eurotek

edited and translated by **Erwin David, G4LQI***

*An **omni-directional vertically polarized antenna for 145 and 435MHz** can be built using easy-to-get materials and hand tools only. Adjustment requires only a dual-band transmitter and an SWR meter. **Bert Veuskens, PA0HMV**, described his design in Electron (NL) 4/99.*

THIS ANTENNA acts as an end-fed half-wave radiator on 145MHz. This makes its 145MHz gain 0dBd. Its high-impedance feed point must be connected to a parallel resonant circuit. Usually the coax is tapped down on the coil at the 50Ω point; but as this antenna must also work on 435MHz that arrangement is out. Instead, the feed from the coax connector is placed in series with the capacitor, making the coax look into a series tuned circuit, while voltage-feeding the antenna. On 435MHz this arrangement acts as an high-pass filter, ie it is transparent.

On 435MHz the antenna acts as two stacked 5/8λ radiators with a gain approaching 5dBd. To end-feed such an arrangement with 50Ω coax, the lower 5/8 must be extended to 3/4λ; this is done here by adding 1¾ turns on top of the 145MHz coil. On 435MHz, resonant radials are required; these are insignificant on 145MHz. See **Fig 1.**

The proper phasing of the stacked sections is achieved by inserting a phasing stub between them, as shown in **Fig 2.**

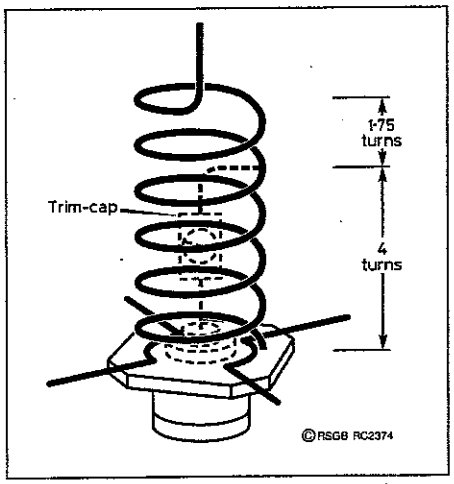

Fig 1: The matching section of the antenna.

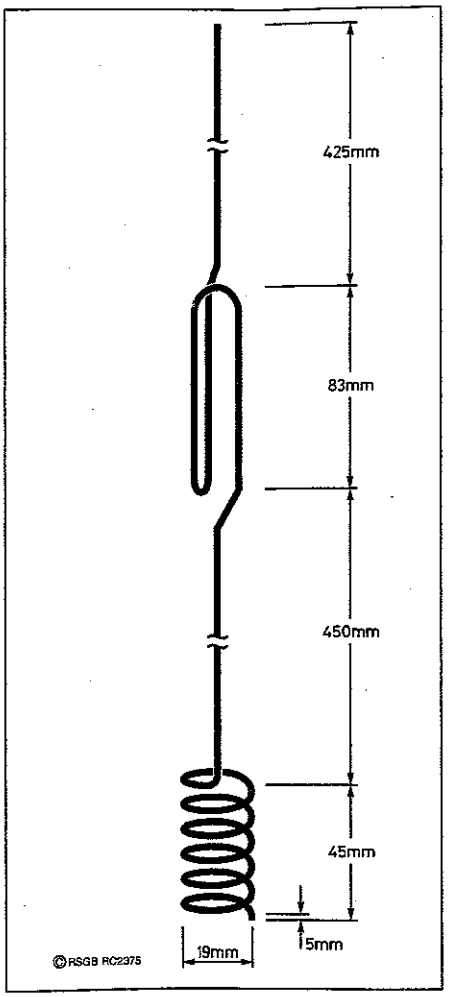

Fig 2: Shape and dimensions of the wire.

sets of radials as shown in Fig 1 and Fig 3 and fix them to the chipboard, eg with staples. Now solder as shown (you will need a 50W or bigger soldering iron). If you have used a professional grade coax connector, its insulation will be PTFE and will not melt in the process. Cut each radial to 173mm, measured from the centre of the coax socket. Solder the 'cold' terminal of the tubular trim-cap (or the centre conductor of the RG58 capacitor, if used instead) to the coax connector.

