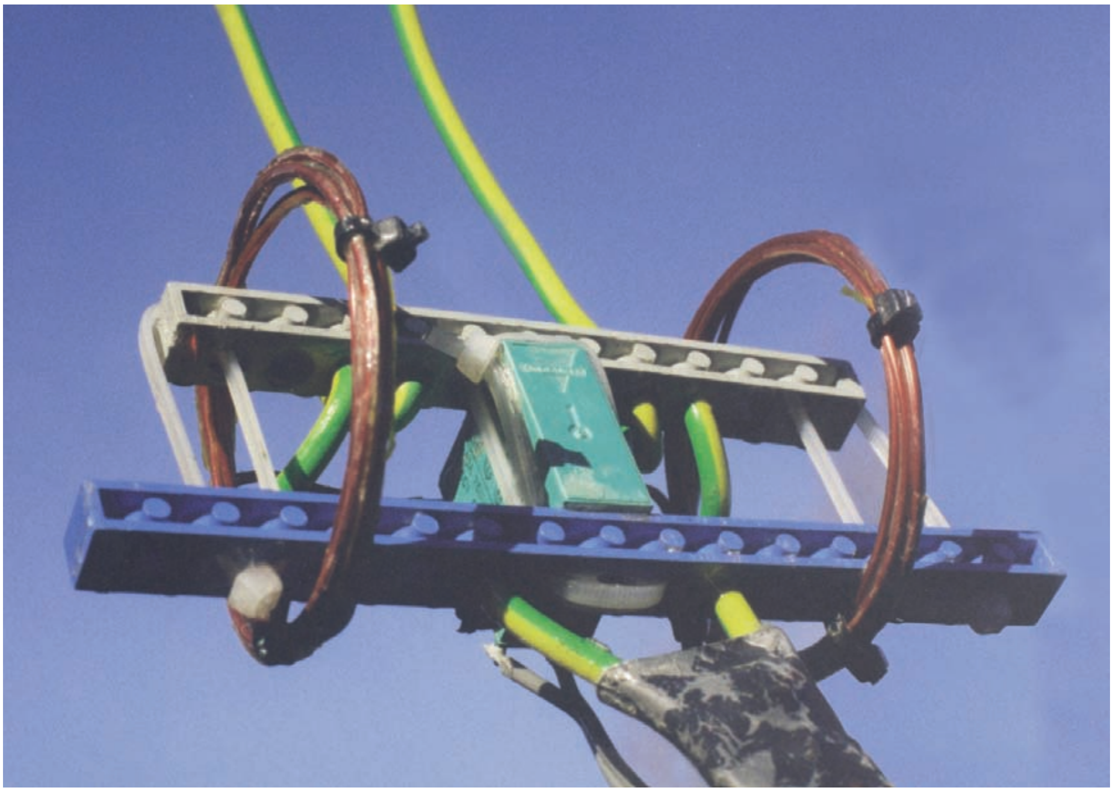
A PRACTICAL 'V' BEAM FO

Here's an antenna that thinks it's a dipole for 3.5MHz and above, but it's really a V beam for the 18MHz band. Read about the antenna that Edward Rule G3FEW used on returning to Amateur Radio.



The two additional coils allow the 18MHz V beam to work effectively on 3.75MHz (see text for details).

Returning to Amateur Radio after being away from it for 14 years, I found many changes had taken place during our separation. Not least the introduction of the WARC bands of 10, 18 and 24MHz. But let me explain how this antenna grew out of my new start.

My new start in Amateur Radio was on my old favourite of 3.5MHz and from there I was soon encouraged to try the new WARC band of 18MHz. My first antenna for this band was a simple vertical, one that allowed me to find out that this new, to me at least, band had much potential.

The 18MHz band, was I quickly found, a friendly band with something of the old Amateur spirit, with stations more interested in a chat, rather than a simple rubber stamp QSO. However, I decided that a better antenna was needed if I were to enjoy the band's full capabilities.

The first antenna was a full-wave length long simple wire antenna, voltage fed from a quarter-wave length matching stub. The results I had were very encouraging, but I felt that I could do better.

