Laid Back Loops

Robin Trebilcock GW3ZCF discusses horizontal loop antennas and says they offer advantages over many other types, especially as they're cheap to put up!

The horizontal loop is an antenna which hardly ever gets a mention in most books about wire antennas. Yet it's capable of DX performance comparable with multi-element beams - and all for very little cost! The idea is not new, one of the earliest references I've found was an article by **W0MHS** in the November 1985 *QST*. And there's a form of the antenna described in *The ARRL Antenna Book*.

One of the first exponents of the horizontal loop in the UK was **Mike G4HOL**. Mike wrote about it in the December 1993 issue of the Royal Signals ARS magazine *Mercury,* though only a small proportion of *PW* readers will have seen that article.

My own interest in the antennas stems from QSOs I've had with Mike, who sent me some information. Mike has said that provided you send a largish stamped self-addressed envelope‡ to him, he'll let you have a copy too.

The principle of the antenna could hardly be simpler. It consists of a continuous loop of wire one wavelength long (at the lowest frequency) and ideally in a square - but it's not critical. This is fed in one corner from good quality slotted 300Ω twin feeder. But if you cannot manage a full square, use any shape that will fit in your garden, keeping it as open as possible.

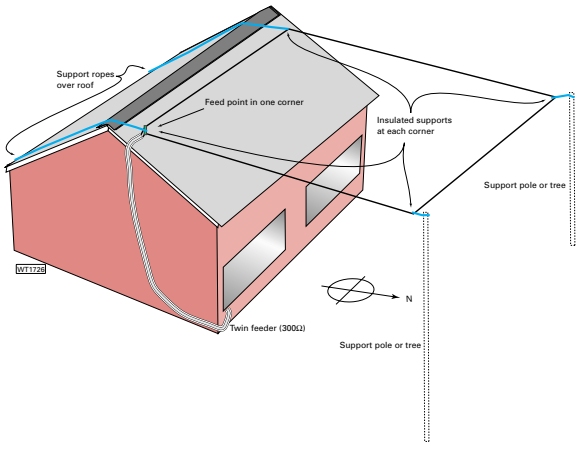

Fig. 1: The loop that Robin built to cover 7-28MHz, but can be used as a capacity hat loaded vertical for 3.5MHz too!

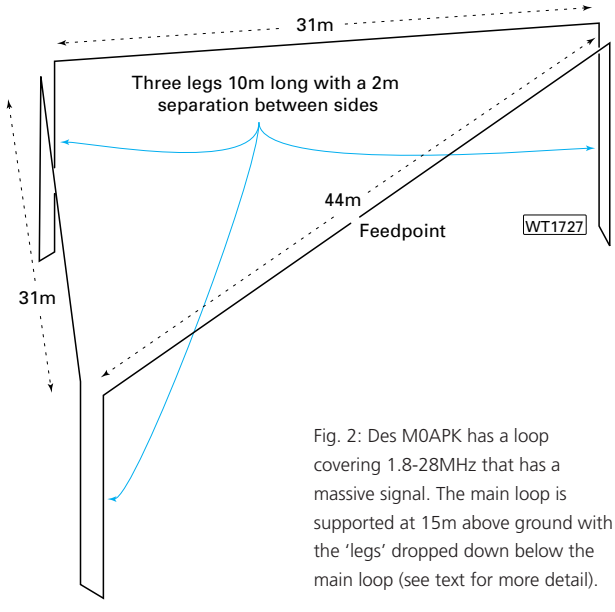

Fig. 2: Des M0APK has a loop covering 1.8-28MHz that has a massive signal. The main loop is supported at 15m above ground with the 'legs' dropped down below the main loop (see text for more detail).

Maximum Enclosed Space

The idea is to get the maximum enclosed space within the loop of the antenna. In his notes Mike suggest that you **don't** use a balun to feed the twin feeder, although I've had good results when using a 4:1 balun at the transmitter end of the feeder.

The lowest band you can set the antenna up for, is very dependent on the size of your garden. But even a small garden should be adequate for a loop that will work from 7-28MHz. You'll find in **Table 1** the lengths for the three lowest h.f. bands upwards. When using this antenna, one thing to bear in mind is that on the lowest band that the loop is cut for, the angle of radiation is predominantly high.

The angle of radiation become progressively lower as you move up the bands, but for me it's the ideal compromise. In my own little bungalow garden I can just squeeze a loop antenna for the 7-28MHz bands which gives me very good coverage of the UK and Europe on 7MHz (although with occasional DX QSOs).

On the higher h.f. bands, I have very good DX performance due to a number of lobes all with low angle radiation. In these lobe directions the antenna compares well with a three-element Yagi-Uda array. Although you will have to accept the DX directions that the layout of your antenna defines. **This antenna is definitely not steerable**.

Non Rotating

Although the antenna cannot be rotated, **you can move the feed-point around** to see what difference that makes to the direction of DX. It might be possible to find a feed-point that has lobes favouring the part of the world that you're interested in. Each of the corners would be favourite start points.

The feed-point impedance of the antenna

does change over the range of frequencies, but it is still easy to tune. The table of impedances shown in **Table 2** shows the range of impedances that I've measured on my loop set-up. With the 4:1 balun in use, I've had no problems tuning the antenna, even on the 24MHz band. Originally I used some 20m of twin feeder and although there was more variation of impedance at the a.t.u. the antenna seemed to work as well in practice.

