A full coverage beam for the six metre band

With the 50 MHz end of the six metre band now available to Australian amateurs, a beam to cover the full band is a natural requirement. This log-period yagi design does it, and then some!

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AS HAS BEEN long observed, long-distance (DX) propagation on the six metre amateur band is definitely frequency sensitive, particularly with regard to ionospheric F-layer modes that take advantage of the equatorial F-layer 'anomolies' sited north and south of the geomagnetic equator. Afternoon-type or Class I transequatorial propagation being the favourite for contacts to the US, Japan and other Pacific regions. And the lower the frequency, the longer and more frequent the openings. Amateurs in countries across the 'big pond' (Pacific Ocean) are permitted to operate over 50-54 MHz whereas, until recently, Australian and New Zealand amateurs have been permitted to use only 52-54 MHz. That 2 MHz has caused some difficulties. The popular segment of the band in the Australasian region is around 52.000 MHz to 52.500 MHz, whereas, in other countries it's around 50.000-50.300 MHz or so. Most of the local area beacons, widely used to indicate improving propagation conditions, are spread between 51 MHz (ZL1UHF, Auckland 51.020 MHz) and 52.500 MHz (VK7RNT, Launceston 52.470 MHz and ZL2MHF, Mount Climie 52.510 MHz).

The most popular antenna on six metres is the Yagi, generally of four to six elements. These generally have a bandwidth of around 5-6%, which gives adequate coverage of part of the band if cut at an appropriate centre frequency, but when narrow bandwidth matching methods (like the common gamma match) are used, overall bandwidth may drop to 1% — 500 kHz! A Yagi like this, cut and matched for best performance at 52 MHz, does poorly at 50 MHz as many frustrated operators will attest.

A better bet is the log-periodic Yagi array, or log-yagi as it has been dubbed in some quarters. This design is based on the ETI-714 VHF Log-Periodic Antenna published in the February 1978 issue of ETI. It comprises a three-dipole log-periodic array with passive reflector and director elements added. It has been cast to cover 45-55 MHz and should yield a gain of some 6-7 dB over a dipole. Balanced feed is necessary and a simple coax feedline balun is all that's necessary for matching. Feedpoint impedance is in the 60-70 Ohm region and VSWR across the band should remain below 1.5:1 which is quite acceptable, there being generally little point in trying to better that.

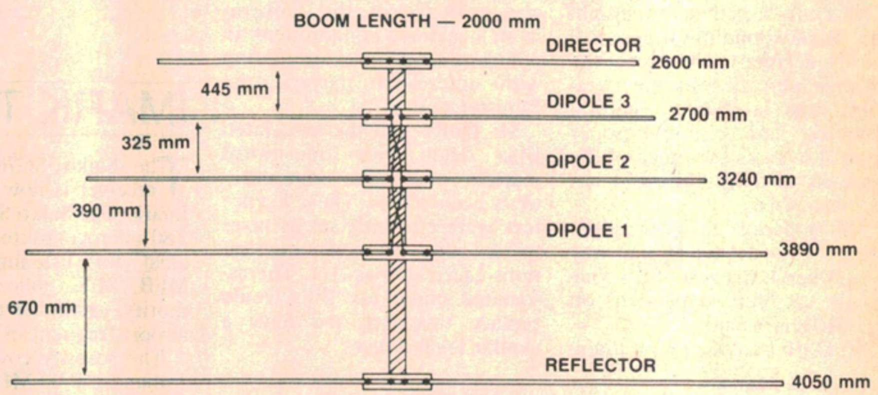

Figure 1. Overall construction of the beam. It provides coverage from 45 MHz to 55 MHz and gives around 6-7 dB gain.

Construction

The beauty of log-periodic designs is that they're tolerant of construction variations. At these frequencies, tolerances of ±10 mm can be accommodated without serious (if noticeable) effects on performance. Figure 1 shows the overall construction dimensions. Each of the dipole halves must be insulated so an insulted boom is required, along with some convenient method of mounting the dipole elements on it. There are two basic ways of achieving this — using a wooden boom and wooden element support brackets; or using a boom of high density water pipe of a suitable diameter and conventional element-to-boom brackets.

