Antenna Workshop

The Twin-Quad Antenna

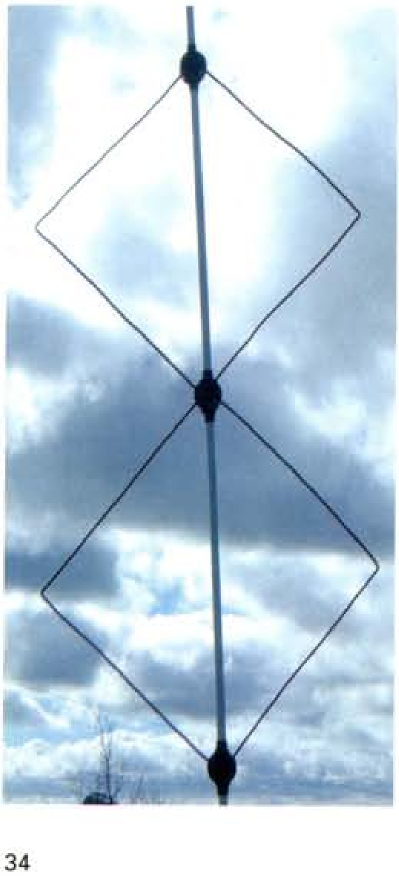
David Butler G4ASR looks at a Twin-Quad antenna...also sometimes known as a 'Bowtie antenna'.

Many readers will be familiar with the term 'quad' when applied to antennas, but here's a variation that you may not have seen before. The twin-quad antenna represents a variation using two parallel stacked quad antennas. The stacking effect significantly reduces the vertical beamwidth, resulting in an additional forward gain of about 2.5dBd. (*See the article 'Funny Things dBs' in this issue* Editor)

The twin-quad antenna is a proven antenna with a reasonable amount of forward gain and a low v.s.w.r. across the band. Depending on its application the broad horizontal radiation pattern may be regarded as having advantages over a Yagi-Uda antenna. There are no trimmer capacitors to adjust and it may be used directly with either 50 or 75Ω coaxial feeder cable. A simple illustration is shown in **Fig. 1.**

Table 1

Band (MHz)	Radiator Side(mm)	Total (mm)	Reflector (mm)	Spaced (mm)
144	520	4160	(see text)	275
430	170	1360	550×550	100
1296	60	480	250×250	30



The twin-quad antenna is easily set up for either horizontal or vertical polarisation and it can handle high power. It uses simple construction techniques and has a compact design. It also has an excellent relationship between performance and cost that's also an advantage...what more can you ask for?

Twin Radiator

The twin-quad radiating element can be made from 5mm diameter wire or tube, using either copper or aluminium. I actually made one of my versions from surplus Andrews LDF2-50 Heliax (semi-rigid coaxial cable) as this cable has a solid copper outer conductor. Each side of the quad measures one quarter-wavelength at the operating frequency band, making the entire twin-element element two wavelengths long.

After the element has been bent to shape the two ends are joined, either by soldering or bolting together. The dimensions given in **Table 1** are for antennas for the 144, 430 and 1296MHz bands.

The radiator element is held at the two points by insulated supports mounted on the boom. The supports are made from plastic material and need not have high insulation values since the fixing is at a low voltage point. I used heavy duty 25mm pvc round conduit for the support boom with 25mm plastic junction boxes to fix the twin-element in place as shown in the heading photograph.

Added Reflector

To provide additional forward gain, reflector elements may be fitted behind the twin-quad radiator. This increases the gain to around 10dBd making the antenna comparable to an 8-element Yagi. To reduce wind loading the reflector for the 144MHz version consists of three rod elements as shown in the illustration **Fig. 2.**

The rods have a length of 550mm each and spaced 275mm behind the plane of the twin-quad element. The outer reflector rods are 510mm apart from the centre reflector element.

