The GW3YDX Super Moxon

Adding extra directivity to the Moxon Rectangle for 6m, 4, and 2m

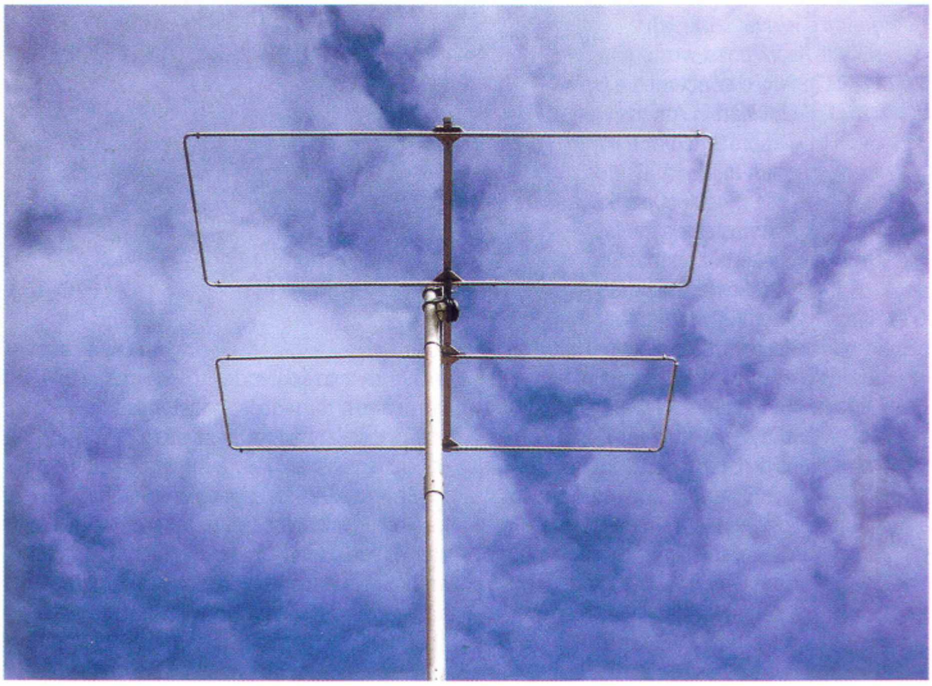

PHOTO 1: Completed 4m GW3YDX Super Moxon.

MOXON FAN. The author is a keen enthusiast of the Moxon Rectangle antenna, invented by the late Les Moxon, G6XN. In its basic form it's easy to build and is a great performer. The reduced wingspan of the rectangle also appeals to the QTH-restricted UK radio amateur and it is a surprise that the antenna has not become more popular.

Spending much of the day in the workshop, I wished to keep an eye (and ear) on the 6m band one June. Something is often happening on six, so I wanted a simple antenna to monitor the band. Although my neighbours are quite understanding of the structures that go up from time to time to be tested, this would be a semi-permanent antenna and thus something was required that was not too visually obtrusive. A Moxon rectangle was built for 6m and put on a short mast outside the workshop door. An FT-847 (a trusty test radio for antenna projects) was installed for monitoring the band.

Much interesting DX was worked, including a memorable evening in late June where more than 80 stations in the USA were contacted, extending as far as west Texas. This was just with 100W from a poor VHF QTH, and there seemed no difference in results compared with the (alleged) kilowatt-and-long-Yagi G stations on the band.

BASIC MOXON DESIGN. Making the Moxon rectangle was not difficult. There are some useful design formulae available that are quite accurate. The best one so far found is *Moxgen* (**Figure 1**), which allows input of wire gauge and frequency and that results in a dimensional guide. *Moxgen* is downloadable as free software from **[1]** and, most usefully, allows creation of a model in either NEC or *EZNEC* formats for further experimentation.

Continuing to use the Moxon rectangle, the fairly broad frontal lobe of the antenna (see **Figure 2**) of 80° between 3dB power points was sometimes not too good in QRM when beaming to Europe.

IMPROVEMENT. Something better was needed, but how could this be achieved without a greater wingspan, yet with a worthwhile increase in gain for not a huge increase in boom length? Lying in bed one night and thinking about radio antennas (as one does) the idea came to me of adding directors to the Moxon, but in the form of another rectangle, ie two directors with the ends bent back and joined with an insulator. Several evenings were then spent modelling the antenna using a combination of *4NEC2* and *EZNEC+*. For an increase in boom length to just under 2m (just over double the original boom length) and no increase in wingspan, another 3dB gain was achieved from the modelling, with a 26.5dB front to back ratio and a VSWR of less than 1.5:1 between 50.0 and 50.3MHz when the model was optimised for 50.1MHz.

