Antenna Workshop

Peter Dodd, G3LDO looks at the Hentenna - a strange antenna that 'hatched' from a new kitchen. It's not surprising really as 'hen' means 'strange' in Japanese.

It has been a difficult couple of weeks here at the G3LDO QTH. The 'station manageress' has, for some time, been pressurising for a new kitchen and eventually got her way. In the course of this operation I made a fair amount of changes to the plumbing arrangements and found myself with some excess plumbing material once the job was completed.

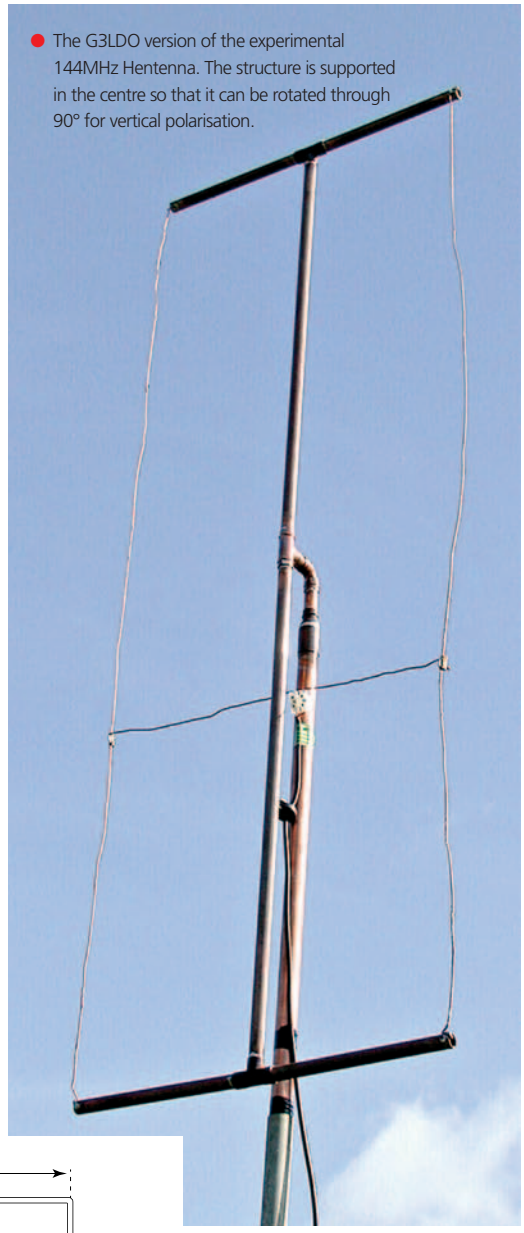
I always look at any pieces of metal as material for constructing an antenna and had been considering a v.h.f. antenna for 144MHz that had gain, yet was not too directive. One such antenna that I had seen before but never tried is the Hentenna. Could be a candidate for my plumbers delight project?

This antenna under discussion originated in Japan and according to *The ARRL Compendium, Vol. 5* was conceived by **Mr Someya, JE1DEU**. The prototype consisted of two quad type loops fed in phase. The design was further developed by **Tadashi Okubu JH1FCZ**, and others, to the form shown in **Fig. 1** and christened the 'Hentenna'. The word 'Hen' in Japanese means strange, odd or curious, and was used presumably because of the unusual way which was found necessary to match it to 50Ω coaxial cable.

You won't find the antenna featuring much in English language publications but it's very popular in Japan. Hardly a month goes by without seeing one in some form or other in one of the Japanese radio magazines, such as the example of a 144MHz model that's shown in **Fig. 2**.

Standard Model

I decided to build the standard model as in Fig. 1. A computer model was 'built' and it predicted maximum current in the centre of the short horizontal sections as shown in **Fig. 3**. From this I assumed that it could be supported at these points without insulators. A variation on the construction method is described by **JR1TTQ** and uses wires for the vertical elements in a 50MHz design. The construction of my antenna would follow this design.



The G3LDO version of the experimental 144MHz Hentenna. The structure is supported in the centre so that it can be rotated through 90° for vertical polarisation.

