THE VK WINDOM

Seemed Like a Good Idea

Over the years there have been many articles about the Windom antenna. It was first popularized by a US amateur called Windom whose 40 m signal on this antenna was outstanding. The design was one of a half wave dipole fed with a single wire connected at the 1/3 point instead of the 1/2 point. It must have something going for it I thought. The old-timers spoke highly of the Windom especially as a multiband antenna but, with the growing popularity of 50 Ω output transmitters, antennas such as the Windom lost popularity in favour of antennas fed directly with coax. As time goes by I gain more respect for the old-timers and recently became convinced that the Windom perhaps did not deserve the bad name it appeared to have acquired. I therefore set out to analyse the antenna on a theoretical basis.

Firstly I wondered why the tapping point was claimed to give a good match on four bands. The reason can be deduced from Fig 1 which shows the current distribution on an 80m dipole at resonances on 80, 40, 20 and 10 metres. At a point equal to 60 electrical degrees in from the end (on 80m) the current amplitude is the same for even multiples of the fundamental frequency. It seems quite possible then that the resistance seen at that point will be similar on all second harmonic frequencies. The tap at the 1/3 point might have a good engineering base. Of course equality in current does not mean equality in resistance, but it’s a good start.

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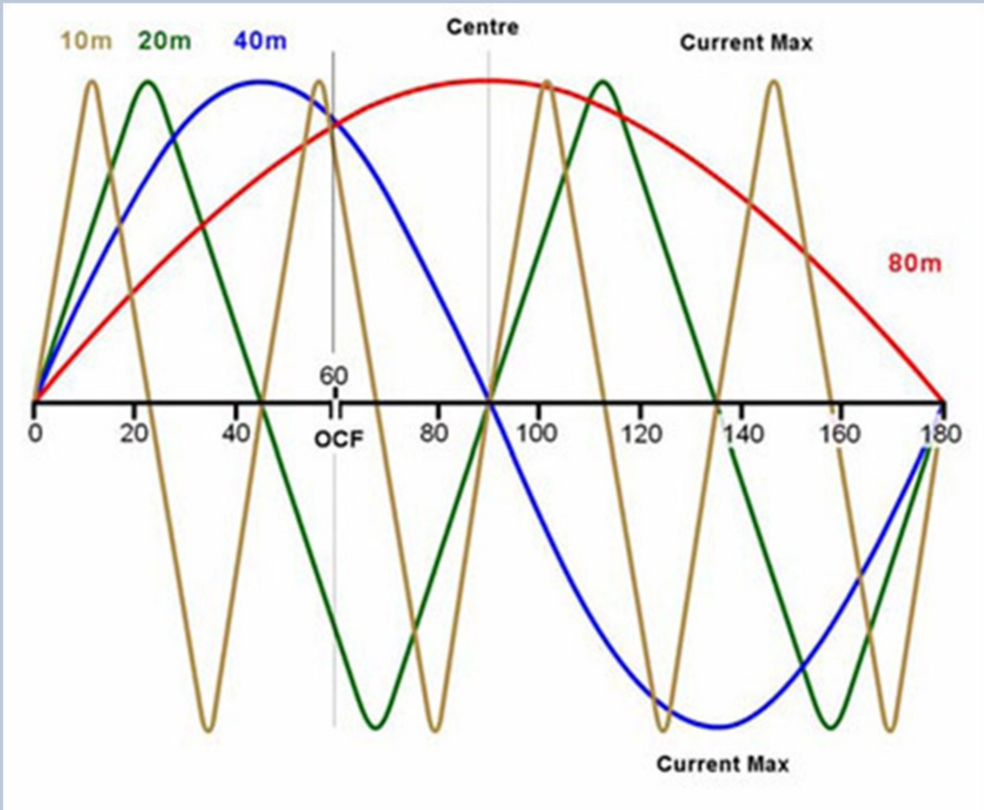

Fig 1. The fundamental and even harmonic current amplitudes on a 80 m half wave dipole.

The Off Centre Feed (OFC) connection is shown at a distance of 60 electrical degrees of the fundamental (one third of the half wave) from one end where the even harmonics all have similar current amplitudes.

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Hitting the keyboard.
Next step was to run the Windom through a computer program called MININEC8 which is a useful tool for analysing a wide range of antennas for feed impedance, gain and polar pattern. I used a 2mm diameter wire, 136 ft. long wire tapped at 44ft 4in from one end. The results are shown below.

