The Taylor Vee 20m Antenna

"Anything you don't understand must be magic!"

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This antenna was designed by Singleton Taylor KB5IAY, as an effort to solve two of the most common shortcomings of simple low-cost antenna systems for 20 meters: lack of real estate and difficulty of SWR adjustment. There was another fairly serious design constraint, as well, readily understood by most hams—limited hobby funds.

The antenna was designed as an inverted vee, allowing it to fit into an available side yard, among several other antennas already in place. The inverted vee is a standard dipole antenna, with the ends drooping down from the center feedpoint.

Since dipoles have somewhat directional antenna patterns, with maximum radiation at right angles to the plane of the conductors, fairly deep nulls exist off the ends of the antenna. This was addressed by mounting the antenna on a PVC pipe framework, and using a light-duty Radio Shack™ TV antenna rotator to rotate the entire assembly.

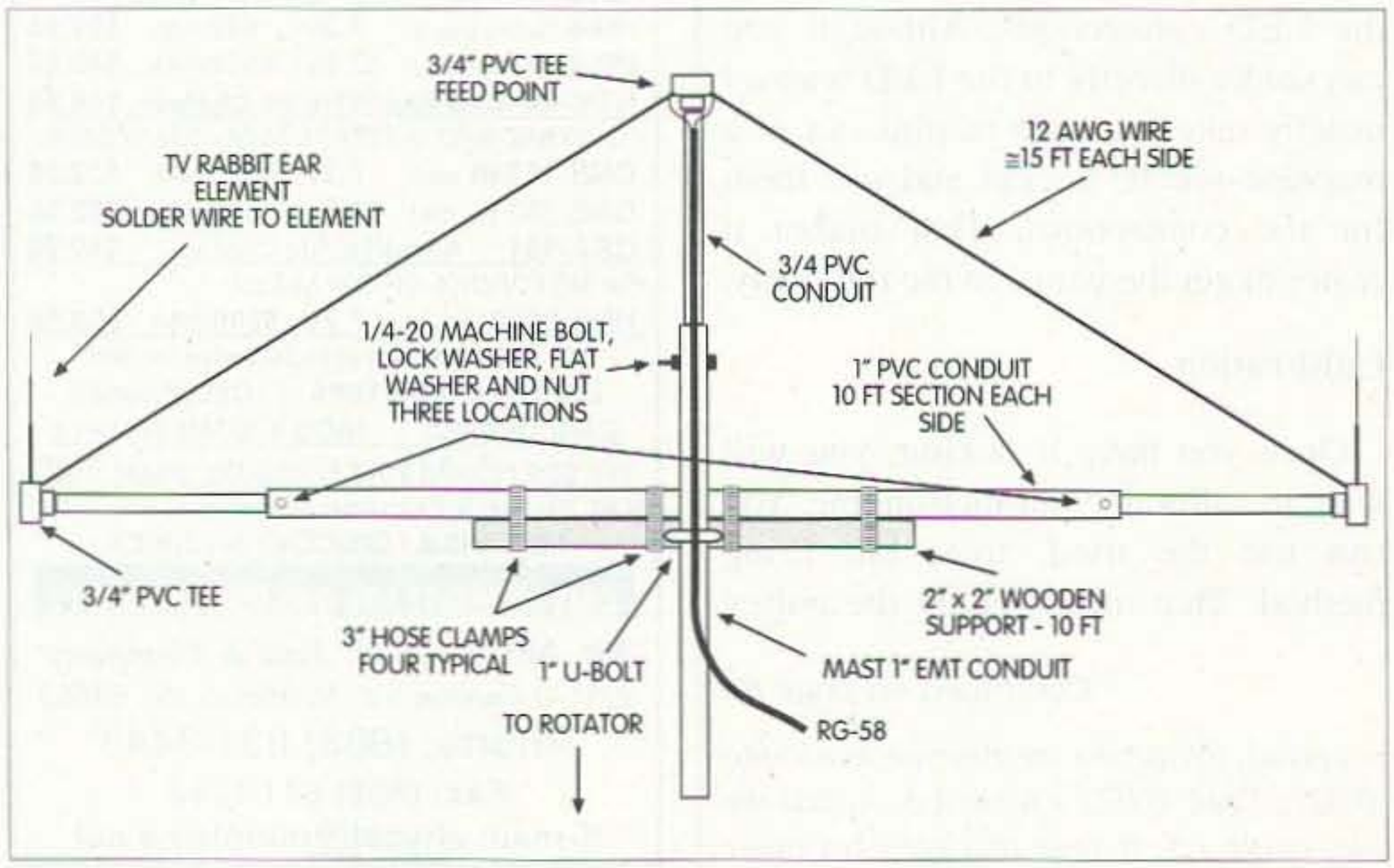

Fig. 1. *The Taylor Vee (drawing not to scale).*

Build simply

The entire assembly is mounted upon a five-foot piece of two-inch EMT conduit, driven about three feet into the ground. See **Fig. 1**. The main vertical support is a single 10-foot joint of one-and-one-quarter-inch EMT conduit, slipped inside the two-inch EMT ground support.

The Radio Shack rotator is mounted at the top of this conduit. The entire antenna assembly support framework is then mounted to the rotator.

The vertical support for the center feed of the antenna is a 10-foot joint of one-and-one-quarter-inch EMT conduit, clamped into the rotator. The top of this vertical support is split for about six inches, and a single joint of three-quarter-inch PVC conduit is slip-fitted into the joint and clamped with pipe clamps to extend the vertical support an additional three or four feet.

A three-quarter-inch PVC tee is mounted at the top of this three-quarter-inch PVC extension. It becomes the support for the antenna feedpoint.

Parts List

Qty.	Description
2	1" PVC pipe, 10-ft. length
1	3/4" PVC pipe, 10-ft. length
1	2" x 2" wood, 10-ft. length (crossarm)
1	1-1/4" U-bolt
4	Hose clamp to secure PVC pipe to crossarm
2	5/16" x 1" machine bolts with nuts
3	3/4" PVC "T"
1	Light-duty TV rotator (RS# 15-1225)
50 ft.	Rotator cable, 3-conductor (RS #15-1149)

scrounged rabbit ear antenna

1-1/4" EMT conduit for mast, length dependent upon height

#12 AWG THHN antenna wire (approx. 30 ft. required for 20 m antenna)
Total length of antenna = #12 AWG + rabbit ear extensions.
L = 468/freq in MHz.

Table 1. Parts list.