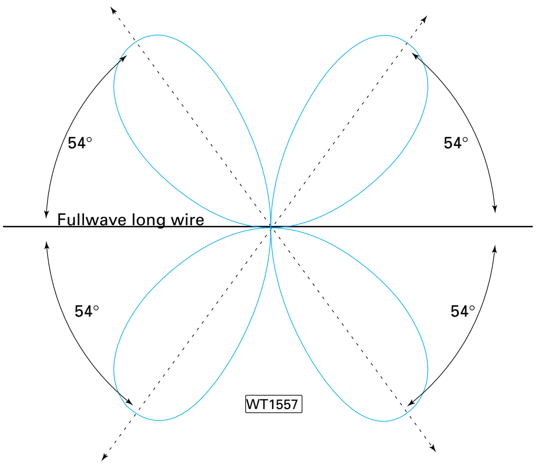
The design presented here is the culmination of my attempts to do better. And I think I have done better as, in my first year on 18MHz, I've managed to work over 120 countries, including some of them through pile-ups!

Why A V?

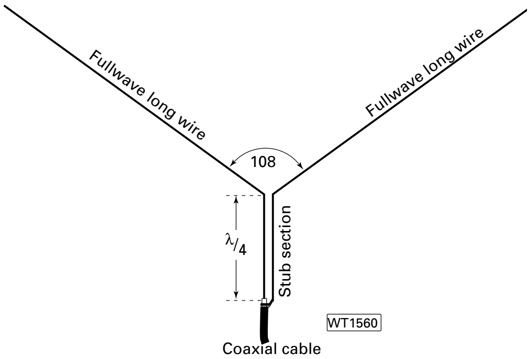
I should first explain why I'm using a V beam. Look at the illustration of **Fig. 1** where I've shown the relative pattern of a full-wave wire antenna. As is shown there are four major signal lobes with maxima at angles of 54° from the line of the wire.

I reasoned that, with correct phasing, if two full-wave wires were angled as shown in **Fig. 2**, then some of their lobes could add together and

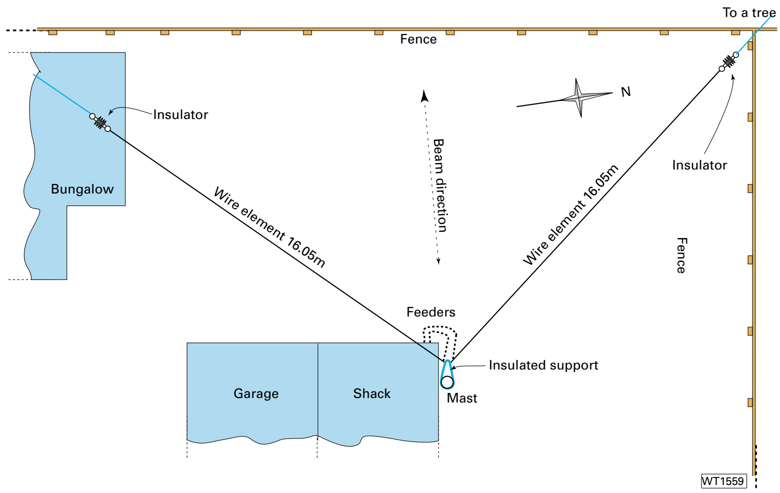
Fig. 1: A full-wavelength long wire give four signal lobes at 54° away from the run of the wire.



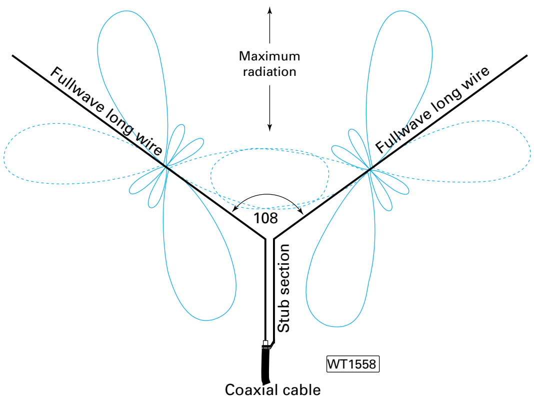
OR 18MHz



● Fig. 2: This is the design, using two wire antennas, that G3FEW settled on.



● Fig 4: This is the layout at the QTH of G3FEW meaning the antenna fires roughly East-West, but also works to other points of the compass..



● Fig. 3: Using two full-wavelength angled at 108° allows two pairs of the individual lobes to add, giving improved performance in two directions, and yet has some good all-round capabilities too!

provide useful gain in two directions. The two directions would bisect the lines of the two full-wave antennas.