Calculated Windom Feed Impedance

Frequency MHz	Impedance Ohm
3.6	98 + j41
7.1	136 - j 26
7.2	142 + j44
14.3	125 + j10
28.6	845 + jl66

This shows that in free space the antenna resonates between 7.1 and 7.2 MHz and a little below the selected frequencies for the other bands. Additional calculations could have been made but the information is enough to start with.

It is clear that a 4:1 balun is not the best choice for matching to a 50 ohm line. It is also clear that the single wire feeder with an impedance of 100 to 400 ohms wasn't a bad choice.

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An infinitely long wire in free space has an impedance of 377 ohms and one nearer earth will have a lower impedance. If it slopes the impedance will increase with height, and as it will be miss-matched it will radiate some energy. My guess is that about a quarter of the radiation from the original Windom is from the single wire feeder.

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The next thought that occurred was that the lowest three bands could be reasonably well matched with a suitable balun but 10m would remain a problem. Suppose 80m was sacrificed by making the antenna half size resulting in a matched antenna for 40, 20 and 10m. The best match obtainable for a simple matching device comes close to the ideal ratio, transforming 50 ohms by a factor of 2.25:1 to 112.5ohms. This would give about1.2:1 VSWR on 40m and better than 1.1:1 on 20 and 10m. Coax feed and no ATU required!

In spite of. the rural image Australians have, very few live in the country on farms where the erection of large wire antennas is a trivial matter. Most of us live on small blocks, about five to the acre, and putting up an 80m dipole is often quite difficult. A smaller antenna.is also desirable from the point of view of visual impact on the neighbours. Thus an antenna with a span of only 66ft has considerable attractions for VK amateurs, hence the name for this version of the Windom, **the VK Windom**.

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The Real World
To test the theory I built and tested a VK Windom, using 2mm diameter hard-drawn copper wire, 66ft long tapped at 22ft from one end. The insulators were obtained from Dick Smith.

The novel feature is the use of a 2.25:1 matching transformer instead of the 4:1 balun used (as we can now see incorrectly) for the Carolina Windom. (It should be noted that in some articles describing the Carolina Windom it is clearly stated that an ATU is required. We can see why).

I had intended to use a transmission line type balun but found that the desired ratio and balanced to unbalanced connection was apparently not possible with one core. It might be possible, but my reference (Transmission Line Transformers by Jerry Sevick W2FMI) did not show me a suitable design. My design might be considered a two wire and a three wire transmission line arrangement. I used silver plated Teflon insulated single strand copper wire to make five wires twisted together and passed three times through two FC501 cores (bought at Stewart Electronics).

Connecting two and three windings in series for input and output gave the ratio of (3/2)^2 or a input to output ratio of 1:2.25

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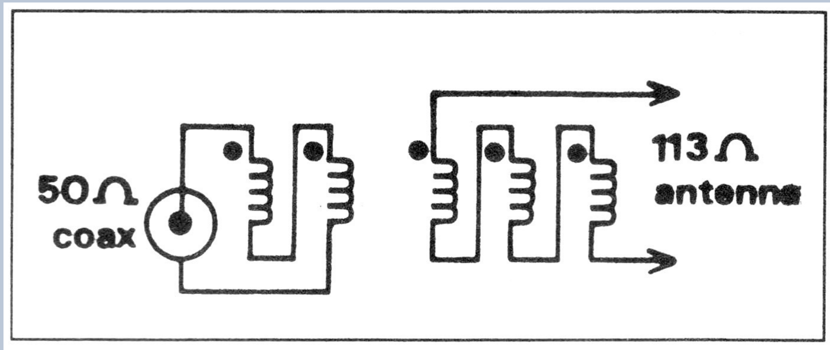

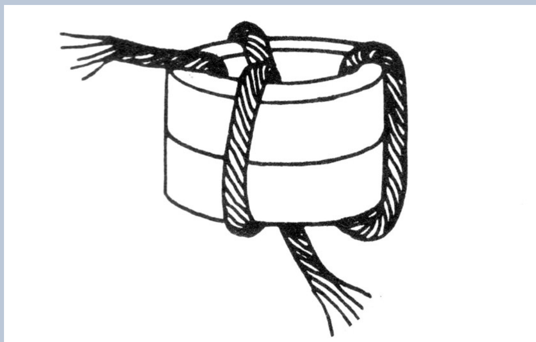

Fig 2. Balun Transformer wiring
The primary is a two wire transmission line, the secondary a three wire transmission line.

