THE HENTENNA RE-VISITED

"The following article has been re-edited for the English language from the Japanese site.
Minor errors and corrections have been made."

The Hentenna was developed by Japanese 6 Meter Hams, JE1DEU / JH1FCZ/ JH1YST in the 1970's and can be designed and built for hf thru uhf and possibly beyond!

After much experimentation, finally, the antenna was developed with good performance, however, it was difficult to explain why the performance was so good, or how it is worked basically at that time. So it was named Hentenna ,
"Hen" means "strange" in Japanese.

The antenna has good performance and many advantages and it has become very popular in Japan. Many JA stations make it and enjoy it at home or in the field. Some Japanese 6m beacon stations are using the Hentenna antenna.

HERE ARE SOME GOOD POINTS FOR THE HENTENNA

1. Good performance

2.5-3 dBd gain
Low angle radiation
*** Total performance is equivalent to 2-3 element Yagi-uda antenna,**
Wide band width

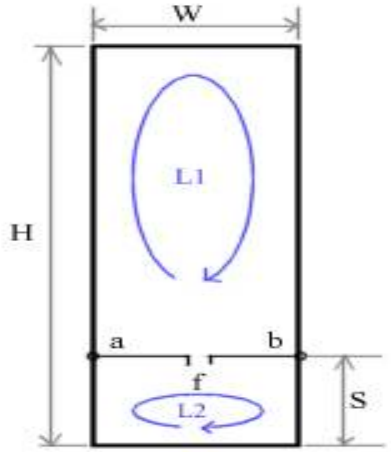
2. Easy to make

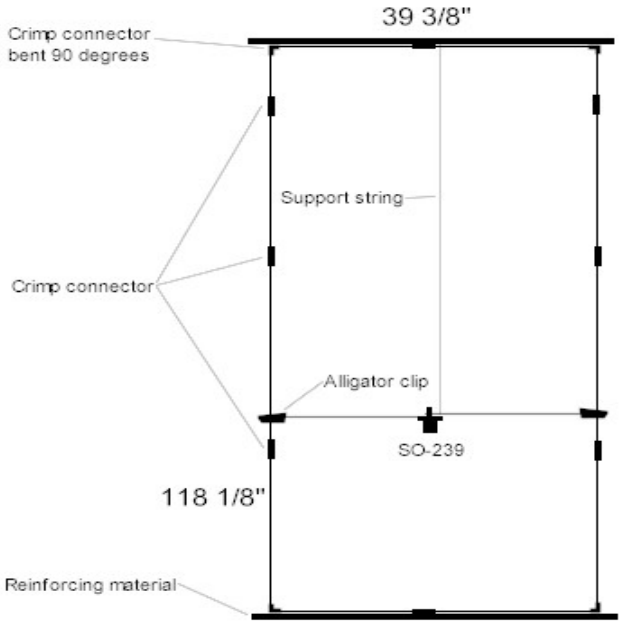
It is possible to adjust impedance and SWR perfectly, This means, not so difficult to make!
No special parts are required. You can use any electrical conductor to make the main rectangle.
Broad adjustment ....wide bandwidth

