[1] The author, a German amateur, WD4CPK/DF3TJ, wrote about the versions he and some friends had built and experimented with. The upshot was that the supposedly "high radiation angle" horizontal loop turned out to be an excellent DX antenna on wavelengths shorter than its design frequency.

Then in November of 1985 a *QST* article by Dave Fischer, WØMHS, triggered widespread interest in the horizontal loop, which continues still.[2] Fischer dubbed it "The Loop Skywire" and gave glowing reports of its performance on all HF bands, which essentially agreed with the conclusions drawn by WD4CPK/DF3TJ.

I decided to construct an 80 meter horizontal loop on my property using conveniently located trees as supports. The average height was about 30 feet, and I fed it at one corner with RG8 coax. The positive reports were confirmed by my experiences on all bands. It was one of

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Fig. 1– The subject of this article—a multi-band W9INN "Space Saver" dipole used in conjunction with an 80 meter horizontal full-wave length loop. →

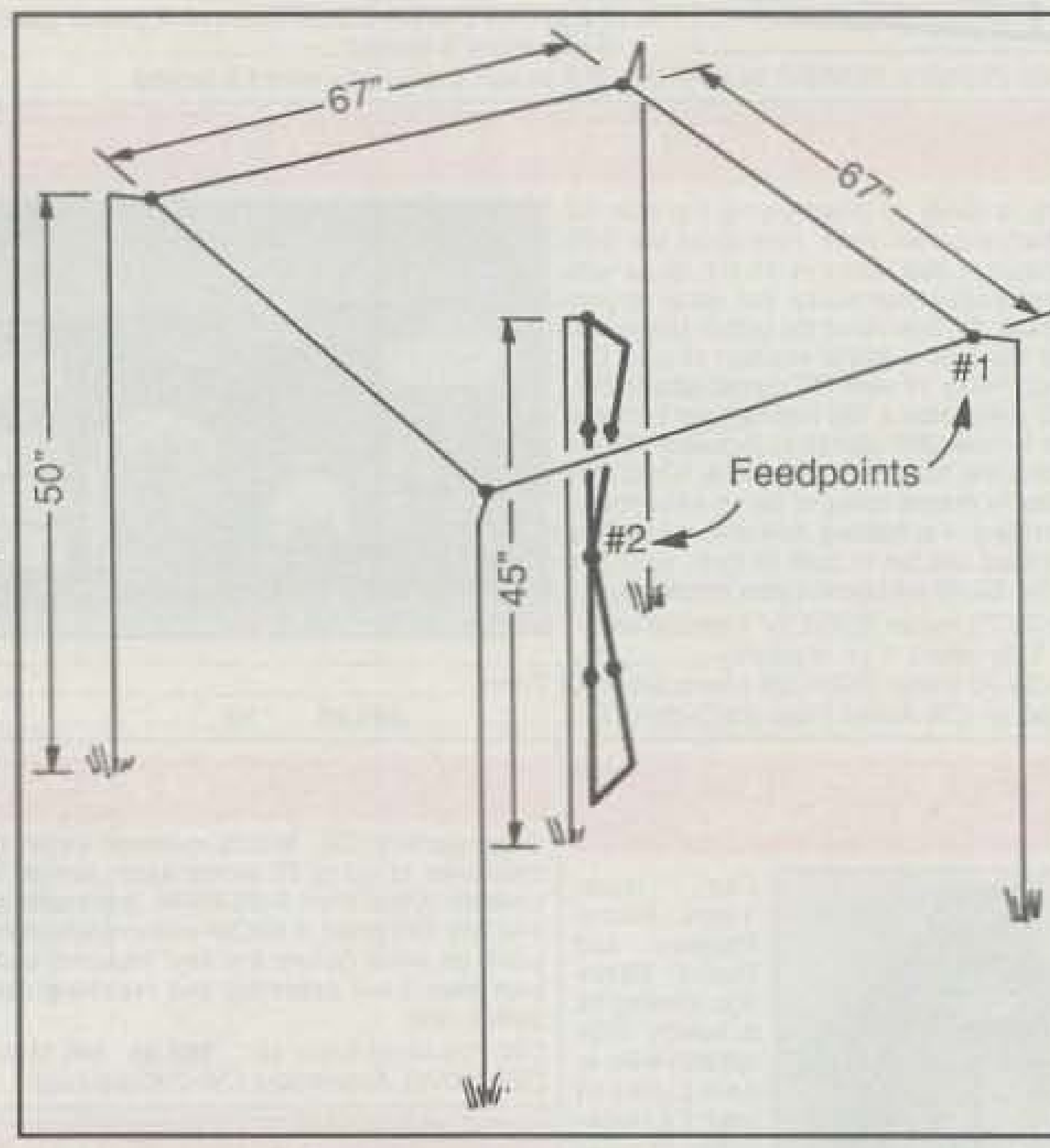
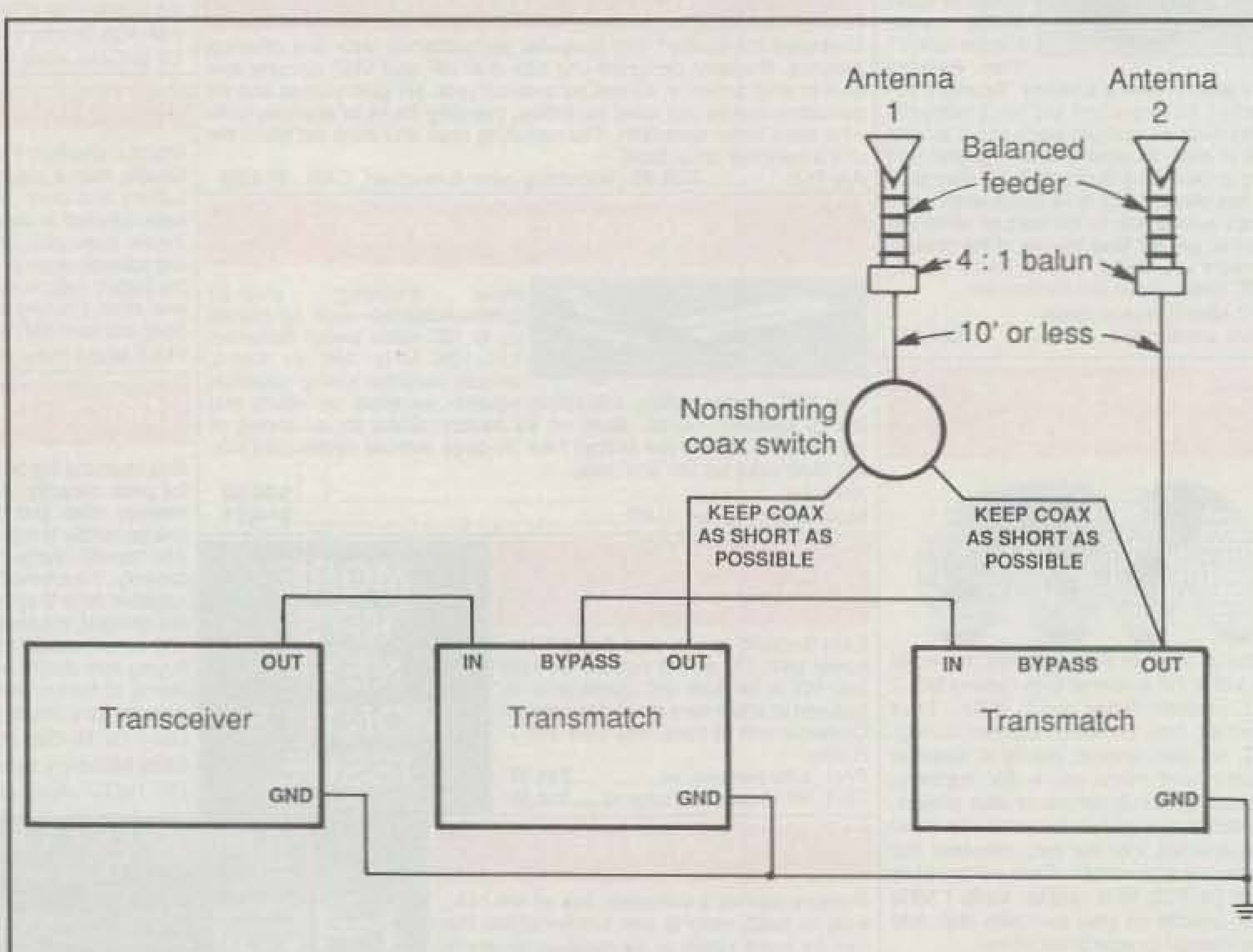


Fig. 2– By throwing two switches, this arrangement allows feeding either antenna singly through its own transmatch or feeding both antennas simultaneously through one transmatch. The baluns can be mounted outside the shack if connecting coax to the transmatch is kept no more than 10 feet long.