Figures 3 and **4** illustrate the modelling results obtained. Note the decrease in -3dB power points to 60° compared with 80° for the original. This narrowing is where gain comes from. Front to back ratio of around 26dB is very respectable and the pattern has a nice clean 'light bulb' shape to it, with no minor lobes. Although modelling indicated that a 38Ω feed impedance was ideal,

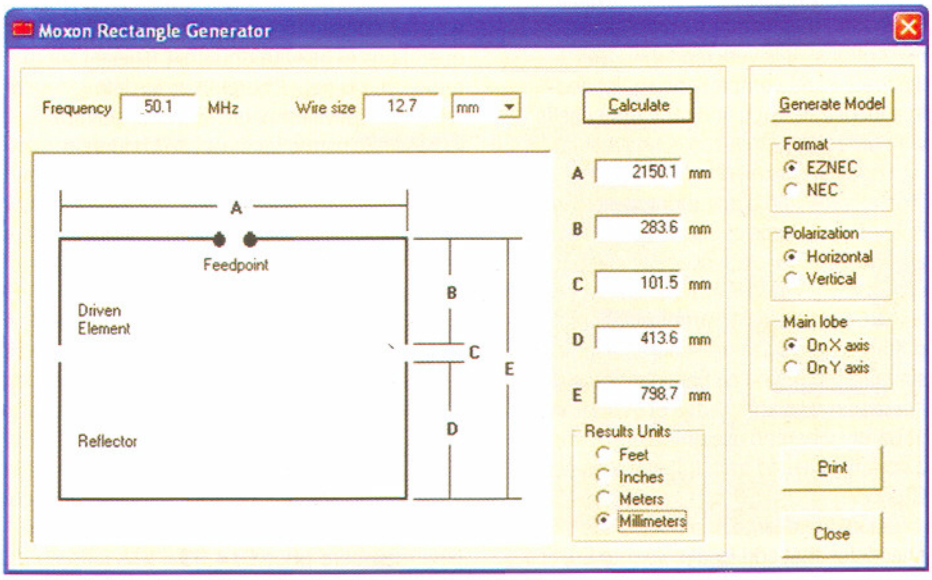

FIGURE 1: Calculating Moxon Rectangle parameters with Moxgen.

PHOTO 2: The 2m version of the Super Moxon is just 30" x 25".

practical models have been fed with 50Ω cable and VSWR plots that follow the model graphs have been obtained with just slight adjustment of the driven cell element lengths. VSWR bandwidth is probably a little narrower than comparable Yagi designs, but at below 1.5:1 for the most-used part of 6m is very acceptable. The author has quite extensive knowledge of Yagi designs and so far (this tempts fate of course) has seen no 6m antenna design with comparable performance on such a short boom. A regular Yagi with the same gain would need a boom length of nearly 50% more and a turning radius nearly double of this design. One can truly say that this design packs more dB into its size than anything else so far realised.

BUILDING THE PROTOTYPE. The next stage was physical implementation, which was done with aluminium alloy for the elements and fibreglass rod for the split driven element and the element-end insulators. This is a lightweight antenna, easy for one person to manage, and only a 1" square boom was required.

Construction of the antenna was principally with ½" aluminium alloy, with the bent corners in 3/8" material. 3/8" fibreglass rod was used for the element insulators both at the driven element centres and at the element ends. The 6m antenna has been tested with 1000W from an ACOM1000 without complaint. (The insulators on the directors on the 2m version are only 12mm long but at the 50W power level no arcing or instability was noted. Unfortunately no greater power was available on 2m for testing.)

Table 1 gives constructional sizes for 6m, 4m and 2m versions, the dimensions relating to Figure 5. The front part of the driver element is of course split at the centre and 50Ω feedline connected there through a balun.

Although the final dimensions are as set out in the table, it is useful to slit the ends of the main element tubes and install stainless hose clamps for fine adjustment, particularly if other antennas are nearby. It would be most interesting to hear of constructors using this design on other bands. 10m is currently in the doldrums, but a 10m version of this antenna or of the basic Moxon rectangle would be the most space-saving means of achieving a good 'gain' antenna on the HF bands.

TABLE 1: Tubing lengths for 6m, 4m and 2m versions of Figure 5. All dimensions in mm, measured to tubing centres.

