ARCA
Amateur Radio Club of Alameda

Notes from ARCA Meeting on Feb 24, 2006

Next Meeting: Friday March 24, 2006 at 1900

1900 Meeting called to order

Net control duties for March

March 2	Tom KG6MAC
March 9	Sam KJ6AF
March 16	Joe KC6ZZT
March 23	Michael John KF6YRG
March 30	Fran KF6UVB

Al KG6HM gave an update on RACES MOU discussions with the City of Alameda on CERT-ARCA coordination.

Interest was shown in particpating in the Phone ARRL International DX Contest March 4-5 at the Club location.

Election of officers for 2006:

President	Al KG6HM
Vice President	David KI6AWR
Treasurer	Jay KF6YQZ
Secretary	Joe KC6ZZT

A technical talk was given by David KI6IWR on 2 meter antennas project, as described in the following pages.

2100 Meeting ajourned

2 Meter Antenna Project

Copper Pipe 2 m Hentenna

BACKGROUND

The Hentenna is a wire antenna that is very popular in Japan, but relatively obscure in the U.S. In 1972 the Sagami Radio Club developed an idea credited to JE1DEU into a working antenna and were impressed by the positive results. The antenna has been in use in Japan on HF bands, as a 6 meter antenna with horizontal polarization and VHF and UHF. There have been several articles in English including an article in the 1982 February edition of QST, the ARRL Antenna Compendium (Vol 5) and recently in the ARRL publication "Simple and Fun Antennas for Hams (2002)."

Typically the antenna is made of wire elements, but the relatively compact size particularly for 2 meters and above invites the idea of a rigid copper version. The idea of making a copper pipe version was developed by Terry Fletcher (WA0ITP).

The name of the antenna is the combination of the Japanese word "hen" with the English word "antenna". The word "hen" translates into English as "strange, "fantastic", or "miraculous", which certainly whets the appetite if you want to try something new!

CHARACTERISTICS

There are a number of useful characteristics of the antenna especially for those with limited space.

1. Easy to build and is widely tolerant of dimensional inaccuracy
2. Compact design
3. Easy to tune
4. Good forward gain
5. Figure of eight beam radiation pattern
6. Wide bandwidth

DESIGN

The basic shape of the antenna is a rectangular loop as shown in Figure 1 below.

POLARIZATION

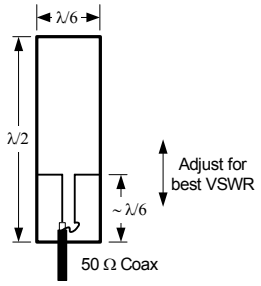


Figure 1. Horizontally Polarized Hentenna

Note that this is the horizontally polarized antenna, not a typo! This a very compact antenna relative to other antennas with similar gain. Simulation in free space shows a gain relative to an isotropic radiator of 5dBi which is about as good as a two element Yagi.

The drive impedance is a function of both the width of the loop and the position of the feed point on the long edge of the loop.

To obtain vertical polarization the antenna is rotated by 90 degrees making an 2 meter antenna that is dimensionally compatible with the tight space availability in attics.

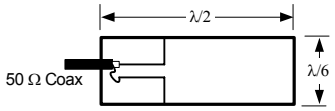


Figure 2. Vertically Polarized Hentenna

DIMENSIONS

The dimensions of the loop are λ/2 on the long edge of the rectangle and λ/6 on the short edge. The position of the feedpoint is adjusted to impedance match to the coax feedline Some designs suggests a length somewhere in the region of λ/6, but the WA0ITP design calls for about λ/10.

MOUNTING

The antenna can be mounted to a PVC pole at the center point or hung from insulating cord. Be sure not to use insulated wire as this will detune the antenna.

NOTE: If mounting from the center point use insulating fasteners such as nylon screws or tie wraps as metal fasteners will detune the antenna.

THE 2 METER COPPER TUBE VERSION

CONSTRUCTION

All parts can be obtained in the plumbing section at Home Depot for a total parts cost of about $12. Assembly is relatively simple, especially if you use a rotary pipe cutter. This will make cutting quick, easy and accurate and is highly recommended.