In the 430MHz and 1.3GHz versions the reflector may be made from a solid sheet of copper printed circuit board (p.c.b.) or fine mesh coated with protective varnish. The radiator-to-reflector spacing is slightly more critical for these u.h.f. versions and the diagram **Fig. 3** shows one method of adjustment.

Feeder Possibilities

Now to mention feeder possibilities. The coaxial feeder cable is joined to the quad as shown in the diagram **Fig. 4**. The feed-point impedance is approximately 60Ω, but balanced. It's possible to connect the coaxial cable directly to the twin-loop without to much in the way of losses. The only effect is to shift the radiation pattern 10° or so away from the main axis.

The direction of shift is dependent on the connection of the inner and outer connections. You may consider the 'squint' inconsequential as the beamwidth of the twin-quad element is about 70° so, you probably won't notice any significant change.

Although you don't really need a balanced feed for the twin-quad, the diagram shows how to provide a

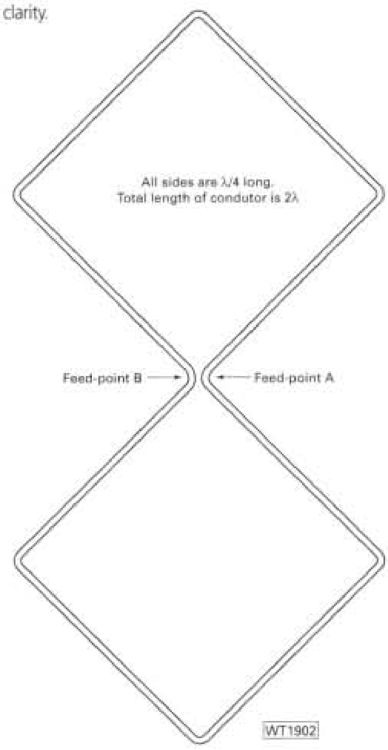


Fig. 1: The twin-quad radiating element shown in the horizontal polarisation position. The mounting points made from plastic conduit boxes are not shown for clarity.

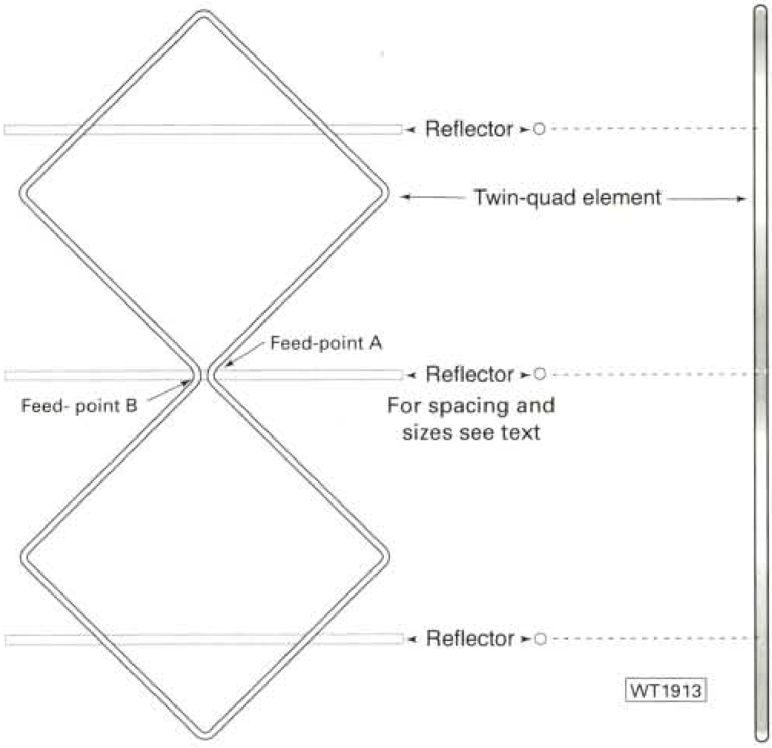


Fig. 2: Adding the three reflector rods to the 144MHz version. They are spaced at 275mm behind the twin-quad. (See text for more detail.)