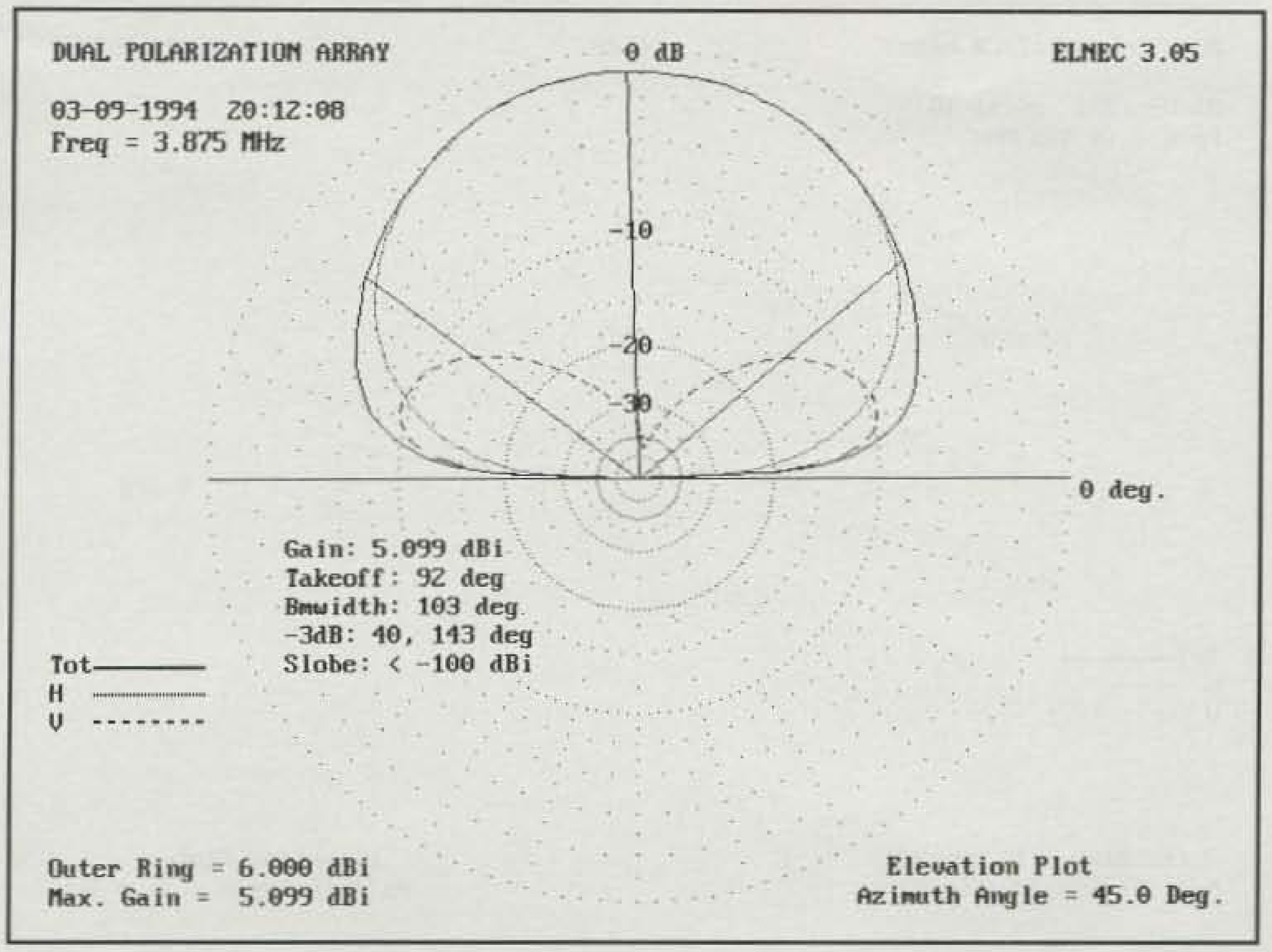


Fig. 3– ELNEC plot of 75 meter radiation angle of fig. 1, dual-polarization array over real ground. Dashed line is vertical radiation. Dotted line is horizontal radiation. Solid line is combined total radiation.