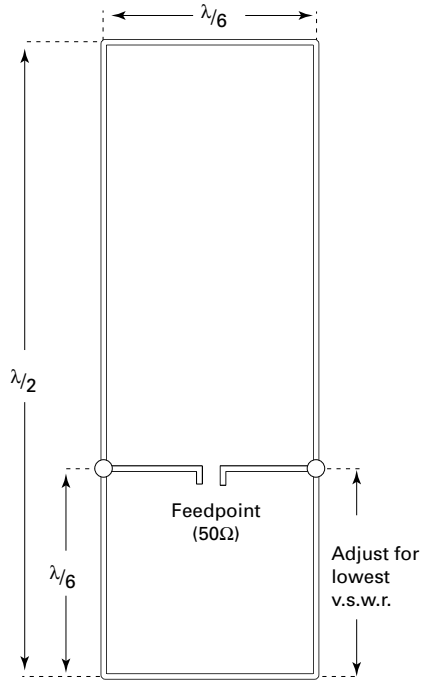
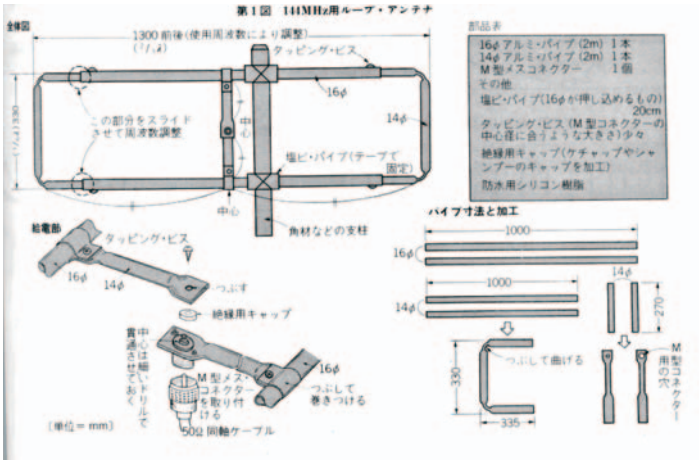


Fig. 1: The basic Hentenna. With the orientation shown the antenna is horizontally polarised. From *The ARRL Compendium, Vol. 5*

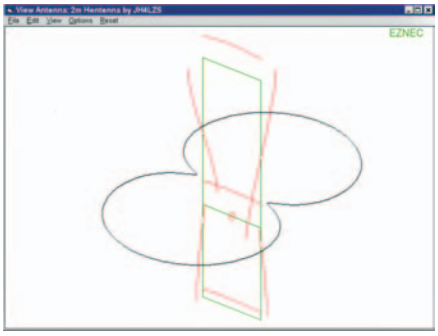
The support structure comprises 15mm copper tubing 1160mm long, with a plumbing T-piece in the centre as shown in the photograph. This centre point is then soldered to a vertical 22mm pole via a 90° bend and 15 to 22mm adapter, which can be seen more clearly in **Fig. 4**. The 380mm horizontal elements are fixed to this vertical support pole, also using T-pieces. Note that the vertical support pole and the horizontal elements have to be cut in the centre to solder to T-pieces together.

The connections, from the tips of the horizontal elements and the feeder connections to the antenna are made using 2mm stranded copper wire. The wire is fixed to the copper tube elements by drilling a 2.5mm hole in the copper tube, threading the wires through and soldering in place.



● Fig. 2: A vertically polarised Hentenna for 144MHz by JH4LZS. This model uses different dimensions to the standard shown in Fig. 1 and has computed a free-space gain of 5.1dBi. Scanned from *CQ Ham Radio* (with acknowledgement and permission).

The antenna is fed directly with 50Ω coaxial cable through a connector block and connected to the vertical wires by short lengths of 2mm stranded copper wire. Brass inserts from connector blocks are soldered to these feed wires and the inserts



● Fig. 3: Computer model of the Hentenna. The antenna elements are shown in green, the antenna currents in red and a two-dimensional azimuth section of the antenna polar diagram is shown in black. The model predicts a free-space gain of 4.8dBi.

● Fig. 4: Detail of the construction method. The antenna is fed directly with 50Ω coaxial cable via a connector block and connected to the vertical wires by inserts from connector blocks. This enables the connection points to be adjusted for minimum s.w.r. See text for more detail.

threaded on to the vertical wires prior to being fixed to the horizontal tube elements. This arrangement allows the connection points to be adjusted for minimum s.w.r. and tightened up by the insert screws when the optimum point has been found.

Ideally, the coaxial cable should be connected to the antenna via 1:1 balun. In practice the current choke arrangement shown in Fig. 4 removed the ill effects of coaxial cable feeder antenna currents. This is described later.

