Antenna Workshop

A MONO-BAND MOXON

David Butler G4ASR offers hope for operators who cannot erect a conventional 28MHz Yagi because local obstructions or small gardens limit the size of antenna to less than the six metres required for this band. Try it and see!

There's many an Amateur who looks for a beam antenna with a good performance that will fit into a small garden or as small a space as possible. Perhaps even a space that's smaller than your average dining room? For those who have this requirement, there is indeed a 28MHz antenna that fits this description almost perfectly.

The antenna I'm about to describe, possesses the gain of a 2-element Yagi, has an excellent front-to-back ratio and matches well (v.s.w.r. of below 2:1) over the entire 28MHz band. It requires no matching system and the antenna connects directly to a 50Ω feeder. Even better is that you can make the antenna yourself from easily obtainable materials and components.

The beam antenna is 3.8m wide and measures less than a metre and a half, from front to rear elements. It's lightweight and can be turned with a small rotator. This fantastic antenna is ... the rectangular shaped Moxon beam.

Moxon Derivative

The Moxon rectangle is a derivative of the VK2ABQ square. **Fred Caton VK2ABQ** took a quad loop antenna and laid it horizontally. He then cut the loop at each side in the front-to-back mid-line and then insulated the resulting two half-wavelength wires from each other by using large buttons as insulators. He then found that the beam antenna possessed some directivity and gain in the direction of the feed-point.

Then, **Les Moxon G6XN** looked at VK2ABQ's design and made two very significant discoveries about the antenna. His experiments showed that a rectangular shape improved the forward gain and that the spacing between the ends of the wires had to be much greater than that provided by coat buttons. In effect the Moxon rectangle is a two element beam, which is approximately 70% the length of a full size 2-element Yagi.

The design is quite accommodating, in that the

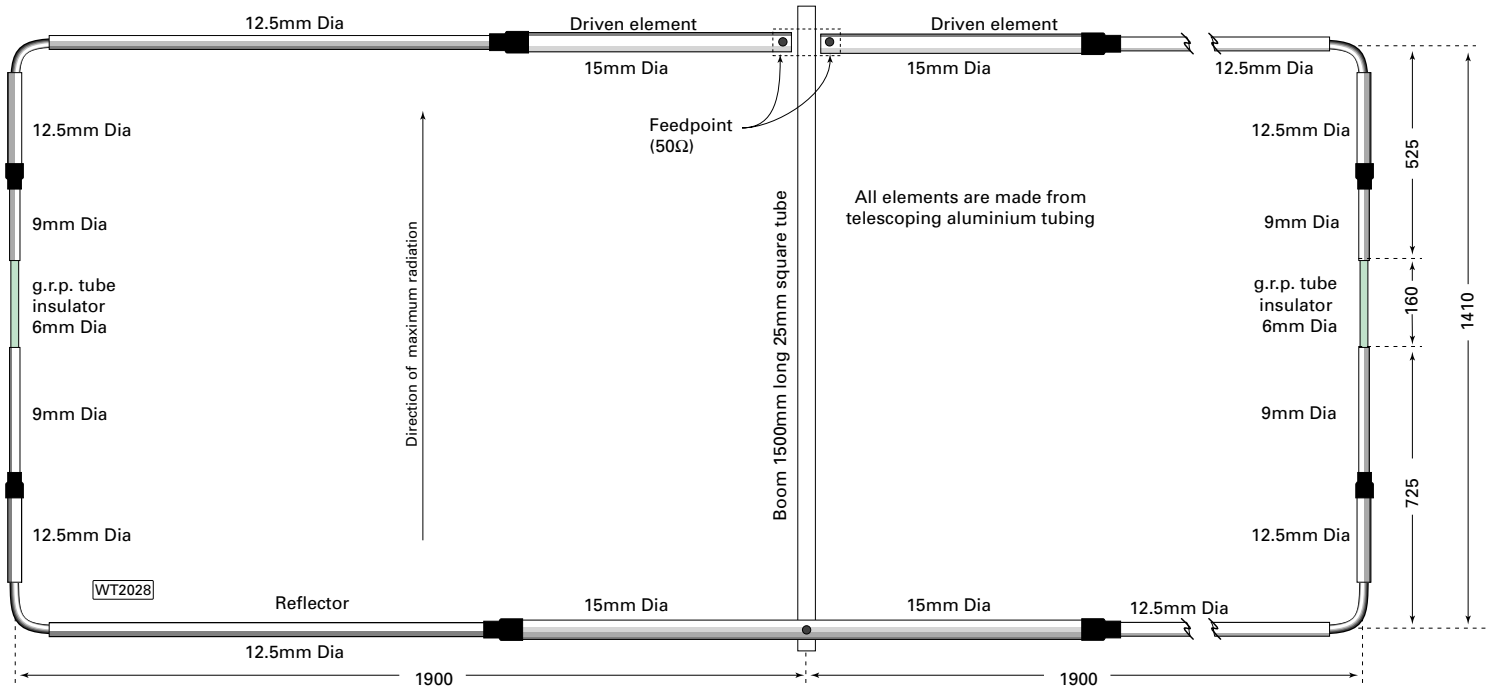

Fig. 1: The dimensions and layout of the Sandpiper design of 28MHz Moxon antenna.

antenna can be built as a wire array for the lower frequency bands or as a beam made from aluminium tubing for higher frequencies. The individual components or the complete kit of parts for the antenna that I'm about to describe are all available from **Sandpiper Communications** (see separate box).