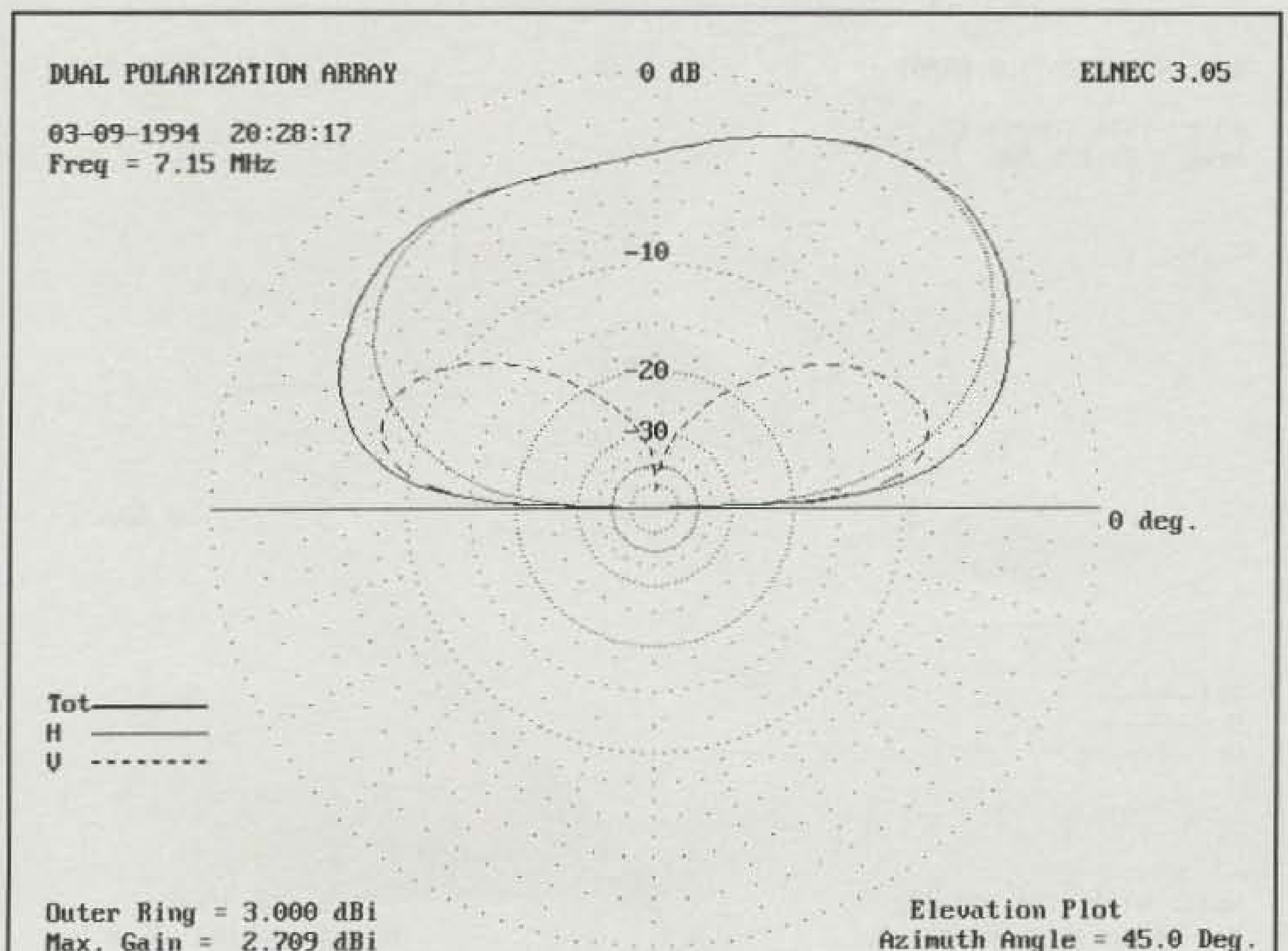


Fig. 4– ELNEC plot of 40 meter radiation angle of fig. 1, dual-polarization array over real ground. Dashed line is vertical radiation. Dotted line is horizontal radiation. Solid line is combined total radiation.

the best general-purpose, all-band antennas I had ever used.

At that same time I had one of my 42 foot long, W9INN, 5-band dipoles suspended vertically from a wood support mast, which just by chance was situated in the center of the horizontal loop (fig. 1). This vertical was fed with 450 ohm ladder line. Both antennas were tuned with a 2 KW transmatch in my shack.