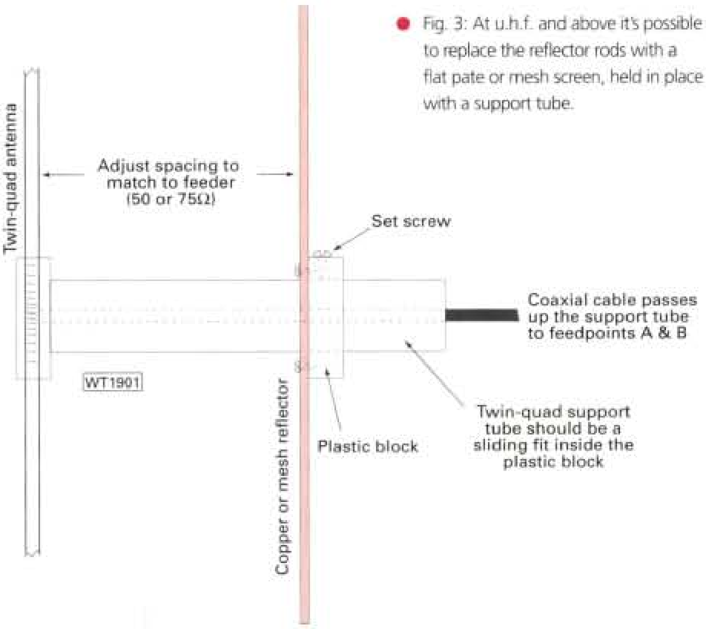


Fig. 3: At u.h.f. and above it's possible to replace the reflector rods with a flat pate or mesh screen, held in place with a support tube.

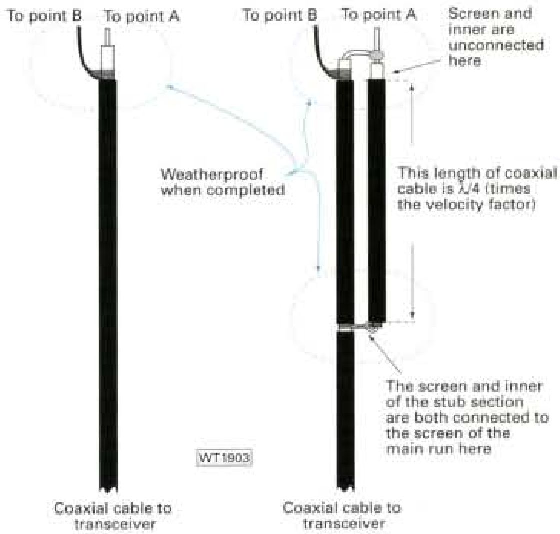


Fig. 4: Two feed arrangements. The balanced version shown to the right is the better one to use. (See text for more detail.).

Fig. 5: Close-up shot of the unbalanced feed connected to the 144MHz antenna.

balanced feed stub match using coaxial cable. This technique may come in useful if you need to feed other types of balanced antennas. The λ/4 line balun should be cut from the same cable material that you are using for the main feeder.

The screening braid **is unconnected at the antenna end of the stub**. The insulating sleeves should remain on both cables. The spacing between the main feeder and the λ/4 section is shown for clarity only and can be in close contact. After making the balancing section you should seal the ends of the assembly with self-amalgamating tape or other sealant.

Initial Adjustments

The impedance of the twin-quad is around 60Ω, a reasonable match to either 50 or 75Ω coaxial cable. The twin-quad with reflector may require a small adjustment to achieve a low v.s.w.r. but I didn't find this necessary in practice.

Horizontal polarisation is achieved by mounting the twin-quads in the vertical plane as shown in the illustrations on these pages. Simply rotate the twin-quad by 90° if you wish to use the antenna for vertical polarisation.

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