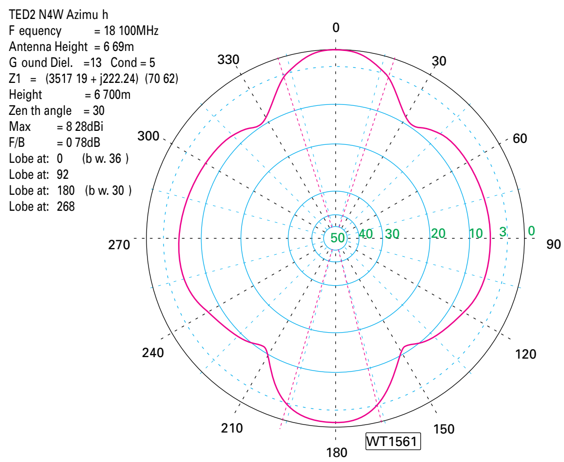
The angle of the major lobes decreases as the number of (full) wavelengths increase. This would allow the design of a narrow, high gain beam antenna to be built. In fact, such antennas are used for point-to-point communications, but are not really suitable for Amateur Radio use, due to the limited coverage resulting from the narrow angled beam.

For most Amateur Radio use, a single full-wave V beam antenna would give useful gain in two main directions with a beamwidth which is fairly broad. The remaining side lobes, giving coverage in other directions, but without the gain of the main directions.

So, the result is an antenna with good overall radiation, but with a gain of 1-2 S-points in two directions. The illustration **Fig. 3**, shows the addition of the two forward and reverse lobes, but that the side lobes will not cancel one another. They neither in nor out out phase with one another. So, some energy is directed to the sides as well.

Construction Considerations

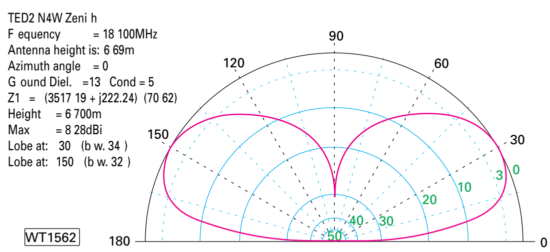
Now to look at the construction considerations. My garden is around 17m wide in an east-west direction and around 27m long in a north-side one with the shack roughly in the middle at one side. So, it may be considered ideal for this design as the main lobe directions are effectively east-west.



● Fig. 5: Some 6dBd of gain in two directions in the horizontal plane, but only a slight loss against the dipole in other directions makes this a useful antenna to have.

The main layout is shown in **Fig. 4**. The rear end of my shack (an extension of the garage) is on the eastern side and has just one support mast around 7m tall mounted on the end wall of the shack. This mast is the centre support for the system.

One wire end is supported with an insulated line tied to a tree in my neighbour's garden. The other, is held in place by a nylon rope passing over the roof of the bungalow. The average height of the antenna is only around 6m, but the results



● Fig. 6: The front and back lobes have launch angles slightly higher than would be considered ideal, but they're still a better than many antennas when near the ground.

Table 1

Band (MHz)	Match (s.w.r.)
3.75	1.5:1
7.05	Max:
10.15	Max:
14.250	Max:
18.125	1.1:1
21.250	Max:
24.938	2.1:1
28.500	Max:

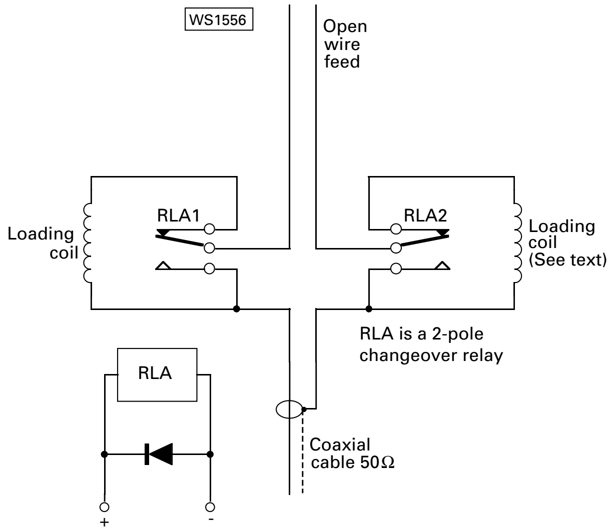
● Table 1: Measurements of s.w.r. taken without using an a.t.u. By using an a.t.u. it should be possible to use the antenna on some of these bands.

have been outstanding on s.s.b. with 100W of r.f. from the Kenwood TS-530S.