I don't suppose there is an amateur anywhere who at one time or another hasn't tried switching between a vertical and a horizontal antenna for comparison purposes and discovered that in many cases when the signal is weak on the vertical, it will be strong on the horizontal antenna, but when it fades on the horizontal unit a switch to the vertical will reveal that the signal has climbed back up. We believe this effect results from continuous and random shifting of the signal's polarity as it is refracted by the "F" layer. Not all fading is caused by this phenomenon, but some of it definitely is. The above-mentioned antenna comparison is a quick and easy way to observe this effect. This test is not applicable in the case of short-distance, ground-wave communication where polarity would remain constant.

I began to think about the possibility of feeding both vertical and horizontal antennas simultaneously. I hoped for a reduction in QSB, but I wasn't sure just what would happen. Admittedly, my experiment was very unscientific—too many uncontrolled variables such as different types and lengths of feed lines, no control over percentage of power going to each antenna, etc. However, plunging ahead, I rigged a switching arrangement, with two identical transmatches (fig. 2), so that I could feed either antenna by itself and/or simultaneously.There seemed to be virtually no interaction between the two antennas. They both tuned almost exactly the same as they did when not in the presence of the other, as might be expected of two antennas with 90 degree polarity difference. Furthermore, the horizontal full-wave loop seems to be relatively insensitive to other antennas or objects which are located inside the loop. When simultaneously fed, only a slight adjustment of the transmatch was needed, which proved to be very convenient.

The results were astounding. There was significantly less fading on received signals when the antennas were paralleled than when either the vertical or the horizontal loop was operated singly. The effect was most pronounced on 20 meters through 10 meters, but was still noticeable on 40 and 75 meters.

I remember one rather dramatic 20 meter QSO I had simultaneously with two other amateurs, one in Virginia and the other in Oregon (I was living in Missouri at the time). Both stations gave me identical reports; QSB was quite pronounced when the vertical was used by itself and still present, to a lesser degree, on the horizontal loop. It disappeared completely, however, when the antennas were fed simultaneously. The report was "a steady S-9 signal with no QSB." Among my nighttime 40 meter friends I was getting the reputation of being a "big gun." In 1987 I upgraded to Extra class and moved into the DX window on 80 meters, where I