Just above the rotator, the horizontal support is mounted to the one-inch vertical EMT conduit. The horizontal support is formed of two joints of one-inch PVC conduit, joined by a PVC coupling. This, in turn, is supported by a 10-foot section of 2 x 2 lumber, U-bolted to the vertical pipe. The one-inch PVC is secured with hose clamps to the 2 x 2 horizontal support in four places.

The horizontal support is further extended by slip-fitting a three-foot section of three-quarter-inch PVC pipe into each end of the one-inch PVC horizontal support and gluing a PVC tee onto each end of this three-quarter-inch PVC horizontal support, with one port pointing up. The tees are the attachment points for the antenna ends, and mounting for the VSWR adjustment elements. The three-quarter-inch PVC extensions, with the PVC tees attached, are secured into the one-inch horizontal supports by one-quarter-inch bolts through holes drilled through both PVC pipes.

Details, details ...

The basic antenna is built from 12 AWG THHN insulated electrical wire, available at any hardware store. The drooping radials are attached to each side of the PVC tee, mounted at the top of the vertical support, and the coax feedline is soldered directly to the antenna elements. Since only low-power (100 W) operation is envisioned, RG-58C/U is employed as feedline. The antenna conductors are attached by drilling holes through the PVC tee, and looping the antenna conductor through the hole, before soldering. No matching transformer or balun was used, as impedance of the feedline (52 ohms) was close enough to the anticipated feedpoint impedance.

The drooping ends of the radials are secured to the PVC tees at the end of the horizontal supports with electrical tape. The length of each side was cut to approximately 14-1/2 feet, with the remainder of electrical length (approximately 16-1/2 feet total, depending upon desired frequency of operation) to be made up by the adjustable VSWR elements mounted on the ends of the antenna. The elements droop at about 34 degrees, for no particular reason other than the space available.

Adjustable VSWR elements

In order to adjust the electrical length of the antenna, adjustable elements were improvised from rabbit ears salvaged from an old TV set. One of the sliding elements was mounted at each end of the horizontal support, and the antenna conductor was soldered to this element.

A short section of wooden dowel was driven into the top end of each of the PVC tees mounted at the ends of the horizontal support. A vertical hole (to fit) was drilled through each dowel, and the rabbit ear element was pushed through the hole and glued into place. The antenna conductor was then soldered to the bottom end of the element, allowing easy adjustment of antenna electrical length (VSWR), without having to drop the entire antenna assembly.