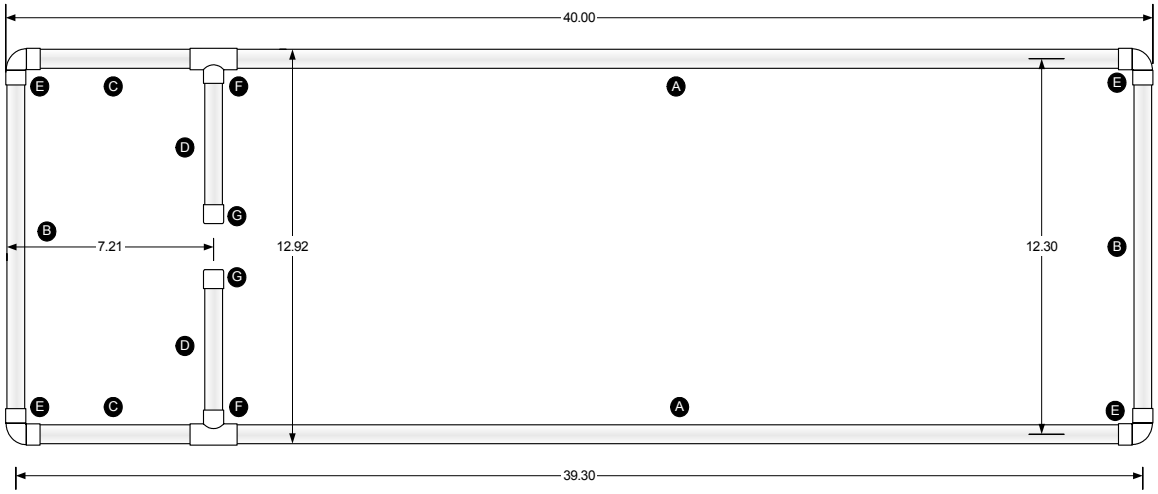


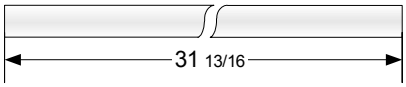
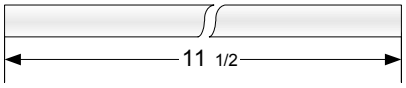
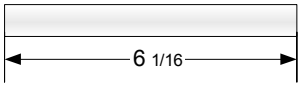
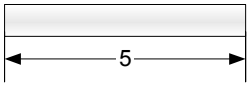
Figure 3. 2 m Hentenna Copper Pipe version (Vertical polarization)

PARTS LIST

Construction of the copper tube version requires at trip to Home Depot, a few cuts and a few minutes with a propane torch.

The parts list is shown in the table below.

All the tubing parts can be cut from a single 10 foot length of ½ inch copper pipe.

Item	Description	Qty
A	½ inch ID copper tubing 	2
B	½ inch ID copper tubing 	3*
C	½ inch ID copper tubing 	2
D	½ inch ID copper tubing 	0*
E	½ inch copper 90 deg elbow 	4
F	½ inch copper Tee piece 	2
G	½ inch copper cap 	2

NOTE: All dimensions in inches
* Item D cut in situ from one item B

ASSEMBLY

- Cut all the tubing according to the list above.
  Note that assembly may be easier if you use an extra length of item (B) for the feed tube assembly, and then cut to length in place to form the 2 (D) sections. This method aligns the tee pieces automatically.
- Dry assemble the pieces to make sure that all the dimensions are correct. It is a lot easier to fix problems before soldering the pipes to the fittings.
- Clean and flux each joint before soldering.
- Start by soldering an elbow to each of the long lengths (A)
- Connect the two long lengths with and end length (B) taking care to keep the long lengths parallel. This is easier to see if you temporarily fit the tee pieces to another short length (B) fitted between the tee pieces.
- Remove the tee pieces and clean the pipe and fittings ready for soldering.
- Refit the tee pieces to the long lengths and put an end piece (B) between the tee pieces
  The end piece will be cut in place later to form the feed tubes (D)
- Solder the tee pieces to the long lengths (A)

- Solder an elbow to each of the short lengths (C)
- Connect the two short lengths (C) together with the end lengths (B)
- Insert the other ends of the short lengths (C) into the tee pieces (F)
- Solder all the joints on both short lengths (C) and the end piece (B)
- Using a pipe cutter cut and remove 1 ½ section of pipe from the center of the(B) section connecting the two tee pieces.
- Drill holes in the end caps so that the feed cable can be soldered into the caps, or attach an SO239 connector.
- Screw the end caps to the feed tubes using sheet metal screws so that the feed cable can be easily removed.

Performance

RADIATION PATTERNS – SIMULATED

The figure below is a simulated radiation pattern for a 6m Hentenna.