The loop is far less susceptible to electrical noise than a dipole fed with coaxial cable. It also is quite broadband in operation with slow changes of impedance. When you have tuned upon one part of the band, you can move some way in frequency without having to retune - very useful in today's crowded band conditions.

Table 1

Bands Covered	1.8 - 28MHz	3.5 -28MHz	7.0 - 28MHz
Total loop length	172.5m	86.25m	43.13m

Total loop lengths for loops covering the bands shown.

Set-up Simple

I've shown the set-up I have here at my location in **Fig. 1**. As you can see the set-up is quite simple, but you can use whatever support points are available to you. At each support point there's an 'egg' insulator through which the wire is allowed to slide. This allows the loop to be tightened or loosened from any one corner support.

The two points on the building are each merely a length of polypropylene rope passed over the apex of the bungalow roof. I have one advantage of a strategically placed placed tree in one corner of the property leaving only one support pole to be used. None of the corners are higher than about six metres, although the north-west corner is about one metre lower.

The slight incline on the plane of the loop due to the north-west corner does seem to enhance the sensitivity to the north and west, as I get good reports from both North and South America. I also find that both Asia and VK-land may be worked on long-path. Though this doesn't mean that other directions suffer, as I also get good reports from the east, with many contacts in China, Taiwan, Japan, India, Pakistan and the Philippines as well as other areas of Oceana!

I would, of course, like to put up a version that would cover 3.5MHz as well, but space does not allow this. However, I found all is not lost on this band, as by strapping both sides of the feeder together and using this as vertical antenna with a capacity hat against earth, works quite well too.

Capacity Hat

When using the loop and feeder as a vertical antenna with a capacity hat, remember the vertical portion (the feeder) must run vertically as far as possible. So, when using the antenna this way it's unlikely to work well if the shack is upstairs near the feed-point.

The amount of capacitive coupling to ground can be quite marked. I have on occasions, used a version of the 7MHz loop when operating portable from my caravan. On these occasions, no part of the antenna was over three metres above ground, and yet I still worked the DX with some 50-100W output.

There was one time, when on a caravan in Wales and the loop antenna I'd erected was flapping up and down in the wind. This movement, with its changing capacitive loading, made it impossible to load to the output of my rig with a semiconductor output stage. (The s.w.r. bobbing up and down with the wire flapping caused rapidly changing feed-point impedances.)

There was no alternative under the windy conditions, I had to erect a long wire that, although it also flapped up and down in the breeze, caused less change on loading than the loop antenna had. Under these conditions, the longwire proved to be more effective.

Scope For Experimentation

The scope for experimentation to suit your area and circumstances is immense. Those who have heard signals from **Des M0APK** will know how effective this type of antenna can be. Des has a 172.5m version of the loop antenna that covers all bands from 1.8MHz upwards.

The format of the loop at the M0APK shack is in the form of a right angled triangle with total leg lengths of a little over 106m at a height of around around 15m. The extra lengths of the antenna are hidden in three 22m 'tucks', one at each support point. Each of the tucks has the drop of around 10m with the wire legs of the tucks being kept about two metres apart.

Fed in the middle of the longest leg, very potent signals are radiated from the M0APK QTH...bearing testimony to the antenna's effectiveness. For comparison purposes Des has retained his full-sized Windom antenna with its 77m top. However, on all bands other than 7MHz his monster loop is around three S-points better than the Windom. Although on 7MHz the loop is "only slightly better".

Interesting Variation

Perhaps the most interesting variation of the loop I've come across, is from **Brian G0NSL** who has a 7MHz version cut a little longer than my 7MHz loop. Brian has his loop cut to 43.43m long and it's supported at around 7.9m above ground.

Some 4.9m below the main loop Brian has placed a second loop of wire as a reflector. This loop is a little over half a metre longer overall and is continuous. Feeding the upper loop with his 5W of r.f. via electrical twin wire (Z_0 approximately 120Ω), Brian manages to cover the UK as effectively as other stations using 100W.

Brian's loop and reflector seems to be resonant on 7.07MHz presumably because of the coupling between the loops. His antenna works well at the frequency where he's often heard as net controller on the **Worked All Ireland** net. His is one of the few stations that can both hear, and be heard by all the other participants in the net.

Table 2

F(MHz)	7.07	10.1	14.3	18.15	21.2	24.9	28.5
Z(Ω)	123	363	133	301	151	753	229

Impedance measurements for Robin's loop antenna on various bands.

So in summary, in my opinion the horizontal loop is a true multi-band antenna that costs only a few pounds to put up, and is capable of surprising performance. Since gaining my licence, I've tried many antennas with varying degrees of success, trying G5RVs, long wires, verticals, W8JK, etc., although I've never had the space for a rotary beam.

In many years of operating before using the horizontal loop, being the first station pulled out of the midst of a pile up was a comparatively rare experience for me. But since putting up the horizontal loop, it has happened surprisingly often.

I think the horizontal loop antenna is, without a doubt, the best limited space antenna I've ever used and I can thoroughly recommend it for almost all locations. *PW*

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