Must be magic

Hams who have used this antenna claim it outperforms a conventional

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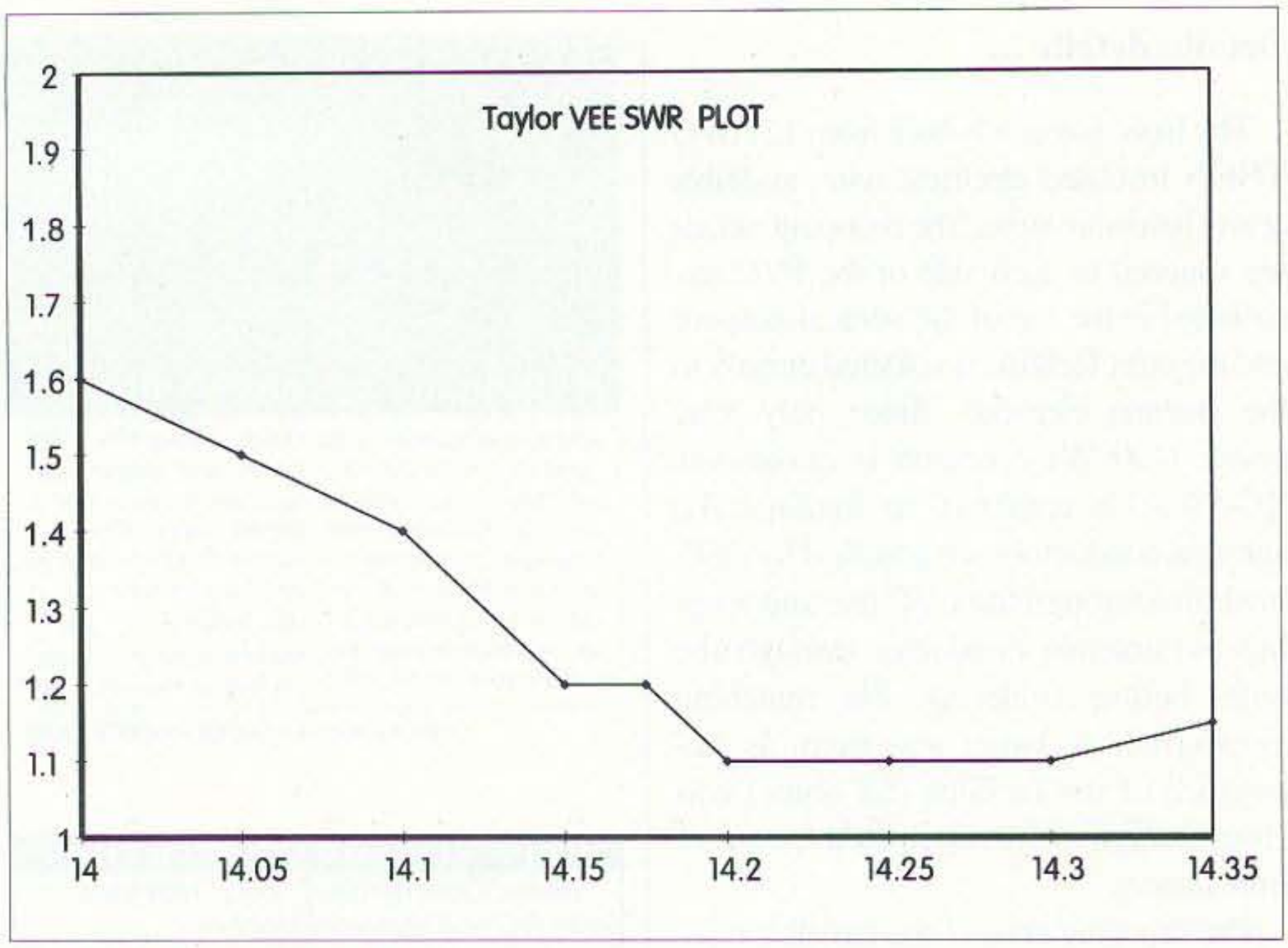

Fig. 2. Taylor Vee SWR plot.

dipole, under similar conditions. In an effort to better understand this apparent performance improvement, some rudimentary testing was done of both VSWR and radiation pattern.