The antenna is simple to make, being just two wires, each some 16.05m long using, in my case, heavy gauge insulated earthing wire with a cross sectional area of 2.5 square millimetres. It's available from most d.i.y. outlets and is, I feel, ideal for antennas.

The length of the two legs is rather shorter than the theoretical 16.5m, but the antenna works well. Also, the wire's separation angle of 108° is not that critical and in practice, there seems to be room for variation without dramatic changes of performance.

The wires are fed from at their close ends with a quarter-wave matching stub of 600Ω open wire twin feeder. The length of this matching stub should be 3.55m, which is connected in turn to a 10m length of 50Ω coaxial cable to connect to the transceiver in the shack. The redrawn plots of **Fig. 5** and **Fig. 6** show the computer analysis of the antenna set-up



● Fig. 7: A simple changeover relay adds the coils in series for use on the 3.5MHz band. The control voltage is taken on a separate wires that run alongside the coaxial cable.

Due to the layout of my garden, the main lobes are slightly south of East and North of West, giving a gain of about 6dB over as dipole. The side lobes giving good radiation in other directions, giving an additional overall coverage.

Almost Perfect

The standing wave ratio (s.w.r.) was almost perfect at the 18MHz band centre without any other form of matching. But if you experience problems, then adjustment of the lengths of the wire elements will alter the s.w.r. to bring the s.w.r. within the range you would like.

The arrangement described was in use for several months and proved to work well. However, with all the wire available I also wanted to use it on other bands, and my eventual choice was for dual 3.5 and 18MHz use. So, I set about modifying the system.

The length of the 18MHz full-wave wire, plus the 600Ω feeder added up to just rather short of a quarter-wave length on 3.5MHz. All that was needed was a small additional inductor in each leg (to keep the system balanced) to resonate the antenna on that band too!

Neither the fact that the angle of the elements is only 108°, nor the fact that the centre section of the 3.5MHz dipole is vertical open wire feeder has had any noticeable effect on my use of that band. I've had signals of S9 consistently from Europe and a reasonable amount of DX work.

Extra Wire

The extra wire switched into circuit to bring the antenna to resonance on 3.5MHz consists of two small coils at the coaxial feed-point. Each coil is made up of five turns of heavy insulated wire with a diameter of 50mm. The heading photograph on page 24 shows the coils and the simple band-change relay. The circuit that I use for change-over is shown in **Fig. 7**.

Some adjustment of the number of turns and their diameter may need to be made to bring the resonance point to the centre of your area of interest on the 3.5MHz band. The point of lowest s.w.r may be adjusted quite easily by altering these coils.

Make sure that the antenna is set-up correctly on 18MHz first, then make and temporarily fit the two coils in line, then check the s.w.r. on 3.5MHz. To adjust the point of lowest s.w.r. on 3.5MHz lower the centre point and adjust the spacing between turns or number of turns until the s.w.r is acceptable.

I've found that when the centre point is lowered only part way and a set of step-ladders used to gain access to the coils, there's little need to raise the antenna again to check the s.w.r. as this make only a slight difference.

I set my antenna to lowest s.w.r at 3.570MHz as my interests lay in the s.s.b. portion of that band, but it would be possible to set the lowest s.w.r. anywhere in the band.

You should be able to see from Fig. 7 that I've used two lengths of Lego material (it's stable and has good insulation properties) as the support for the coils. But whatever you use you should give the coils and changeover relay several good coats of varnish to weatherproof them before hauling the finally back up again.

Simple Arrangement

On this simple antenna arrangement, I've managed to work All bands except 1.8MHz with the aid of a good antenna matcher. Without a doubt, a better arrangement would be to use extra relays to bring in different coils for each band, but I've not tried this idea yet.

Although the dimensions given work well at my location, you may have to experiment with your version to obtain the best results. My layout gives a low s.w.r. over the whole of the 18MHz band and has been optimised for lowest s.w.r in the 'phone section of the 3.5MHz band.

You will probably need to use an a.t.u. for other bands, to reduce the s.w.r. to acceptable levels. The values shown in **Table 1** give the values, I found with my antenna. A better solution would be to use a balanced output a.t.u. and extend the open wire feeders down to the shack, dispensing with the coaxial cable feed all together.

Such a simple antenna, but very affective nonetheless!

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