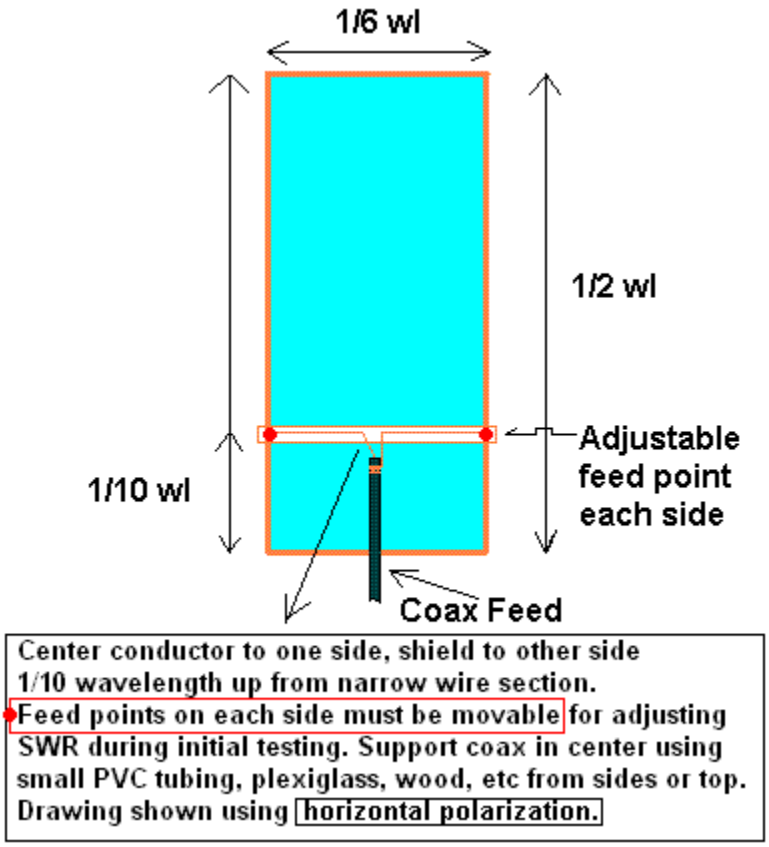
3. Easy to build up

If you use thin aluminum pipe and thin wire, you can make this antenna for 6m very light. It can be designed for most any band or frequency by using the included formulas below.
Due to it's construction, it is easy to put it in a higher position in the air. You can also use light mast for it.
As this is a vertically long antenna, it is easy to install the antenna

on a veranda or small space.
It appears to be a vertical antenna but has mainly <u>Horizontal radiation</u>:
This is one of the reasons this antenna is "Hen",(STRANGE)







This antenna is shown in drawings above horizontally polarized.... lay it on it's side for vertical polarization.
Also please note in the above English drawings that the Hentenna is basically a loop fed about 1/10 wavelength from the bottom element with 50 or 75 ohm coax attached to the top element of the bottom loop at the center point.

Hentenna Basics

1. Basically 1 1/3 WL Loop antenna around outer edge of antenna
2. L1 works as 1 loop antenna
3. L2 works as matching section
4. Vertical long rectangle has more gain than ordinary square loop and has less impedance.
L2 helps the matching and low angle radiation.
5. 3D pattern is like shell of peanut (maximum gain directions looking at you and away from you) so it will be somewhat bi-directional.

How to Adjust

1. Move the "a" and "b" points to adjust swr. (move in equal amounts), move towards top (in the drawing) to increase resonant frequency,
move towards bottom to decrease resonant frequency.

2. SWR may be higher than 1:1.5 at first so move matching points "a" and "b" in small increments up or down the loop until lowest swr is obtained and secure at these points with whatever method you choose depending on your construction materials. The overall outside (total) length may have to adjusted a small amount also.