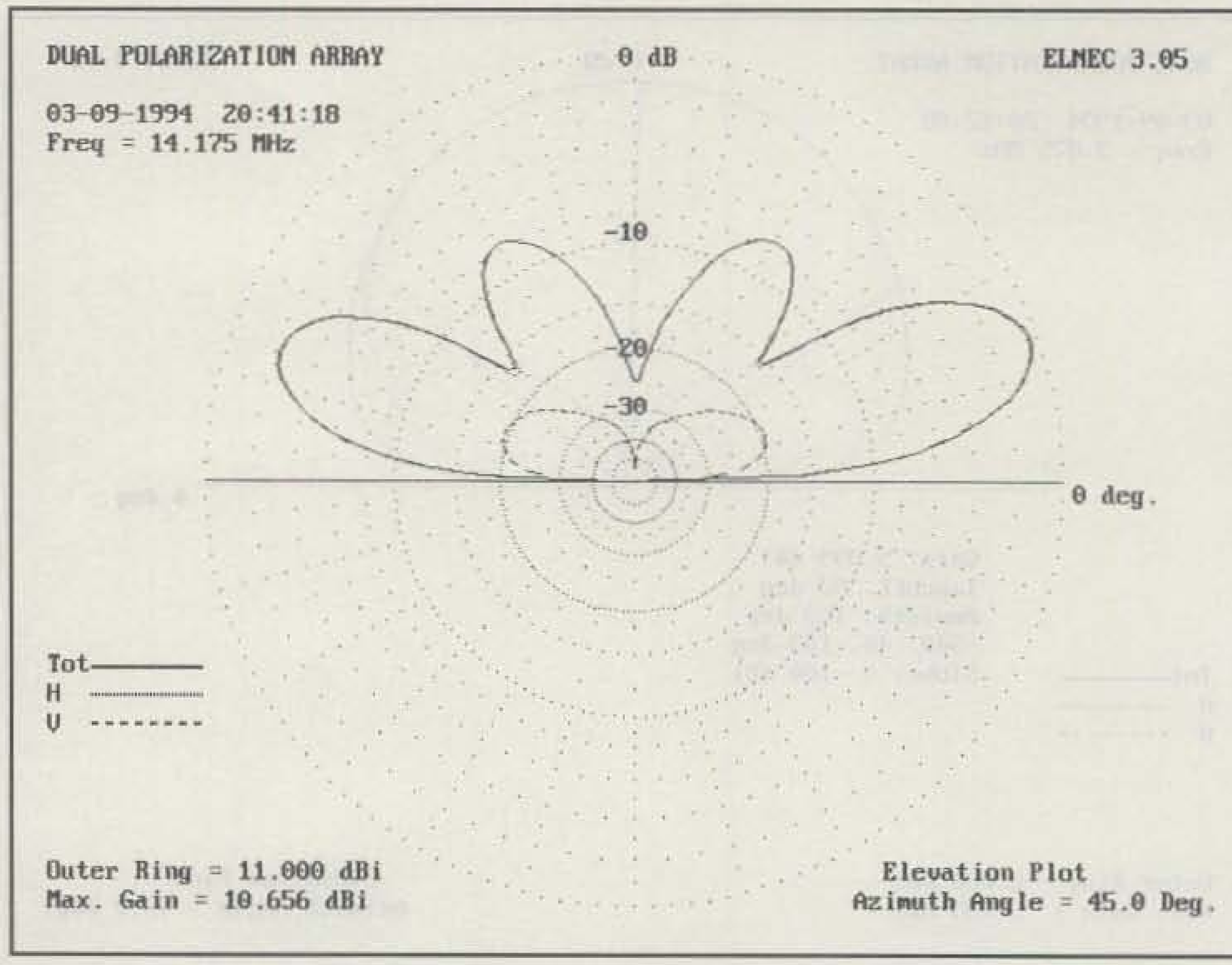


Fig. 5– ELNEC plot of 20 meter radiation angle of fig. 1, dual-polarization array over real ground. Dashed line is vertical radiation. Dotted line is horizontal radiation. Solid line is combined total radiation.