Unroll and stretch the antenna wire to straighten it. Cut off 60cm, and, starting at one end, tightly wind six turns on a 19mm (¾in) tube, rod or dowel. Stretch the coil and fashion its ends to the shape and dimensions of Fig 2. Solder the short end of the coil into the hole drilled in the flange of the coax socket and connect the other terminal of the trim-cap to the coil, four turns above the earthy end. Approximately half of the lower radiator section should now point straight up, coaxially with the coil.

With the remaining wire, shape the phasing section as in **Fig 4**, using a 9.5mm (3/8in) drill bit as a former. Trim the lower wire end so that it, when butt-spliced to the top of the wire on the coil, makes up the 450mm shown in Fig 2. Slide a polystyrene foam centering

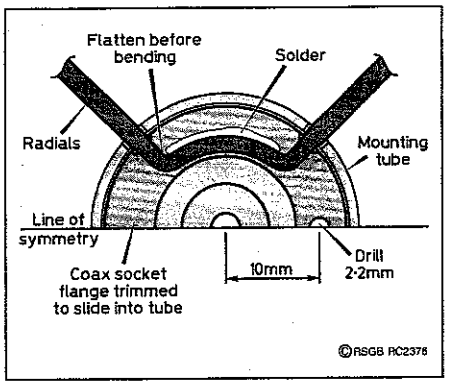

Fig 3: Working on the coax socket and attaching radials.

CONSTRUCTION

REFER TO THE bill of materials in **Table 1.** It lists what PA0HMV bought and used in Holland. The [bracketed] numbers refer to notes on what is available in the UK. As with all UHF-and-above projects, good craftsmanship is essential.

Saw and/or file the corners off the flange of the coax socket to make it fit snugly into the 28mm mounting tube. Drill a hole for the earthy end of the coil, as shown in **Fig 3.**

Pre-bend two sets of adjacent radials, leaving the ends a bit long. To solder the radials to the coax socket, a jig is a big help. To make one, drill a 16mm diameter hole in the centre of a 25cm square piece of chipboard, insert the coax socket (barrel-down) into the hole, place the two disk onto the wire below the phasing stub and butt-splice the two sections together. This is best done by soldering them into a short sleeve of copper tubing [or into the brass barrel removed from a smallest-size choc-block; if the latter, discard the steel set screws as they will rust - *G4LQI*]. Cut the top wire to 460mm (this leaves some for later pruning to frequency). Slide the second centering disk onto the top wire.

Saw and/or file into one end of the 28mm copper pipe four slots, 90° apart and each 4mm wide by 7mm deep, as shown in **Fig 5.** Do the same with one end of the PVC

Copper or brass mounting tube, 28mm OD, 220mm long [1]
PVC tube, 32mm OD, 28mm ID, 1.2m long, and cap [2]
Jubilee clip, 32mm, pref. stainless steel [3]
N-type (preferred) coax socket with square flange, 50Ω.
Brass rod or tubing, 3mm OD, for 4 radials, 720mm req. [4]
Bare copper wire, single strand, 2.25mm dia, 1.6m req. [5]
Trim-cap, tubular, 10pF max, *Tronsor*, (or RG58 per Fig 6)
Centring discs, polystyrene foam, sliding in PVC tube, 2 req.
Sealing compound [6]

Table 1: Bill of Materials.

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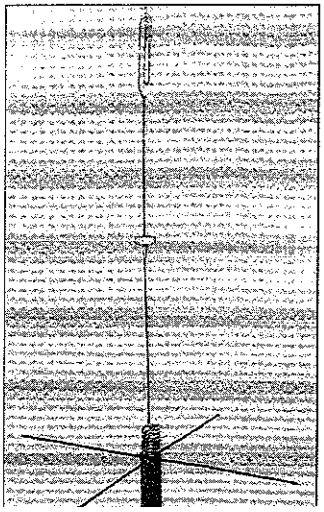


PA0HMV's prototype, without its PVC cover.