The impedance ratio is 1: 2.25, or 50 ohms to 112.5 ohms. This will give a good match for antenna resistances from 75 ohms to 168 ohms. For the Windom this means the fundamental and the second and fourth harmonics will have good matching.

Fig 3. Core and winding Arrangement.
A rigid and waterproof arrangement can be made by dipping the assembly in an epoxy designed for coating cork or wooden flooring.

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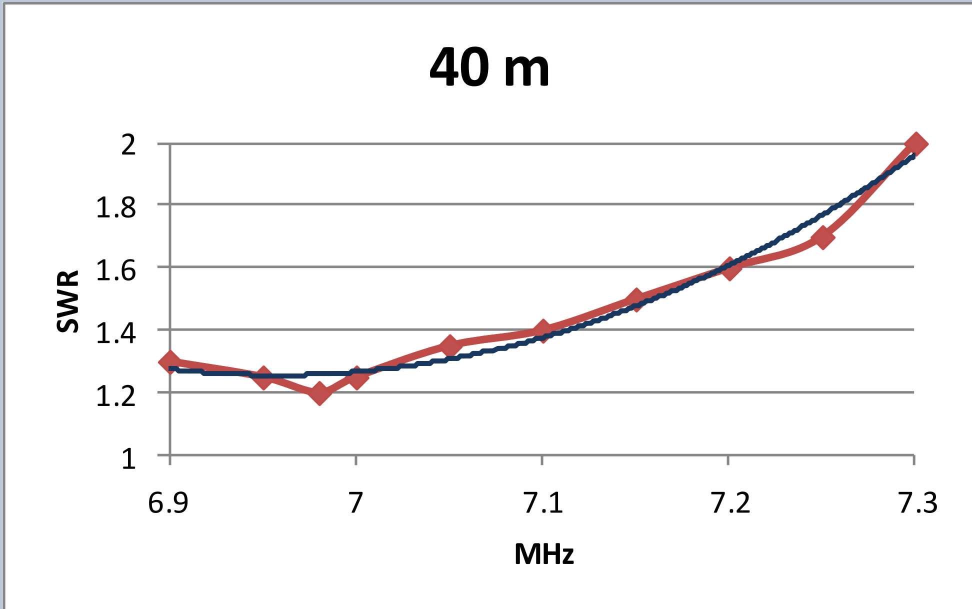

Fig 4. Measured SWR curve for 40 m.
The blue line is a best fit curve that smooths out the bumps which are probably due to test in-accuracies.

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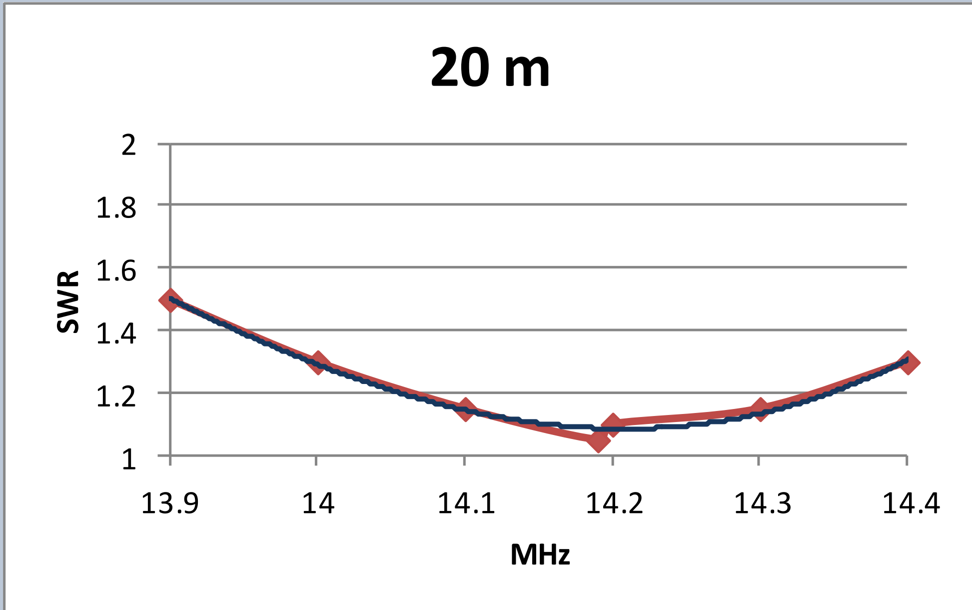

Fig 5. Measured SWR curve for 20 m.
The blue line is a best fit curve that smooths out the bumps which are probably due to test in-accuracies.