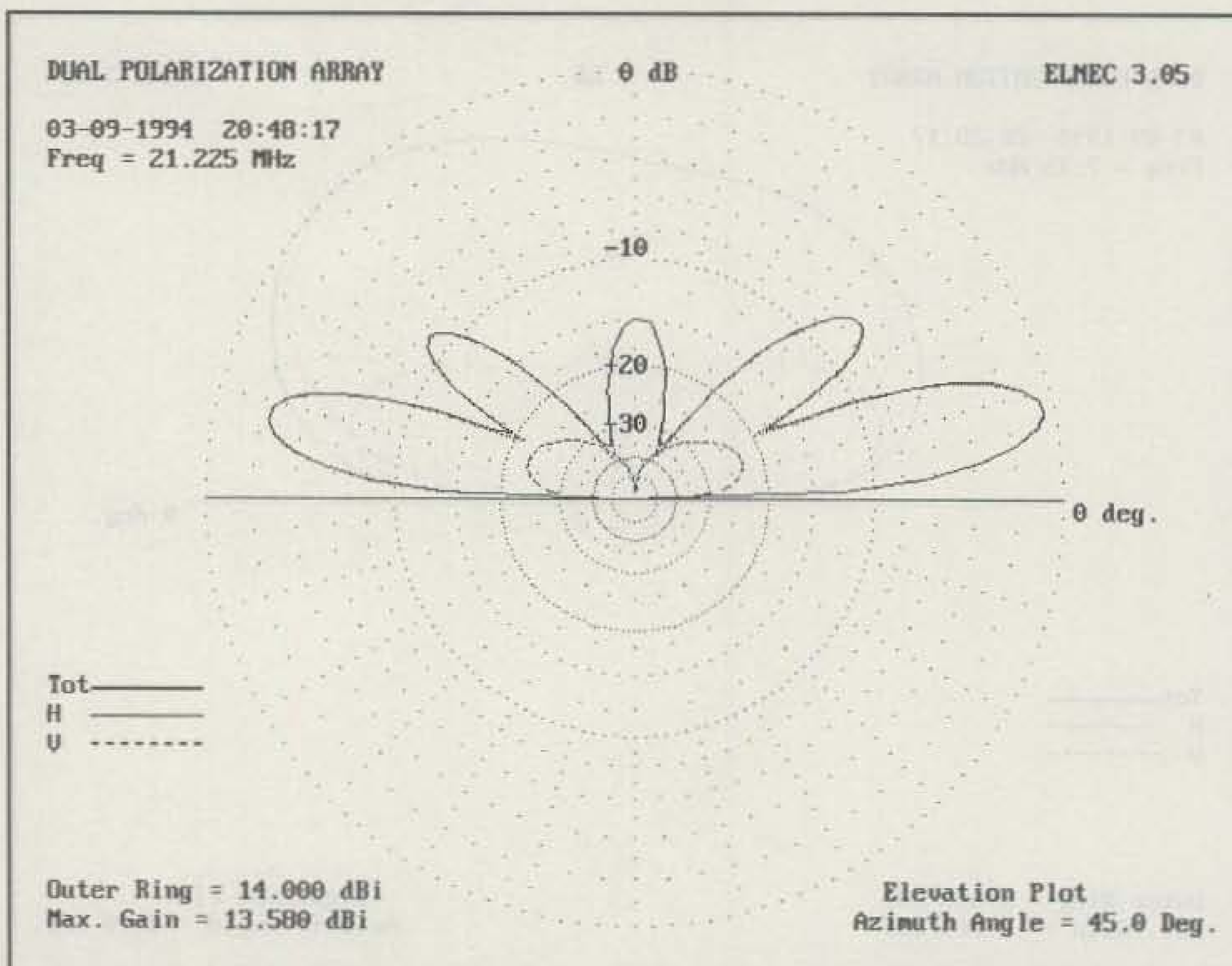


Fig. 6– ELNEC plot of 15 meter radiation angle of fig. 1, dual-polarization array over real ground. Dashed line is vertical radiation. Dotted line is horizontal radiation. Solid line is combined total radiation.

found I could use this system to successfully work the pile-ups right along with the big boys.

What was happening here? Obviously, this dual-polarization antenna system had no gain. However, I got repeated reports of "strongest signal I've heard on the band tonight," "steady signal with no fading," etc.

About this same time in 1987, while attending a local hamfest, I purchased a stack of old *QST* and *Ham Radio* maga-