Rectangle Elements

The elements of this Moxon rectangle, shown in **Fig. 1**, are made from various lengths of 15mm (5/8in), 12.5mm (1/2in) and 9(10)mm (3/8in) diameter tubing as shown in the diagram. The tubing and the insulator sections are sized so that they slide into each other. The main boom is made from a 1.5m length of 25mm (1in) square aluminium tube.

One of the two largest diameter tubes is cut in half and separated and insulated along a 300mm length of fibreglass rod that fits neatly inside the tubes. The two halves of the inner of the driven element are joined to the main boom using insulating components.

The feed-point assembly consists of a moulded dipole centre with integral SO-239 coaxial connector. Short wire links are attached to the split driven element as shown in the photograph, **Fig. 2**. The main element sections consists of four 1700mm lengths of tubing that are slid into the ends of the two central elements.

Time Consuming

The corners of any designed antenna, are probably the most time consuming aspect of building this or any antenna. You could bend your own by filling suitable aluminium tube with sand and bending the tube around a 15mm wheel or pulley, working slowly and by keeping the sand well packed in the tube to prevent pinch bends.

Alternatively, you could do what I did and use radius-bent aluminium tube sections obtained from Sandpiper Communications. The side sections of the rectangle consists of a 600mm length of 12.5mm tubing for the reflector, a 400mm length for the driven element, two 300mm lengths of 10mm tubing and a 300mm length of 6mm fibreglass rod for the insulator.

To set the element lengths and element spacing I used plastic couplers with integral screws, again available separately from Sandpiper if building your own antenna. They are available in diameters to suit various sizes of tubing and fibreglass rod used.

Very Straightforward

Tuning up a Moxon rectangle is very straightforward. The antenna is connected directly to 50Ω feeder. Although a 1:1 choke balun is recommended for this and indeed any fully balanced antenna, you can work without one. As a start point just adjust all elements to the dimensions given in Fig. 1.

The side-to-side dimension is the key to centring the v.s.w.r curve for lowest reading. The centre frequency changes approximately 50kHz for every 10mm of width adjustment. The spacing between the element tips has the greatest affect on the place of the deepest front-back ratio null within the 28MHz band.

To tune up the antenna at ground level I fastened the antenna to a short mast section clamped to a pair of step ladders as shown in the photograph **Fig. 3**. This arrangement made it very easy to alter the antenna without putting it on a large pole or tower. Adjustments were made to the elements at ground level and then the antenna was tilted upwards at 45° to check the v.s.w.r. readings.

When a good match is achieved, tighten up all joints and waterproof the coaxial cable connector with self-amalgamating tape. When the antenna is positioned on its permanent mast there should be no noticeable difference in v.s.w.r. performance.

Other Bands

If you're intent on making Moxon beams for other bands, a program that calculates the dimensions of a Moxon rectangle has been written by **Dan Maguire AC6LA**. You can find this on his website (**www.qsl.net/ac6la/moxgen.html**). All you have to do is just input the design frequency and diameter of the wire or tubing and the program will provide all the dimensions.

Note that if you want to build a Moxon rectangle with different size tubing, as shown here, then altering the element diameter will result in slight changes for the required spacing of the element tips. Different size tubing changes the coupling between the tips.

To achieve the same coupling with larger tubing the tails will need to be further apart but without significantly changing the overall final design length of the reflector element. Anything more than small changes in element diameter may require juggling all of the dimensions to maintain performance and still have a near 50Ω feed-point impedance.

So, get building that Mono-band Moxon

PW

Fig. 2: A close up of the feed-point arrangement, the two sides of the driven elements are separated and mounted on an insulating g.r.p. strengthener.

Fig. 3: Mounted angled upwards at around 45°, the antenna is quite easy to adjust for matching and band centre.

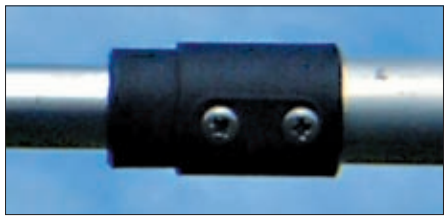

Fig. 4: Using pre-moulded joining pieces allows adjustments to be made before finally screwing the parts firmly together for permanent use.

Fig. 5: These radius-formed bends make the finished design look good as well as giving a sturdy construction.

A complete kit of parts to make the Moxon 28MHz beam antenna described here, may be obtained from **Sandpiper Communications, Unit 5, Enterprise House, Cwmbach Industrial Estate, Aberdare CF44 0AE, Tel: (01685)870425**. There's a special introductory price of £47.50 including carriage.

Sandpiper are aiming to develop this Moxon rectangle into a dual-band 28MHz and 50MHz antenna, which will consist of the above 28MHz Moxon rectangle with two additional parasitic elements for the 50MHz band.