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Antennas

G3LDO looks at his Double-D antenna, the VK2ABQ, the Moxon Rectangle, and modelling HF antennas at VHF

Sending and receiving material with images over the Internet and e-mail had been testing my patience of late, so last month I invested in broadband. While exploring antenna article sites on the Internet I came across *Rothammels Antenna Buch*, see [1]. This German antenna book comprises 42 chapters and is larger than the ARRL *Antenna Book*. To give an example of the scope of the book, the first five chapters cover: 1. Terms, fields, waves; 2. Propagation of electromagnetic waves; 3. Antenna forms; 4. Antenna characteristics; 5. Transmission lines. The best method of looking at this website if you don't understand German is to go via Google and use the translation facilities. The site contains a full contents list and index, plus some sample pages and other information.

Chapter 18, HF directional antennas (beams) has a sub-title, '18.1.4 Miniature Yagis', and under this sub-title I was surprised to find '18.1.4.3 G3LDO-Beam'. In references [2] and [3] it is called the 'Double-D Antenna'.

MODELLING HF ANTENNAS AT VHF

The G3LDO or Double-D antenna configuration was conceived by mischance. When I first moved to my present QTH nearly 20 years ago I looked for a method of making a small compact beam to go on the chimney of this rather small house. The only configuration that I was aware of at the time that would fit the bill was a wire beam by VK2ABQ [4], the basic structure of which is shown in **Fig 1**. I didn't know how this antenna would perform and (this was before the days of computer modelling) so I made a VHF model. This technique had been used with some success to investigate the performance of other HF beams, and is described in [5].

The model was constructed with wire elements laid out on a wooden X-spreader with the element ends tried in various directions. The results were rather disappointing. It would give the gain of a two-element Yagi provided the elements were not folded too far back on themselves, or directly towards each other on the same plane as shown in Fig 1.

The VHF model indicated that the ends of the elements could be folded back towards the mast and down to an angle of 20° from the horizontal before the gain started to deteriorate. This resulted in a structure shown in **Fig 2**. The antenna proved to be a simple and stable mechanical arrangement and the HF model survived some very strong gales.

Since that time, antenna modelling programs such as *EZNEC* have shown the antenna configurations shown in Fig 1 do work quite well, even at VHF. So why did my VHF model fail in this regard? It is possibly that it was due to capacitive end-coupling. With VHF modelling, wavelengths, capacitances and inductances in the VHF scale model are reduced in proportion to the linear dimensions while gains and impedances are unchanged. However, the insulator supporting the ends of the elements represents a fixed capacitor, the reactance of which is frequency-dependent.

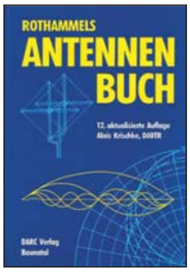
THE MOXON RECTANGLE

The original VK2ABQ antenna is a square structure, see Fig 1. The driven element and the reflector are a quarter-wavelength apart, although the tips of the elements support each other using insulators. G6XN [6] changed the structure from a square to a rectangle, thereby reducing the centre section spacing of the elements from 0.25λ spacing to 0.17λ spacing. This resulted in improved gain and directivity. It also reduced the feed impedance from around 120Ω to 50Ω, thereby overcoming the need for a matching network. Multiband editions of these antennas can be made by nesting the elements.

C B Cebik, W4RNL, reduced the element spacing further to 0.14λ, and obtained yet more gain and improved directivity. The downside of this higher performance is that the design is more critical, the feed impedance is down to around 35Ω and multibanding can pose a challenge. This antenna was called the Moxon Rectangle.

The first documented account of a two-element Yagi with bent elements (that is what all the antennas described above are) was by John Reinartz, W1QP, and a model was constructed for 14MHz by Burton Simson, W8CPC. It was described in *QST*, October 1937 [7].

These antennas are also described in an earlier 'Antennas' column [8], and in [9]. ♦



Front cover of the German antenna bible, '*Antennen Buch*'.

FIG 1 © RADCOM 539

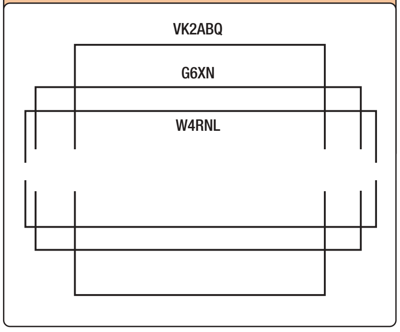


Fig 1
The original VK2ABQ antenna structure compared with the G6XN and the W4RNL. The G6XN has a centre section spacing of the elements of around 0.17λ spacing, while the W4RNL has element spacing further to 0.14λ, the closer spacing gives a greater gain and front-to-back ratio.

FIG 2 © RADCOM 540

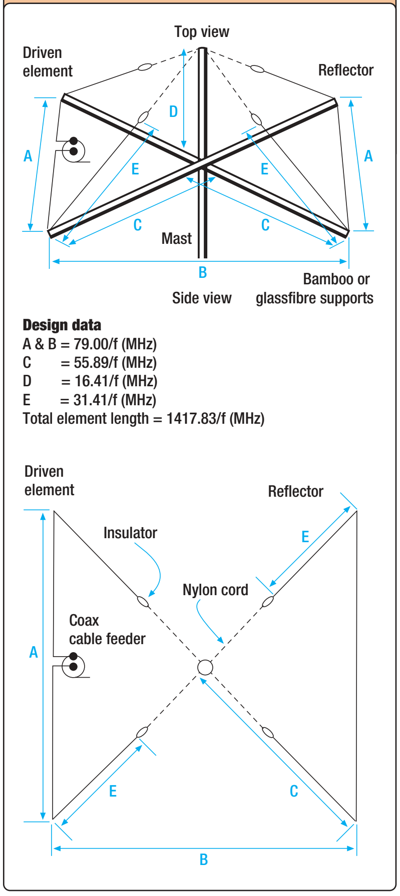


Fig 2
The basic G3LDO Double-D wire antenna with approximate design data. Multiband versions of this antenna have been made by fixing nested elements to the existing support structure.

REFERENCES

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[8] 'Antennas', *RadCom*, March 2002.
[9] *Backyard Antennas*, G3LDO.