

# How to Gain with PVC

*This could be history's cheapest quad.  
Try water pipe on 2m.*

To find out why I need a very portable, high-gain 2-meter antenna, first you must understand a bit of both ancient and recent California history.

About 15 million years ago (an extremely short while, geologically speaking), the Earth groaned and shuddered; huge rock plates cracked together, and the

spiny hills known as the Sierra Nevada started to rise 20 to 30 thousand feet into the air. Huge volcanoes resulted from this immense pressure and uplifting, and these 30,000-foot peaks belched smoke and lava, breaking themselves into smaller hills (like Mt. Whitney, "only" 14,000 feet high) and deep valleys, which in time became huge lakes. Lake Ta-

hoe, 6000 feet high and unknown thousands of feet deep, is the result of one of these huge cindercones blowing its top and then collapsing back in upon itself, a classic case of a mountain lake surrounded by peaks many thousands of feet high.

At about this time, Tehama, one of the minor volcanoes of the range, also ex-

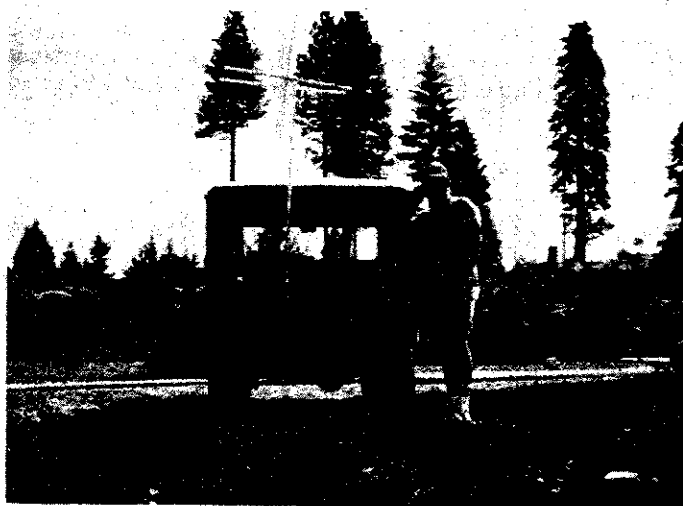


Photo A. The author, with quad mounted on the jeep.

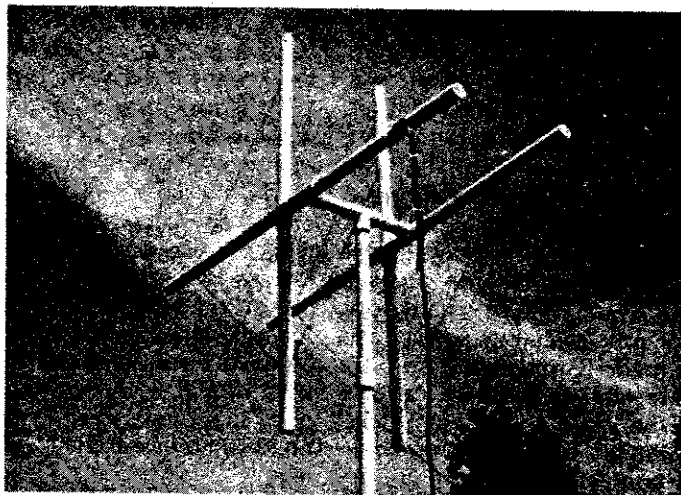


Photo B. The quad in assembled form.



Photo C. The balun attached to the quad driven element.

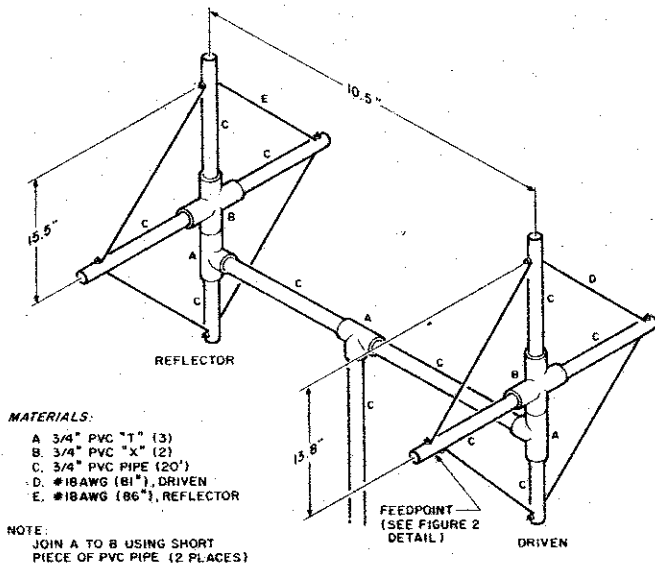


Fig. 1(a). PVC quad.