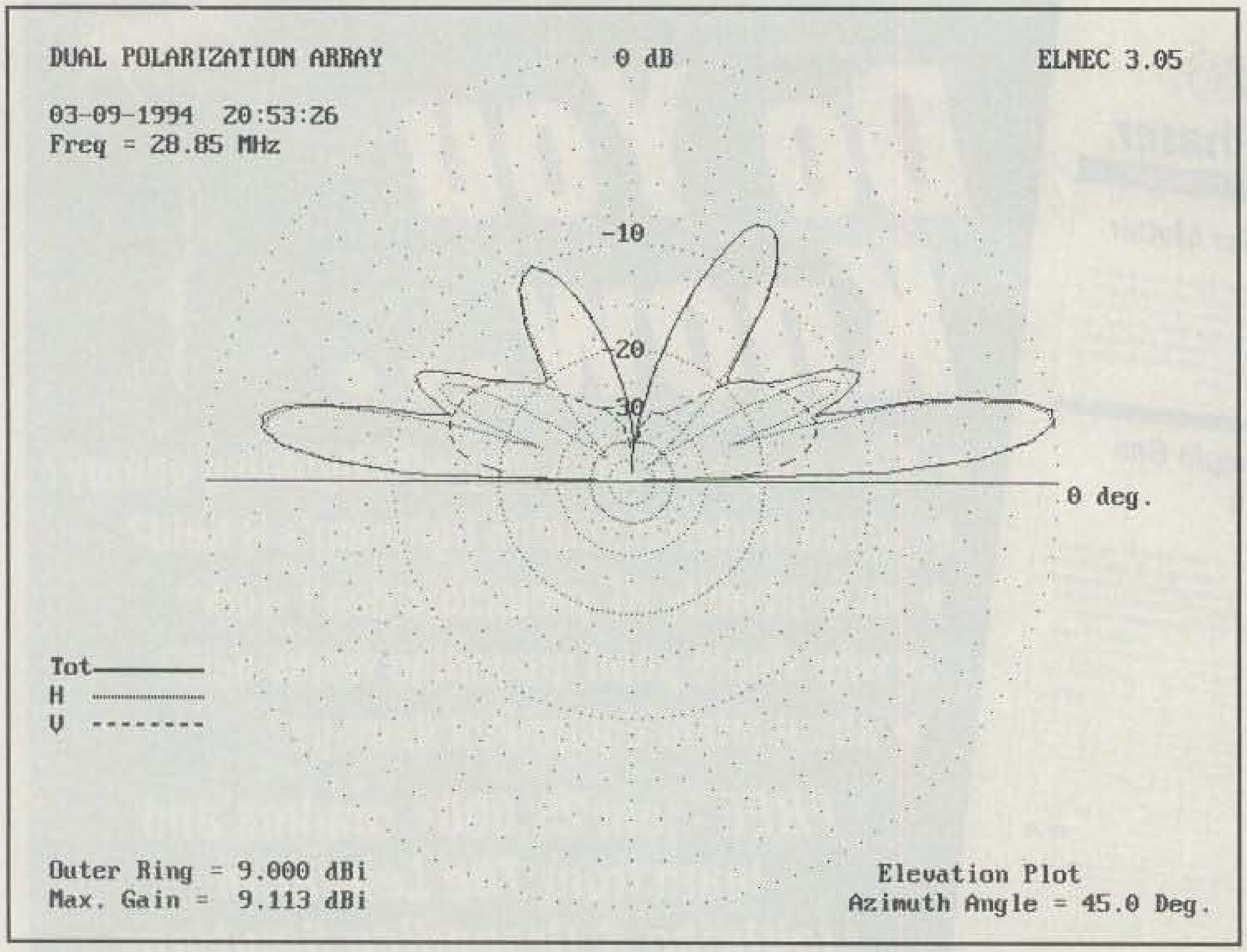


Fig. 7– ELNEC plot of 10 meter radiation angle of fig. 1, dual-polarization array over real ground. Dashed line is vertical radiation. Dotted line is horizontal radiation. Solid line is combined total radiation.

zines dating back well into the early to mid-1970s. In the March 1972 issue of *QST*[3] I discovered an article by Walter J. Stiles, W7NYO, on virtually the same subject matter we've been covering here. However, Stiles used a more carefully controlled test setup than I did. He mounted two Yagi/Uda beams on his tower, one horizontal and the other vertical. He fed them with separate amplifiers in order to control and equalize the power going to each antenna. The most remarkable part of the article was the summation of the results in which his observations on signal strength, readability, and reduction in QSB were exactly the same as mine, the difference being that his installation was much more expensive and difficult to erect than my wire antennas.

Subsequently, other related interesting and informative articles appeared. John H. Mullaney, W3NGJ, wrote about use of variable power splitting to achieve polarization diversity[4] in February 1986 *Ham Radio*, and B. Sykes, G2HCG, related his experiences with enhancement of signals through control of polarization in his article[5] in the November 1990 issue of *Communications Quarterly*. These articles all examine the same phenomenon, but each with a different approach, and they are worth reading if you should decide to experiment.

The W9INN "Space Saver" dipole is ideal for this antenna system. It is only 42 feet long and works very well on all HF bands if fed with ladder line and a good transmatch. Used as a vertical dipole, the feed point is at least 21 feet above the ground. Therefore, a radial system is not necessary to isolate the vertical from lossy earth. I supported this vertical with an ordinary wood mast as described in my 1986 copy of *The ARRL Handbook for the Radio Amateur.*[6] However, any vertical, such as the plain vanilla quarter wave vertical, should work if you use an adequate radial system.

If you are interested in reducing fading of your transmitted and received HF signals, you might want to give the arrangement shown in fig. 1 a try. Construction is simple and straightforward. There is certainly nothing difficult about putting up a horizontal loop, and W9INN's ads can be found in virtually every amateur radio publication, including this issue of *CQ*. It certainly worked for me in a big way.

In conclusion I would like to thank my good friend Harvey Tetmyer, K5LJM, for his advice and assistance, particularly in the preparation of antenna radiation plots using ELNEC version 3.05.

It is my hope that this article will inspire further experimentation by interested readers and that at least some of them will report their results in the pages of *CQ*. Good luck and good DX.

Footnotes

1. Janker, Christoph, WD4CPK/DF3TJ, "The German Quad," *73 Magazine*, date unknown.

2. Fischer, Dave, WØMHS, "The Loop Skywire," *QST*, November 1985.

3. Stiles, Walter J., W7NYO, "Dual-Polarization DX Antennas" *QST*, March 1972.

4. Mullaney, John H., W3NGJ, "Achieve Polarization Diversity Through Variable Power Splitting," *Ham Radio*, February 1986.

5. Sykes, B., G2HCG, "The Enhancement of HF Signals by Polarization Control," *Communications Quarterly*, November 1990. (Reprinted from *Practical Wireless*, November 1989.)

6. "Simple Wooden Mast," *The 1986 ARRL Handbook for the Radio Amateur*, 63rd ed., chapter 37, p. 20. ■