	A	B	C	D	E	F	G	H	J	K	L	M
6m	2160	395	280	105	290	310	60	2140	0	780	1201	1861
4m	1572	275	175	110	195	202	43	1572	0	560	860	1310
2m	730	135	86	55	82	90	12	730	0	276	434	615

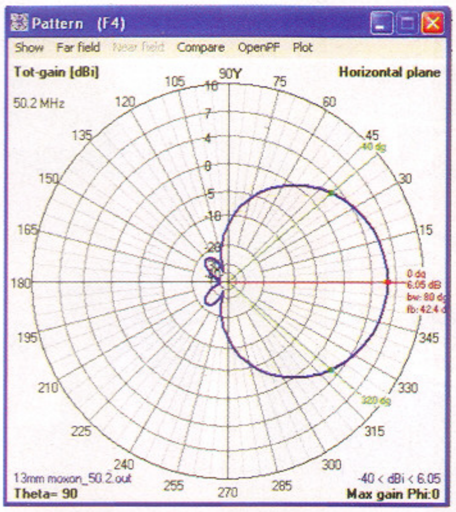

FIGURE 2: *4NEC2* plot of Moxon rectangle showing fairly broad frontal lobe and 80° 3dB points.

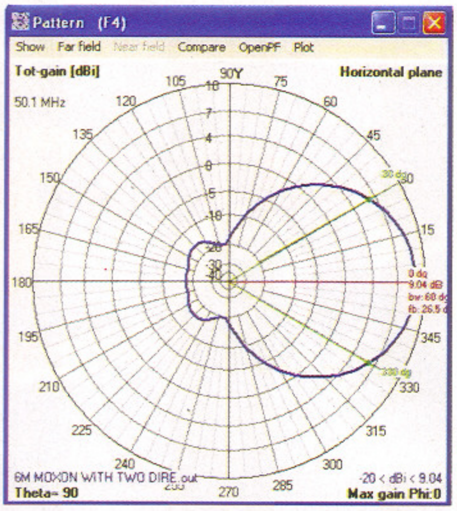

FIGURE 3: *4NEC2* plot of Super Moxon radiation pattern. Note narrower frontal lobe and improved forward gain with very smooth rear pattern.

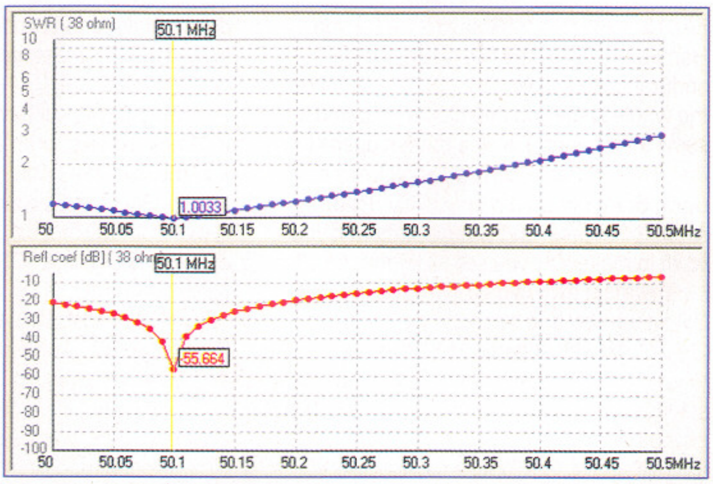

FIGURE 4: *4NEC2* plot of Super Moxon SWR and reflection coefficient.

REGISTERED DESIGN.

This design is being registered and therefore commercial manufacture is not permitted without permission of the design owner. However, radio amateurs may freely construct and use this antenna for their personal amateur stations. Commercial versions of the antenna are available from Vine Antennas Ltd [2].

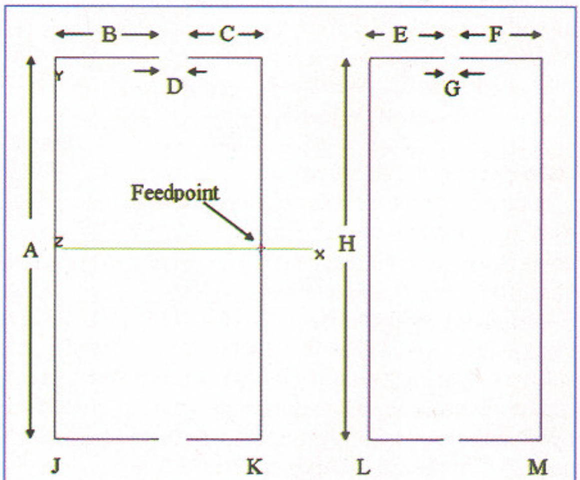

FIGURE 5: Basic design of the Super Moxon. See Table 1 for 6m, 4m and 2m version dimensions.

WEBSEARCH
[1] www.moxonantennaproject.com/design.htm
[2] www.vinecom.co.uk