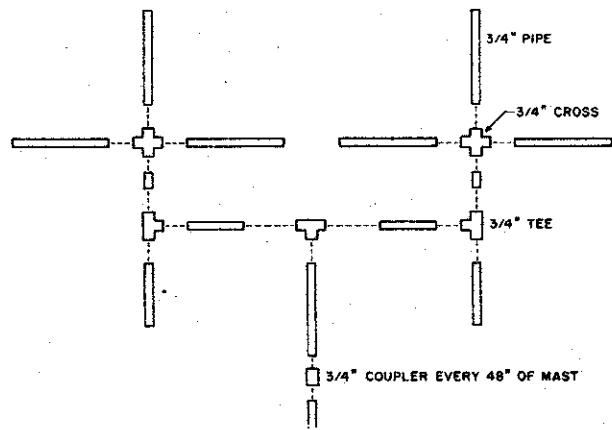


Fig. 1(b). PVC assembly.

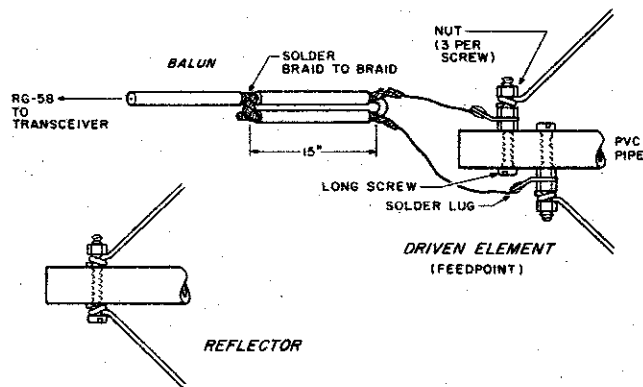


Fig. 2. Feedpoint and balun detail.

ploded, creating a secondary volcano called Mt. Lassen. In the process, a deep lake surrounded by peaks, called Lake Almanor, was formed. Later, about a million or so years ago, an earthquake created a crack in the hills surrounding Almanor. The escaping water created the Feather River and its deep canyon.

Now for more recent history. A couple of years ago, a local group of pilots decided to hold a rather unique air race. Instead of merely the fastest being the best, this group decided to award a trophy to the airplane that hauled the biggest load on the least fuel the fastest. They called this 400-mile race the "Competition for Aircraft Fuel Efficiency," since shortened to the CAFE 400.

All of which brings us to the present day. One of the checkpoints in the race is an island in Lake Almanor, and the race folks wanted reports from Almanor back to race headquarters in the Sonoma Valley, some one hundred fifty miles away, preferably on 2 meters. In case you don't get the picture yet, let me paint it in vivid colors: Here I sit on an island in the middle of a lake, surrounded by hills 3 to 4

thousand feet high in every direction, with no ac power, no telephone, and a mission to communicate via 2 meters to another station 150 miles away, which is further tucked into another valley blocked by another mountain range 4500 feet high!

Fortunately, this deck has 3 aces and I drew them all. First, there is a little knoll on this island that will get me up 500 feet above the lake. Second, the Feather River Canyon, although only half a mile wide, is 3000 feet deep, 40 miles long, and pointed directly at Sonoma. Third, Sonoma has a 2-meter repeater on one of those 4500-foot peaks just outside of town.

And the ace up my sleeve (without which we would have lost the game) is my portable quad antenna. 50 Watts and a vertical dipole bought us absolutely nothing, but with the quad antenna described below, signals were Q5 both to and from the lake. See Photo A.

There were some specifications on this quad, though, that made it rather unique. First of all, the entire antenna and mast needed to be disassembled and packed into a bundle of sticks no longer than a meter and a quarter (48"), a size suitable

for backpacking (if necessary) a considerable distance. Second, it needed to be put together in 15 minutes or less. Third, of course, it needed to be cheap, cheap, cheap. See Photo E. I decided to make the entire antenna-supporting structure from 2-cm (3/4") polyvinylchloride (PVC) water pipe and fittings. Photo B shows the general construction details, and Figs. 1 and 2 show construction details of the quad. In working with PVC fittings, I found that the fittings were all tapered, with the result that if the pipe was inserted firmly into the fitting, the assembly was rigid enough to stay together without the use of pins, glue, or keepers of any sort. Furthermore, the joint so made is rotatable with a bit of elbow grease. This allows the quad to go from horizontal to vertical polarization (and anywhere in between to allow for polarization-rotation bounce off the

canyon walls) in a few seconds time.

For those of you who have never done any aviation antenna work, the balun shown in Photo C and Fig. 2 may appear strange. Note that the center conductor of the coax does not attach to anything at the antenna end, and that the antenna is connected to only the shield braid of the coax. The loss, though, is about 0.1 dB, the balance is near perfect, and the transformation ratio is 1:1. (Note also that this scheme grounds both elements when this balun is used on a dipole—affording cheap and automatic lightning protection.) The balun fastens to the quad element by means of solder lugs. Photo D also shows that the balun is firmly laced to the PVC frame; if the balun is not supported, the coax braid will break at the solder lugs.