The construction materials you use for the loop will determine how the antenna is supported.
It will weigh more if made from aluminum or copper tube.
It will require a non conductive support mast or structure to attach it even if made from wire. Nylon cord or rope, heavy string or other non conductive material can be used for support at the four corners.
A length of pvc pipe, plexiglass, wooden dowels, etc can be used as support for the top, bottom and coax feed point elements with the side wires strung between them or can be used to completly enclose the wire.
Use your own design.
Most JA hams use wire construction.
The final configeration in the air should be as close to a vertical rectangle as possible.
This antenna is shown in drawings above horizontally polarized....lay it on it's side for vertical polarization.
Experiment with your favorite support and try to keep conductor size under 1/4 inch. See the Japan site link below for more info.
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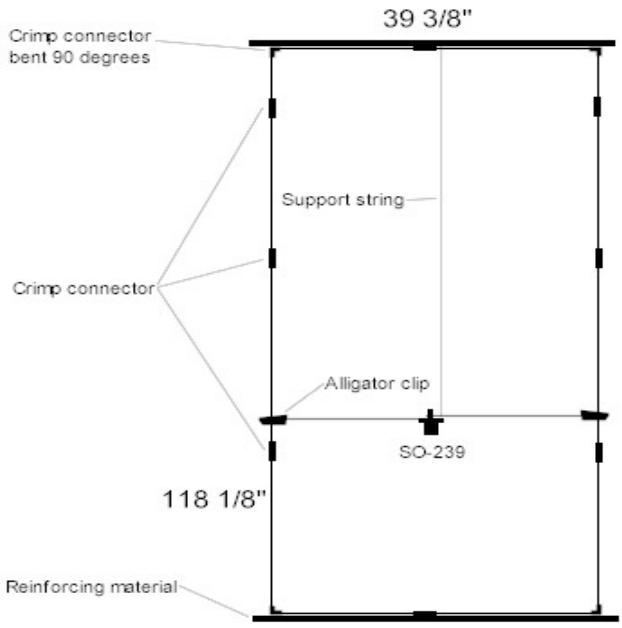
6 Meter Version



THE MATH

Calculating the lengths for the Hentenna is simple and straightforward and can be used for HF THRU UHF and possibly beyond.

The formulas below will get you in the ball park for most any band or frequency. There are two methods for getting the approximate lengths. Chose the one that works best for your math abilities.

First method formulas:

Just start with 1 meter = 39.36 inches
1 inch = 2.54 cm
1 wavelength = 6 meters = 6 x 39.36 = 236.16 inches
(Remember, this is not a 1 wavelength loop! It is 1 1/3 wavelength)
1/2 wavelength per side = 3 x 39.36 =118.08 inches
1/6 wavelength = 6/6 =1 wavelength = 39.36 inches
1/10 wavelength = 236.16 x .1 = 23.61 inches

Second method formulas (The easiest)

These formulas were extrapolated from the Japaneese plans and should yield lengths that are a bit long for easier final tuning.

15744 / Freqmhz = total outside length in inches of the "rectangle"
5904 / Freqmhz = 1/2 wavelength in inches
1968 / /Freqmhz = 1/6 wavelength in inches
1180 / Freqmhz = 1/10 wavelength matching section feedpoints

Using these formulas in an example for 146mhz center frequency:

15744 / 146 = 107.83 inches total conductor length (1 1/3 wavelength)
5904 / 146 = 40.43 inches (1/2 wavelength sides each)

1968 / 146 = 13.47 inches (1/6 wavelength in inches) (top and bottom length as in drawing above)

1180 / 146 = 8.08 inches (1/10 wavelength for matching section feedpoint distance from bottom of antenna.) (Coax feed point distance from bottom)

Some adjustment of lengths may be required for peaking at design frequency. Experiment!

From the above method calculations we arrive at the lengths for the 6 Meter Hentenna:

1/2 wavelength sides = 118.08 inches each
1/6 wavelength top, bottom and coax connection element = 39.36 inches
1/10 wavelength matching point = 23.61 inches up from each side of bottom element.

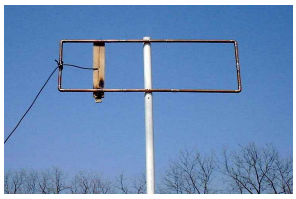
The 2 Meter example yields these lengths:
40.43 inches (1/2 wavelength sides each)
13.47 inches (1/6 wavelength in inches) (top and bottom length as in drawing above)
8.08 inches (1/10 wavelength for matching section feedpoint distance from bottom of antenna.) (Coax feed point distance from bottom)
Total distance around the rectangle = 107.83 inches.

Again, take notice that this is not just a full wave loop!
At 6 meters, the total length around the outside of it is 314.88 inches which comes out to be 1 1/3 wavelength long.
AT first glance the above measurements make this 6 meter antenna to be HUGE! IT IS NOT. It is only about 9.8 feet tall by 3.28 feet wide!
A scaled down Hentenna for 2 meters would be 1/3 it's size or

about 39 inches by 13 inches!