VSWR was measured across the entire 20-meter band, and proved to be usably low across the entire band, with near-perfect match in the phone portion of the band. Due to the adjustable elements, this was easy to shift in frequency. The wide VSWR bandwidth was a pleasant surprise. No VSWR testing was done outside the 20-meter band limits. See **Fig. 2.**

A simplistic measurement of a single point received signal was made, to roughly determine the radiation pattern of the antenna. An IFR-500 service monitor was used as a signal source, and the station transceiver, a Kenwood TS-440, was used in receive mode to measure strength of received signal vs. antenna orientation. Signal strength was adjusted to give nominal mid-scale S-meter readings. S-meter readings were recorded vs. antenna position, and plotted to represent antenna pattern.

Because of the design of the antenna, with drooping radials, and vertical VSWR adjustment stubs at the ends of each element, it was decided that any assessment of correct polarization would be a wild guess, so we opted to use a transmit antenna (IFR-500) aimed at about 45 degrees above the horizon as a "best guess" compromise.

Antenna boresite was determined, using the MK1 Mod 0 eyeball, by setting the antenna element perpendicular to the line to the IFR-500. The signal source was located several hundred feet away, to avoid near-field effects.

The antenna was rotated in approximately 15-degree steps around the signal source direction, and S-meter readings were recorded at each step. The azimuth indicator on the rotator was used for direction readings, which were quite coarse.

S-meter readings were converted to dB, relative to boresite amplitude, and recorded vs. direction. No calibration of the receiver S-meter was done, and we assumed 6 dB per S-unit. After recording, these readings were input to a C++ program, part of a radar antenna modeling software package developed by WA5NPQ for Wright Labs, and expanded to 4096 points. The points entered were extrapolated by software, by using the current point measured, the last point measured, and the next point measured, and applying a curve-determining algorithm to determine the approximate value of the intermediate points.