All plumbing connection surfaces must be cleaned with emery cloth or wire wool and smeared with flux. The joint is heated with a blow torch until applied solder runs freely and runs into the joint through capillary action. **Note**: Most large d.i.y. stores have leaflets on how to make good plumbing joints.

Performance Qualities

One of the noticeable performance qualities of this antenna is that the dimensions and s.w.r. adjustments are not critical. The feeder connections to the vertical wires were very easily adjusted particularly if you have one of these active s.w.r. instruments such as the MFJ-259.

The frequency of lowest s.w.r. is determined by adjusting the position of the feeder connections up or down the vertical wires. The s.w.r. measurement must be made with operator standing at least three or four metres from the antenna and the lowest part of the antenna should be about over two metres from the ground.

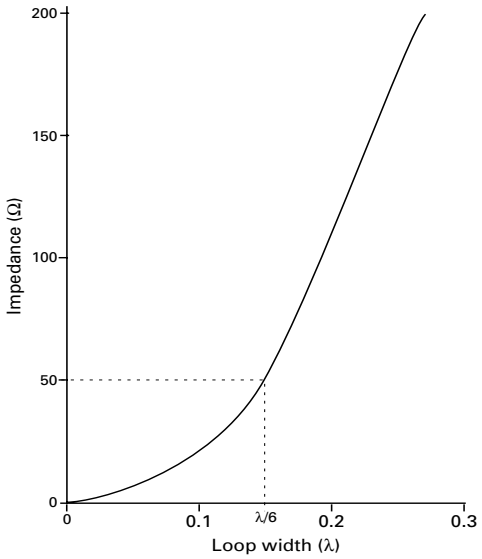
The lowest s.w.r. on my antenna was around 1.1:1 minimum. But if you find that the s.w.r. reading changes when the meter, coaxial cable or connectors are touched, it means that there are antenna currents on the outside of the feeder. These extraneous currents can be minimised by using a current choke with the coaxial cable feeder looped through a ferrite ring, as shown in Fig. 4.

Initial receive tests indicate that the polar diagram is very similar to that shown in Fig. 3. From the top of Highdown (a local highpoint here in West Sussex) using the FT-817 I could hear a DL s.s.b. net along with the GB3VHF, F5XAM and PI7CIS beacons. And this was under fairly flat band conditions. Although none of these signals were strong enough to move the S-meter they were mostly well clear of the noise.

When the antenna was rotated end on to any station the signal disappeared into the noise. This null is very sharp and the antenna would seem ideal for direction finding or 'fox hunting'.

The computer model of this antenna in Fig. 3 shows that the currents in the vertical wires are anti-phase so radiation from them cancels - they can be thought of as open wire transmission lines connecting the horizontal elements. Note also that the currents in the horizontal sections are in phase; this is how the antenna obtains gain. The model predicts a free-space gain of 4.8dBi.

In *The ARRL Compendium, Vol. 5* it states that the feed impedance is determined by the width of the antenna, Fig. **5**, and that λ/6 gives a 50Ω feedpoint impedance. My computer model indicated that λ/6 gives 75Ω and to get 50Ω the antenna should be narrower and longer. This seems to be confirmed by the dimensions of JH4LZS's antenna in Fig. 2. However, it has to be said that my 'standard' Hentenna gave a very low s.w.r. when correctly set up. Interestingly, a computer model of JH4LZS's antenna gives greater gain of 5.1dBi.



● Fig. 5: Impedance versus antenna width graph for the Hentenna at resonance. From The ARRL Compendium, Vol. 5

In May 1990 a two-loop turnstile Hentenna for 50MHz, designed and built by **Masayoshi Eguchi JI6KGZ**, was installed at **JA6YBR**, the Miyazaki University Radio Club, located in southwest Japan [1]. Throughout Cycle 22, JA6YBR's signal was reported throughout the Pacific, South America and the west coast of America. So, the antenna may be strange - but it's efficient. Why not hatch one of your own? **PW**

REFERENCES

[1] The Hentenna - The Japanese "Miracle" Wire Antenna by Shirow Kinoshita, JF6DEA/KE1EO, The *ARRL Compendium, Vol. 5*

[2] 144MHz Hentenna by JH4LZS, *CQ Ham Radio* (Japanese publication)

[3] 50MHz Hentenna by JR1TTQ, *CQ Ham Radio* May 1979 (Japanese publication).