EXPERIMENT! EXPERIMENT!
Editors comments:
" I personally have not built this antenna YET and cannot judge it's performance....make sure you use low power when adjusting the swr and send me any comments you desire about this "strange" Hentenna.
IF YOU HAVE EXPERIENCE WITH THIS ANTENNA AND HAVE ANYTHING TO ADD, PLEASE LET ME KNOW."
N4UJW
Make sure to see the WA0IPT 2 METER VERSION below:

Click the picture to see it or here



Flash! Just added....6 Meter Hentenna by K5USS here
More on the Hentenna with length table at bottom of page here

2 Meter Hentenna
by
WA0ITP

Follow the trials and tribulations of Terry as he attempts a 2 meter version of the Hentenna.
(The following has been edited from emails from Terry in the order of his progress)

"I thought I'd drop a note about my experiences with the Hentenna. I just built a 2 Meter version of it out of 1/2" copper pipe. It was 39" x 13", a nice workable size for a gain antenna. I have a friend whose trying to receive two repeaters 180 degrees apart,, each about 15 miles away, and I put it together to try at his qth.

Try as I might, I couldn't get the swr below 2:1, as read with an MFJ antenna analyzer. The impedance in the 2 Meter band never got below 100 ohms.

Subtracting and adding
(More experimentation)

I fed it with a 104" piece of rg-58, adjusted the matching point up and down 8" to about 14" from the bottom. Reading that the impedance becomes lower with a narrower "aspect ratio", I subtracted and added a couple of inches to both the length and width, one at a time (copper pipe is easy to work with isn't it?). I also added another piece of coax in the line just in case. No improvement, I could only make it worse. The best match was 2:1, So I've left it there.
I think I should have been able to achieve a better match.
Do you think the copper pipe diameter may be at fault?
I'm gonna hoist it into position tommorrw and see if it's any better at 20' off the ground.

Success!!!!!.....at last!
Learn from my mistakes!
Don't measure Swr on a picknic table!

Still using 1/2" copper pipe. I decreased the overall width slightly, saw a favorable result, reduced it a little more and achieved 1.4 swr at 147 Mhz, so I quit there.
I wound up with 39.25" long, 12.25" wide, and the #12 bare wire (on a board) feed point is at 8.75", no balun. Dean Straw (Simple & Fun Antennas) modeled it to help out and found nearly identical dimensions using the 1/2" copper pipe in the model.

I'm happy with 1.4:1, the feed point resistance is 68 ohms and it's pretty broad: 1.4:1 from 146.3 to 148.2, and the 2:1 bandwidth is 144.6 - 150.6!
Don't try to measure SWR on a picnic table!

What would Hams do without duct tape?
A little time passes and we continue.....

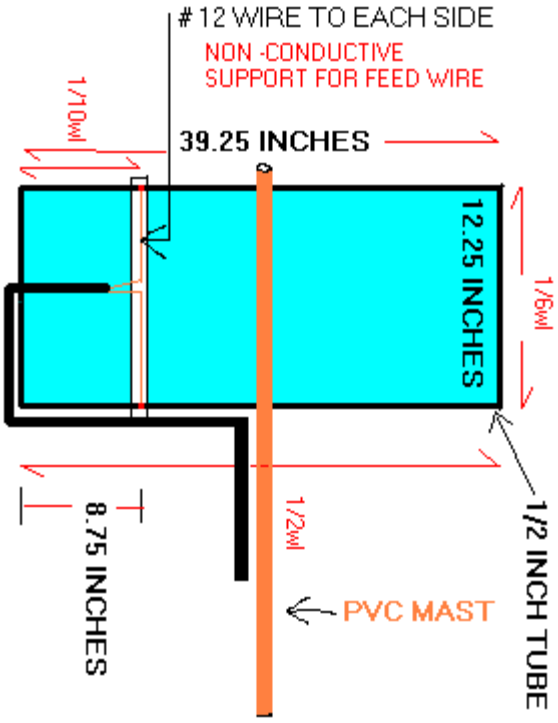
I just returned from the final qth. We installed it temporarily until we can purchase better quality coax.
The antenna wound up being 15' at the base, on a pvc pipe temporarily duct taped to a 10' 4x4 doing double duty as dipole anchors. The swr at 147Mhz dropped to 1.2 to 1 at that height. and the bandwidth is astounding!