The boom for the model illustrated in Figure 1 is a two metre length of 25 x 50 mm (dressed size) wood such as maple, though western red cedar is also good. It must be a straight-grained and knot-free and suitable for outdoor use if sealed with a stain or Estapol. Wattle 'Forestwood' or one of the Cabot outdoor stains are fine and will ensure a long life.

The elements consist of two halves screwed to a wooden support block which is affixed to the boom. These blocks are cut from a length of 42 x 19 mm (dressed size) timber of the same type as used in the boom. The element halves are 10 mm diameter aluminium tube which is generally available from hardware stores or specialist aluminium suppliers (look them up in your local 'phone book). The measurements for element length given in Figure 1 are tip-to-tip dimensions. Cut the element halves 5 mm shorter than required to leave a 10 mm gap in the centre. The reflector should be made from a single length, if you can possibly do it, otherwise, use two, two-metre lengths and bond them thoroughly in the centre to get electrical contact. (If it has to be 50 mm short, it won't hurt all that much). Figures 2 and 3 show the general assembly details for the dipoles.

The position of each dipole support block should be marked out on the boom before assembling the dipoles. Drill the two bracket-to-boom screw holes in the brackets a little oversize so that the elements can be lined up parallel and at right angles to the boom, for appearance's sake. Note that the

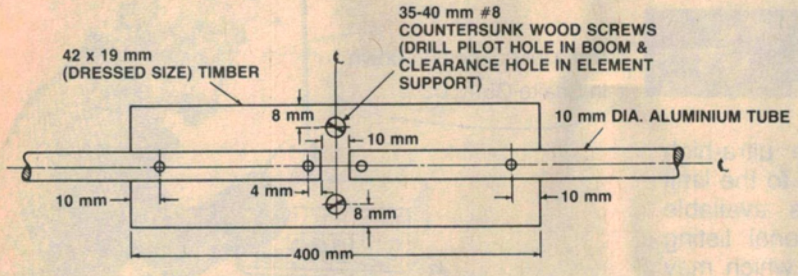

Figure 2. Dipole-to-boom bracket using wood construction.

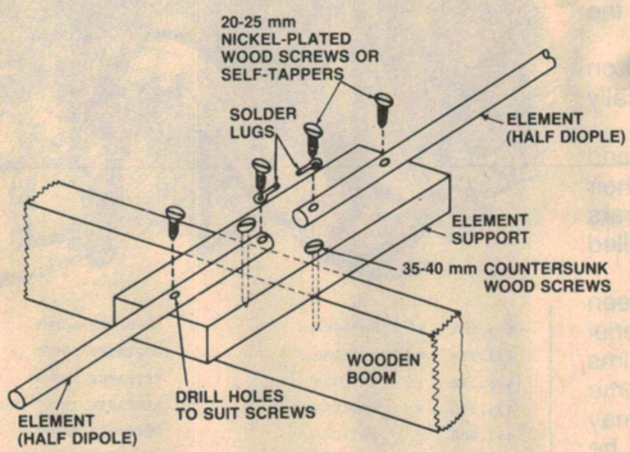

Figure 3. Element-to-boom mounting using wood construction. Estapol or stain all wooden components before assembly.

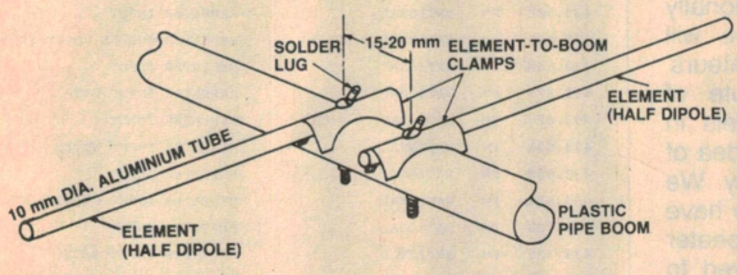

Figure 4. 'Plumber's delight' assembly using a plastic pipe boom.