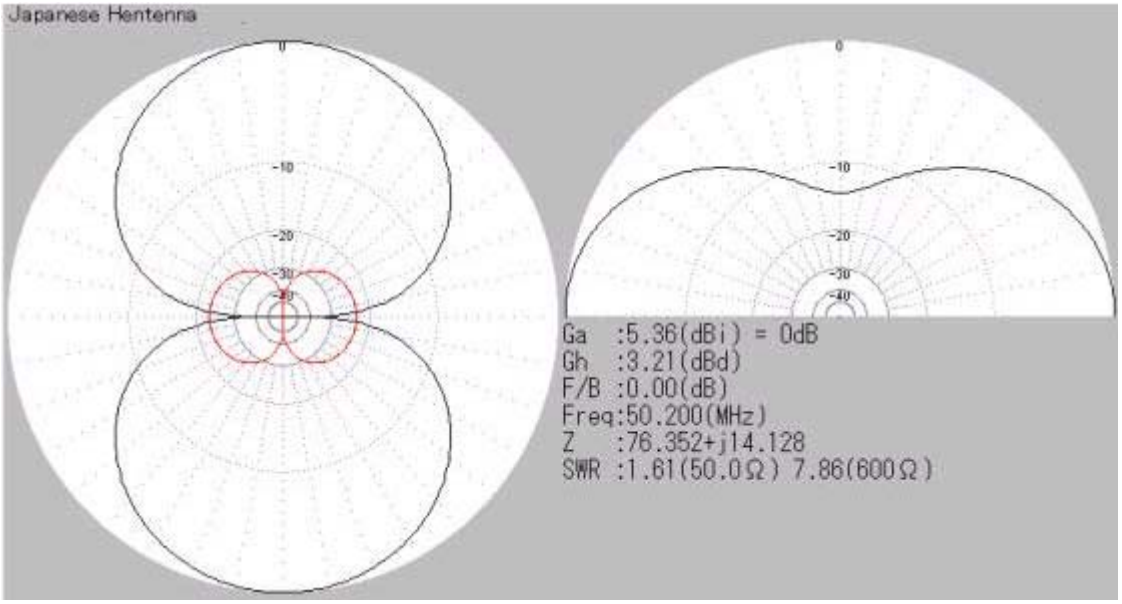


Figure 4. 6 meter Hentenna radiation pattern (JE3HHT simulation software)

Performing simulation for the 2 meter version is reserved for a later date, but actual measurements on the test antenna are shown in the next section.

RADIATION PATTERNS - MEASURED

The performance of the copper tube version was measured and is quite impressive. It was not possible to do any estimates on radiated signal, but testing on the receive side did provide some useful insights into performance. A/B switching between the J Pole antenna and the Hentenna on received signals indicate a gain advantage of about 1 S point. Actual measurements of field strength are shown in the plot below (radial axis in dB). More rigorous testing is still required.

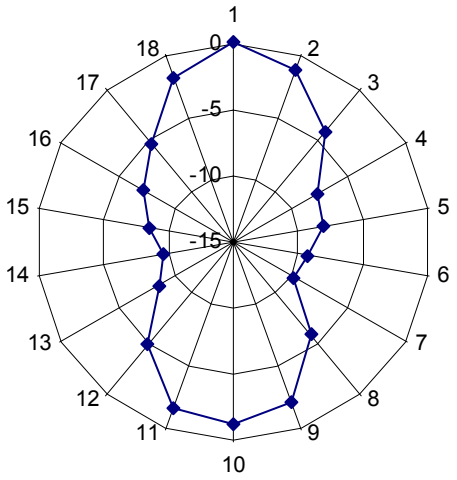


Figure 5. 2 m. Hentenna azimuth radiation pattern (V polarization)

Field strength measurements made using an RF Field Strength meter with the antenna set up on a balcony. The elevation angle was about 18 degrees. The distance from the antenna to the measuring point was about 20 wavelengths.

The number of data points was too low to show the depth of the nulls off the each end of the loop. Estimates obtained on the receive side however, rotating the antenna to a null showed a depth of about 6 S units. Not very scientific but a simple and quick insight into what is going on. More rigorous testing remains to be done!

BANDWIDTH

The measured bandwidth is particularly wide providing low VSWR over the full 2m band. The figure below shows a comparison between a dual band Jpole and the 2m Hentenna.

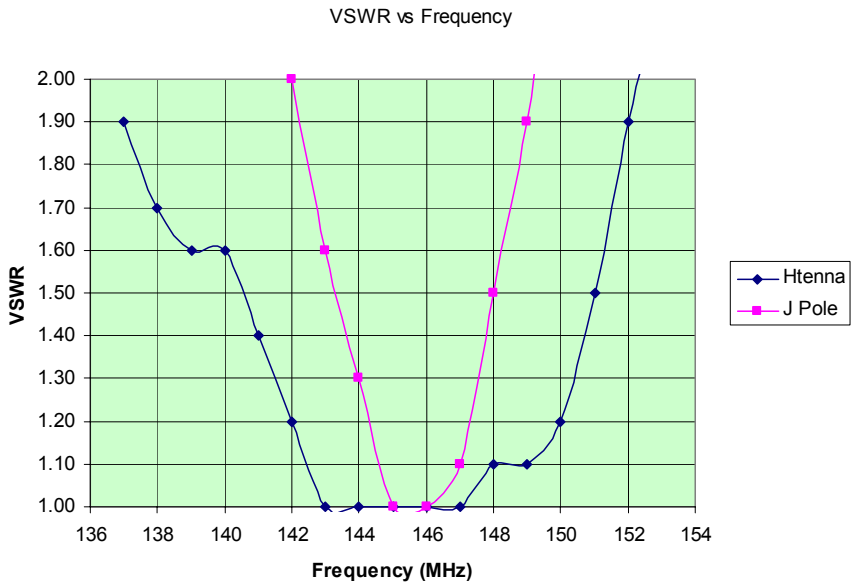


Figure 6. VSWR vs. frequency for Jpole and Hentenna

NEXT STEPS

- 70 cm Hentenna (plastic pipe/wire)
- Simulate with EZNEC (or similar)
- Fork Hentenna
- Dual Band Hentenna

REFERENCES

Simple and Fun Antennas for Hams
Chuck Hutchinson K8CH, Dean Straw N6BV
ARRL
ISBN 0-87259-862-4

2 Meter Hentenna
Terry Fletcher WA0ITP
http://www.hamuniverse.com/2hentenna.html