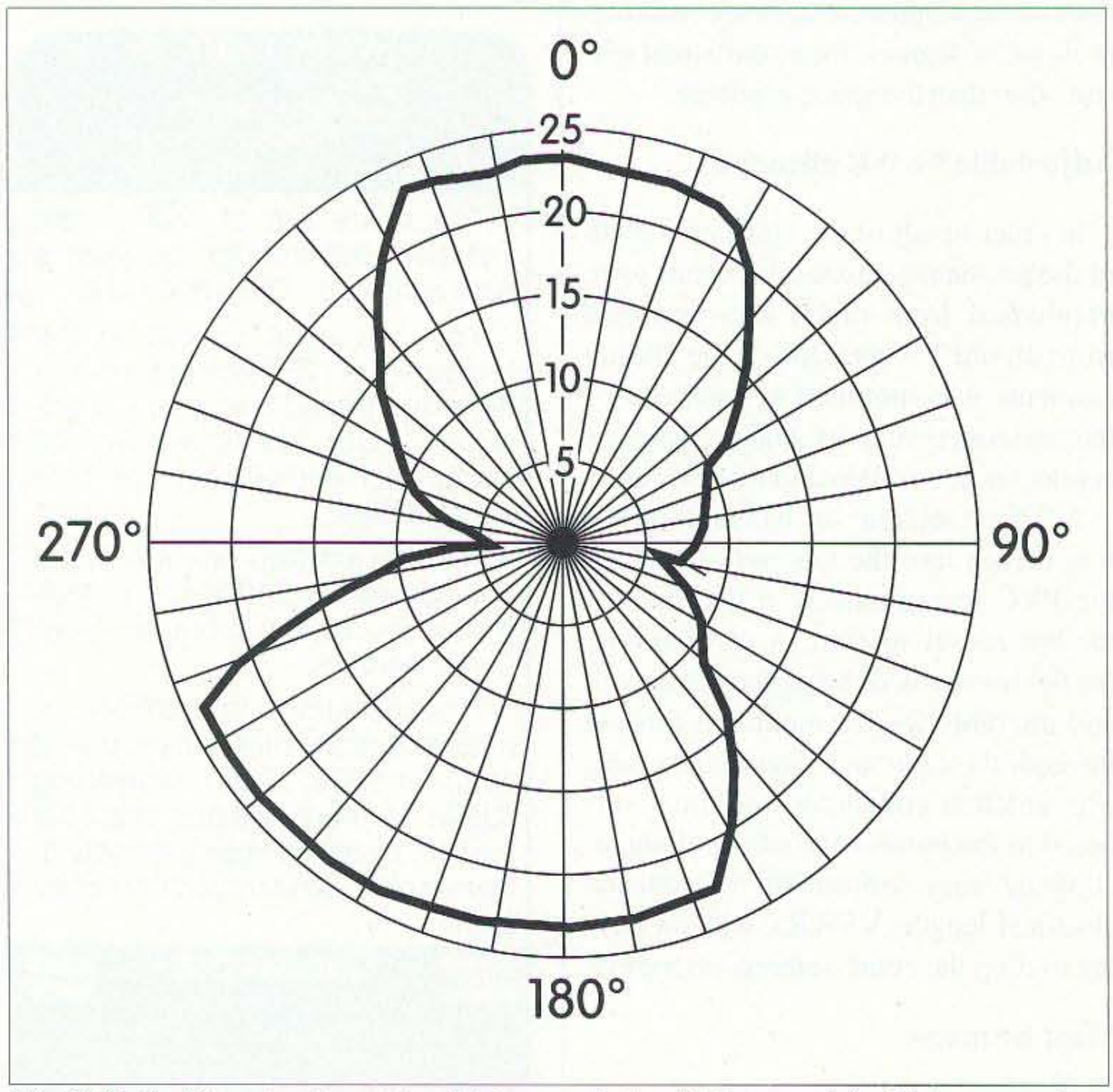

Fig. 3. Taylor Vee azimuth pattern. Units are relative field strength in dB. Antenna plane lies on 270-90 degree line.

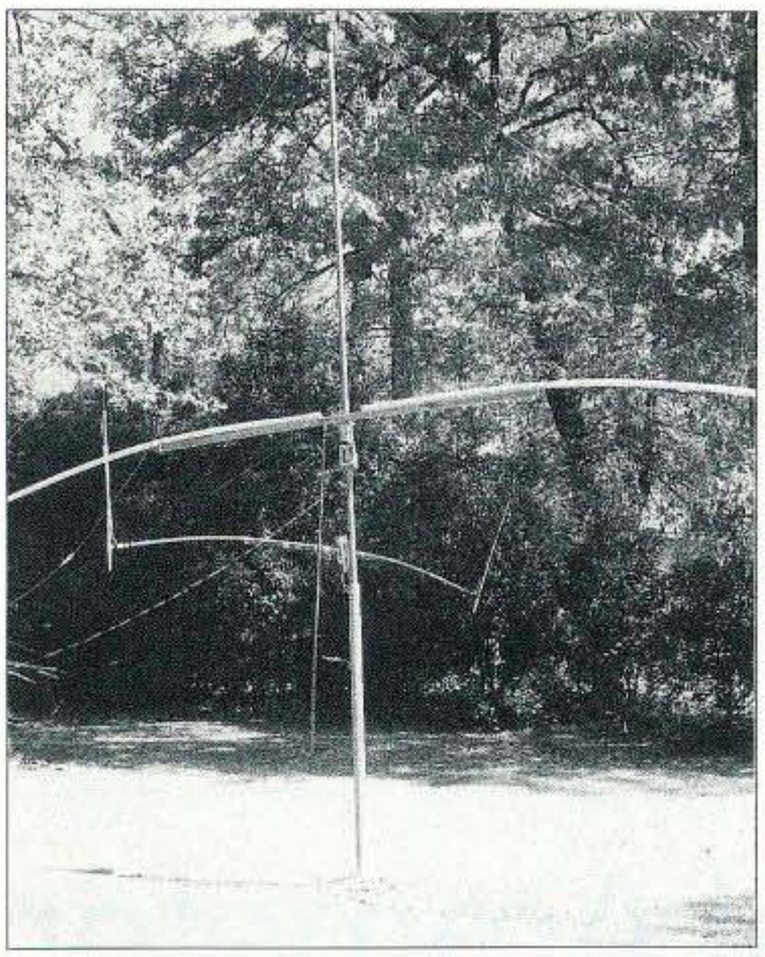

Photo A. *"If it ain't broke, don't fix it."*

The resulting data was imported into Microsoft Excel®, and plotted as a circular (radar) plot (**Fig. 3**). The resulting plot essentially follows the classic expected dipole characteristics. There are some discontinuities, due to the rough measurement techniques. In addition, some distortion is present, and can probably be attributed to current unbalance in the feed (no balun used), to errors in boresite angle determination (MK1 eyeball calibration), and to errors in angle measurement (Radio Shack azimuth indicator).