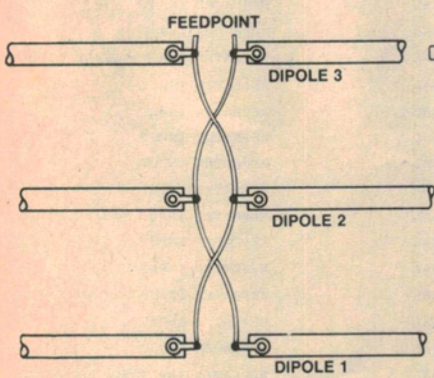

Figure 5. Showing the feedline connections between dipoles, and the feedpoint termination.

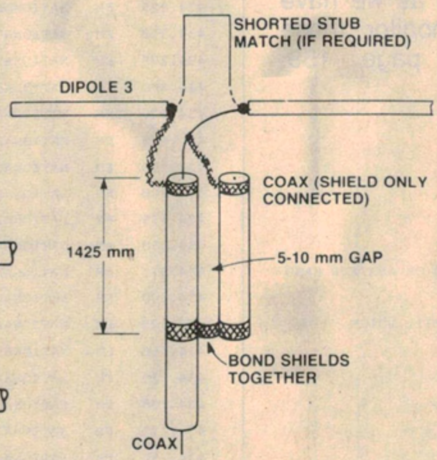

Figure 6. Suggested balun and matching arrangement.

element-to-element spacings given in Figure 1 are dipole centre-to-centre dimensions.

Figure 4 shows 'plumbers delight' assembly. Standard element-to-boom brackets are used. If you can obtain, or modify, element brackets to suit a 50 mm booms, do so, but common brackets are designed for 20 mm booms. A plastic boom will need supporting from the mast to prevent considerable droop. Alternatively, the boom can be drilled to pass the elements which can then be secured with long self-tapping screws through the top of the boom. Make sure you drill the boom reasonably accurately so that the elements lie in the same plane. Mainly for the sake of appearance.

The dipoles are cross-connected (Figure 5) and the feedline is attached to the shortest — dipole 3. Use heavy duty (24 x 0.2 mm) hookup wire for the dipole interconnections. Balun details are given in Figure 6. Seal the ends of the coax with a good sealing compound like Silastic. Tape the balun piece to the main line with electrician's tape, maintaining a spacing of 5 mm or so with small chunks of plastic placed very 100 mm or so between the two coax pieces. Plastic clothes pegs are just great for this! Tape the balun to the boom adjacent to the feed point or secure it with a cable saddle.

Let the balun section hang down from the boom a little, loop the feedline back up and either tape it to the boom toward the reflector end or secure it with a cable saddle.

I'll leave the boom-to-mast clamping arrangements to you as individual circumstances will vary.

A quick VSWR check with the antenna mounted with the reflector about a metre or so off the ground and pointed skyward should tell you all is OK — or not — before you hoist your 'baby' to the top of the tower. If you want to adjust the VSWR, an open-wire line stub, connected at the feedpoint, shorted at the opposite end and about 1400 mm long to start with can be employed. Shorten the stub successively until you reduce the VSWR to what you want. Tack the stub to the boom, away from the feedline, when you've established its final length.

Now call CQ DX on 50.110 MHz! ●

PARTS LIST — ETI-750
(all-wood construction)

- 2000 mm of 25 x 50 mm (dressed size) timber: maple or w.r. cedar.
- 2000 mm of 19 x 42 mm (dressed size) timber: maple or w.r. cedar.
- 16.5 metres total of 10 mm diameter aluminium tubing.
- 20 x 20 mm or 25 mm nickel-plated wood screws or self-tappers.
- 10 x 35 mm or 40 mm countersunk wood screws.
- Heavy duty hookup wire (24 x 0.2 mm)
- 6 x large solder lugs.
- RG8/U coax, length to suit.
- Boom-to-mast clamp to suit.
- Several cable saddles.
- Electrician's tape.