THE VK WINDOM cont'd

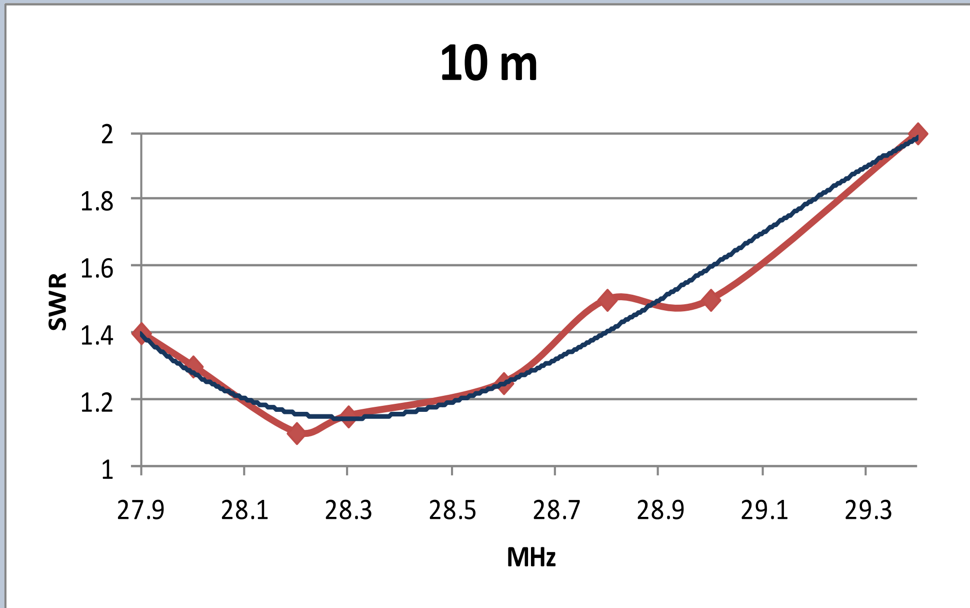

Fig 6. Measured SWR curve for 10 m.
The blue line is a best fit curve that smooths out the bumps which are probably due to test in-accuracies.

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After potting in liquid epoxy (and allowing it to dry, the core was placed on a pad of roof and gutter sealant in a small die cast box. The coax was run in through a small hole at one end and two insulated wires through holes at the other. After soldering to the transformer more sealant was used to water-proof the box. The lid was screwed on and coaxial connector sealant used to seal the screw holes and lid edge. The two wires were then soldered to the antenna which was then suspended from my 40ft tower at the feed point and the ends run to the two side fences. The short end of the new antenna was almost vertical, not a feature that I had wanted but unavoidable given the physical limitations of my QTH.

On air results.

The VSWR was measured and found to agree well with predictions made from the computer program. The curves are shown in Figs 4, 5 and 6. The variations from a smooth curve are partly due to inaccuracies in VSWR measurements and the limited resolu-tion of the VSWR measurements. The antenna was fed through a 60ft length of RG58. It can be seen that the resonant frequencies are not exact multiples of the fundamental. This is as we would expect due to the end effect, but the differences are an acceptable compromise and the length can be optimized for the most used band'

How well will it contain the smoke?

It was tested at up to 400 W of SSB and no changes were noticed. It should run nicely at 100 W.

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How well does it work?
Comparative tests were made against a GSRV wire antenna and a W8JK beam.

On 40m the VK Windom was overall equal to the G5RV. It was better for stations to the north, such as JA, but not as good for stations to the east such as Ws. The differences did not exceed about one S unit and can be readily explained by differences in orientation off the two antennas.

A similar result was obtained on 20m, but on 10m the VK Windom was superior in all directions, by about two S units into Europe compared to the G5RV. It was almost as good as the beam in some directions.

The Wrap
If you need a cheap and easy-to-build antenna, suitable for suburban installation, not requiring an ATU yet providing both local and DX capability, coaxially fed, without awkward traps and with off-centre feed for restricted spaces, then the VK Windom is for you.

The disadvantage is the restriction to three bands as above or, if you have the room, 160, 80 and 40 with a double size Windom or 80, 40 and 20 for the standard size. All band operation is of course possible with open-wire feeder and a balanced ATU. A balun is unlikely to provide the required match on some bands. If the SWR seen by the balun exceeds 3:1 it is inadvisable to use an ATU to operate on that band as the balun will be under stress for all but QRP.
A light weight version would be suitable for backpack operations such as SOTA.

This article is based on one by the author that appeared in the January 1991 issue of Amateur Radio pp 36-37.