Getting there for less

Using ingenuity and a minimum outlay of bucks, the designer ended up with an antenna which fits his available space, is easily adjustable for VSWR, and can be rotated, so no nulls are present. Using only the TS-440 barefoot, he is able to hold his own in the DX quest. He has been able to work as far as Australia and the Cape Verde Islands fairly consistently, working VK6ACY and others on multiple occasions, with very favorable signal reports. Medium and short skip has also been consistent, with excellent results. Why does it work so well? We're still not sure. An entire afternoon of measurement did nothing to improve our understanding. However, we're sticking to two widely accepted engineering maxims: "If it ain't broke, don't fix it!" and "Anything you don't understand must be magic!" 73

NEVER SAY DIE

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Only about 22% of all amateurs are ARRL members, with the trend being toward us old-timers over 50.

The ARRL Board of Directors is loaded down with old-timers like NM7N (71), W4RH (73), WA6WZO (60), and W9PRN (85). Other officers are NØBCI (89), KØTO (66), W6CF (65), and N4MM (61), so perhaps it's no wonder that the League seems to be almost totally out of touch with the bulk of today's hams.

Looking at the results of the last board meeting, I notice that a proposal to increase HF privileges for Novice and Tech-Plus licensees was quickly voted down. Figures. They also rejected a proposal even to study the feasibility of reducing the number of license classes. I've been proposing for years that we have one class of license.

Fellow League members, do you recall ever being asked your opinion on these matters? I know I never have been.

The board decided to push the FCC to better enforce our rules so we won't have to listen to so much bad language on the HF bands. And that, of course, means that the League is going to pressure the FCC to allocate more money to policing our bands — something which I feel we should be doing ourselves. One of the things we've often bragged about is being self-policing. So here we have a government bureau which has been cutting back and auctioning off parts of the spectrum and we're demanding that they spend more money on us because we are unable to keep control of ourselves. Could this demand for more services prompt the commissioners to question the relevance of amateur radio in today's world?

I didn't see anything in the board meeting report about the ARRL initiating any efforts to clean up the mess some of our older hams are making of our HF bands. Every time I bring this up I get accused of League bashing. Well, as a member, I feel it is the responsibility of my organization to help keep our bands clean. The League should also be making a maximum effort to attract new hams. Instead, I get the overwhelming impression that the powers that be at the League are more intent on keeping QRM down by limiting, as much as possible, the number of hams on HF.

The board agreed to push the FCC to establish the League band plans as part of their official regulations. Talk about a power grab! Leaping lizards! Do you agree with this social engineering move?

Heck, our present band plans don't reflect our current use of the bands. We have wide open and virtually unused CW bands, which fewer than 10% of us who are active are using with any regularity, and crowded phone bands for the other 90%. Considering the channel space required for CW vs. phone, the plans are all the more inequitable.

Somehow I'm reminded of the National Computer Conference, which put on computer shows every year. The shows had hundreds of exhibitors and drew over 100,000 attendees. But they, like the rest of the mainframe and minicomputer industry, ignored microcomputers. Today most of the mainframe companies are out of business and the minicomputer companies about gone, too. I loved it when Compaq bought what's left of DEC. What has happened to Prime, Data General, Wang and the rest? The National Computer Conference blew away with the rest of the old computer industry.

Even the largest of organizations has to stay relevant or they're soon history. Will there be an ARRL in ten years? Will I be getting my 70-year pin? I expect to be around, but I'll be surprised if the ARRL is — unless they start wising up and making themselves relevant to the majority of the hams. Right now, at least 78% of the hams don't think the ARRL is relevant. If we count in the members who agree that some big changes need to be made, we might be pushing 90%. No wonder the directors aren't asking us our opinions and then reflecting them at their meetings.

FCC vs. the Constitution

The requirement in Article I of the Constitution that Congress make all laws has been ignored ever since FDR grabbed the reins 66 years ago. We've gradually gotten used to government agencies enacting legislation, and our blessed liberal courts have put up little resistance. If you go into court today and cite the Constitution to support your case, you'll get laughed out of court. Judges are making laws. Government agencies are making laws, and little of this is benefiting us.

Congress has remained silent while federal judges have usurped their power to levy taxes. Congress has remained silent because you have remained silent.

The latest power grab has been by the FCC. Yep, our semi-beloved benefactor has stuck its hand into the public pocket with a tax on telephone companies to finance Internet services for public schools and libraries. This tax will, of course, be passed along to you with higher charges. The phone companies wanted to at least

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