I'll make some more measurments when we get it permantly installed.and send you some more info, and probably write a club newsletter article detailing the thing.
Dean Straw, N6BV sent some ideas for copper pipe construction in an email, however I had already experimentally found dimensions that were nearly identical and had built the thing out of pipe. This has been a lot of fun, I agree Ham radio needs some easy to build, easy to install, cheap, and good performing 2 Meter antennas. This seems to be one of them.
I'll keep ya posted."
Terry, WAØITP

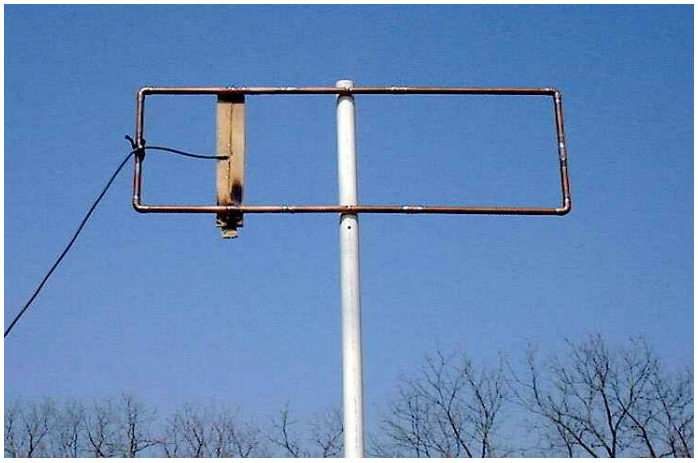
NOW LET'S BUILD ONE
Building the Hentenna I used 1/2 inch copper water pipe as the loop element. Each elbow adds about 3/4 inch to the overall lengths so plan accordingly.
I cut the long sides to 37 3/4 inches, and the short sides to 10 3/4 inches. Assemble the loop using 4 elbows and solder. I just laid it out on the garage floor to keep it flat.

Use SAFETY GOGGLES or glasses since a concrete floor may “pop off” small pieces of concrete when heated by the torch. I used acid flux and non lead solder from the hardware store but rosin flux should be used for longevity.

The feed points were made by glueing a piece of #12 wire from a piece of Romex house wiring to a piece of 1/4 inch plywood. It was moved up and down the loop until a match was found at 147 MHz., then soldered. Plastic clamps (wire ties) were used to hold the wire to the loop while checking swr. Use them in final installation to tie coax to the loop and the support pipe.
It is performing well at the final qth and WA0MWW is pleased to be able to use two or 3 repeaters that were unuseable on a 5/8 wave vertical.
See pictures below!



Drawing not to scale!



Isn't it a beautiful piece of art!
Photography by WA0ITP
Go direct to his page for more details on the Hentenna.
Learn more about building, testing and putting it on the air! Click here

I hope this helps you build this great little antenna. WA0ITP.....TERRY

Editors note:
From the first email to the working model of this project, Terry only took

a couple of days to get the 2 Meter version up and running. After a little fine tuning....now a great project! If you use wood as the support for the feed wires, seal it well with weather proof sealer or use plexiglass or some other suitable non-conductor. Seal all coax end connections from the weather..
Many thanks go out to Terry for sharing his project with all of us!
Great work Terry!
Keep EXPERIMENTING and have FUN!.....N4UJW