The quad elements themselves are AWG 18 wire.

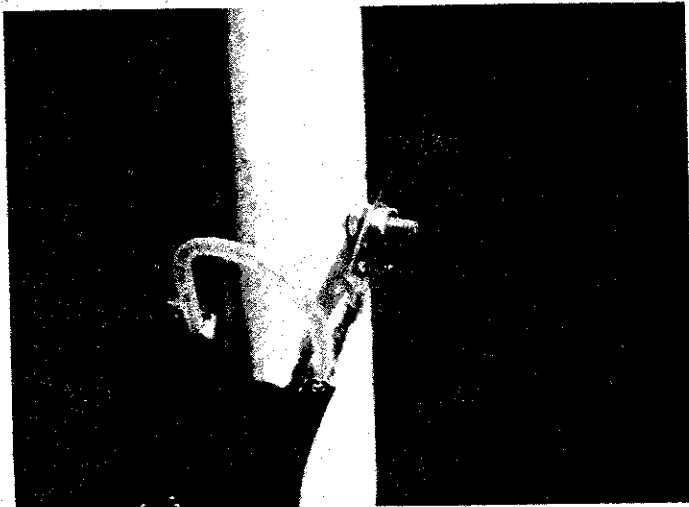


Photo D. A closeup of the balun attach point.



Photo E. The quad disassembled into a box of fittings and a pack of sticks.

There is nothing sacred about this size; my company uses rolls and rolls of the stuff, so I got it off the shelf. AWC 18 gave us a 1.5:1 vswr bandwidth of about 3 MHz. If you need more bandwidth, use heavier wire.

The proof of any antenna is its gain. While I have not been able to sniggle any free

time on the company antenna range for this product, a bit of field testing using a calibrated Kenwood TR-7400 shows the gain of this quad to be between 6 and 8 dB above a reference dipole. The most repeatable measurement indicates a gain of 6.5 dBd. There are many narrow, deep nulls on the back-

side of the quad, so that a true front-back ratio is hard to define. I can comment that a machine in Reno that was giving me fits at Almanor completely disappeared into a null that was measured later in excess of 30 dB. The main beam is fairly wide; eyeball measurements

show the 3-dB forward beamwidth to be about 30 degrees wide.

Many thanks to Ron N6AUB and Grover KC7IW for their help in field testing. Also many thanks to the ghost of Mt. Tehama, whose explosion created the need for this antenna. ■

## Bring Your Listening Into Focus!

FREQUENCY LISTS  
SCANNING  
SHORTWAVE LISTENING  
UTILITIES DX'ING  
SATELLITE RECEPTION  
STOCK EXCHANGE  
EXPERIMENTER'S WORKSHOP



'10.50-1 year • '20-2 years • '30-3 years  
Canadians please add '9.50 per year.  
Foreign subscribers please add '9.50 per year for  
surface mail or '28.00 per year for air mail.



352

# MONITORING TIMES

140 DOG BRANCH ROAD BRASSTOWN, N.C. 28602 704 837 9214

## MAKES HEADLINES

Monitoring The AWACS Net  
Tracking The Great Storms  
Special Report: Space Shuttle Panorama  
Nuclear Shipments  
Spy Numbers Transmitter Located

MT Exclusive!

New Worldwide Aeronautical Frequencies

**Finally** - a monthly tabloid newspaper written for you, the listener. 32 fact-filled pages on how to improve your listening post, where to hear those intriguing frequencies, home brew projects to save you \$\$\$ AND MORE!

Here's a sample of subscriber's feelings about MONITORING TIMES:  
"I felt it necessary to praise you on your informative, unique paper. I subscribe to many different magazines on shortwave communications and scanning, but your publication is the one that I enjoy most of all." —Bob Blackburn, Highland, MI.  
"I've found MT contains far more useful information than other magazines."  
—Charles Dean, Andover, KS.

"MT is a unique publication that offers something for every type of reader that is unavailable from any other hobby publication." —Nicholas Berkholtz, Minneapolis, MN.

**JOIN BOB, CHRIS, NICHOLAS AND THE THOUSANDS OF OTHER ENTHUSIASTIC SUBSCRIBERS TODAY!**  
CALL NOW TOLL FREE 1-800-438-8155 (cont. US except NC) to place your subscription for 2 or 3 years on Mastercard or Visa. Or for a one year subscription mail your check to Grove Enterprises, Inc., 140 Dog Branch Road, Dept. D, Brasstown, NC, 28902. Office phone 704-837-9200.

**FREE SAMPLE AVAILABLE UPON REQUEST**