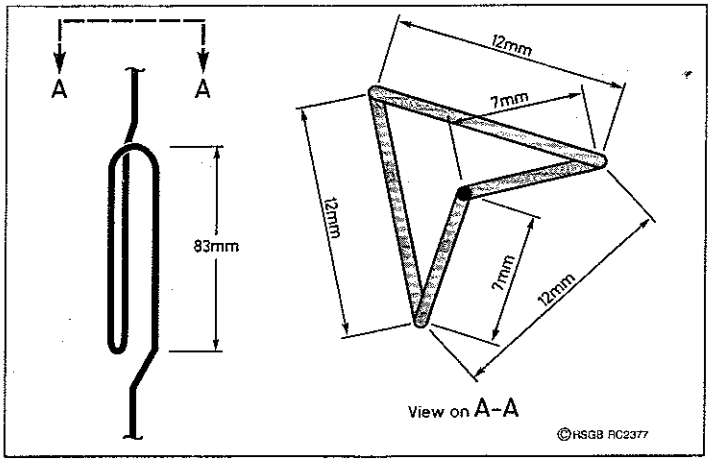
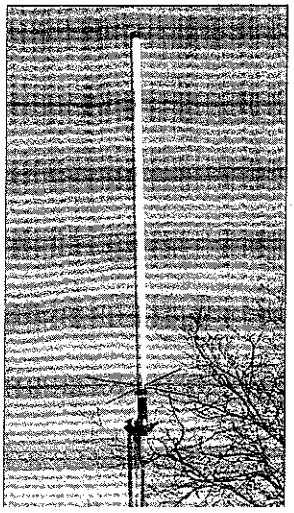


Fig 4: A number of bends are required to form the phasing stub.



The finished antenna looks professional.

tubing, but make the slots 70mm deep.

After assembly and tuning, the 28mm mounting tube will be clamped to the top of the mast using commercial hardware, eg two U-bolts, each with three saddles.

TUNE-UP

AS THE PVC weather shield lowers the resonance frequency on 70cm by approximately 3MHz, tuning on that band, without the PVC tube, should be done 3MHz above the frequency where the best SWR is wanted.

Remove the antenna assembly from the chipboard and inspect all solder work. Feed a short coaxial cable through the 28mm copper pipe and connect it to the N-socket. Push the socket into the copper pipe until each radial touches the bottom of a slot. Place the assembly well clear of other conductors, but low enough to work on it. Connect a 70cm signal source, eg a hand-held transceiver, through an SWR meter.

You should find that the frequency of lowest SWR is lower than intended [if you do not get a decent SWR reading anywhere in the band, it may be because the coax has become part of the antenna system; try coiling the coax just below the copper tube, eg two turns of about 10cm diameter - *G4LQI*]. Bring the resonant frequency up by snipping bits off the top of the antenna, eg to 438MHz. Fix the two centring discs with a drop of epoxy glue to the radiator at the voltage nodes, 170mm below the top and half-way between the top of the coil and the bottom of the phasing stub. Slide the PVC pipe down on the antenna until each radial is squeezed between the bottom of its slot in the copper pipe and the top of its slot in the PVC tube. Verify that the best SWR now is where you want it and that it is below 1.5:1.

Connect a 2m signal source, raise the PVC tube just enough to gain access to the trim-cap and adjust it for best SWR on 145MHz. It was found that a capacitor fashioned from a piece of RG58 coax according to **Fig 6** worked OK, but some adjustment of the braid length may be necessary.

This completes the adjustment. Push the PVC tube down again and fix it in that position with a stainless jubilee clip below the radials. Place the cap on top and weatherproof the assembly by applying sealing compound to the gaps in the PVC around the radials, making sure that rain cannot reach the capacitor but that condensation has a way out.

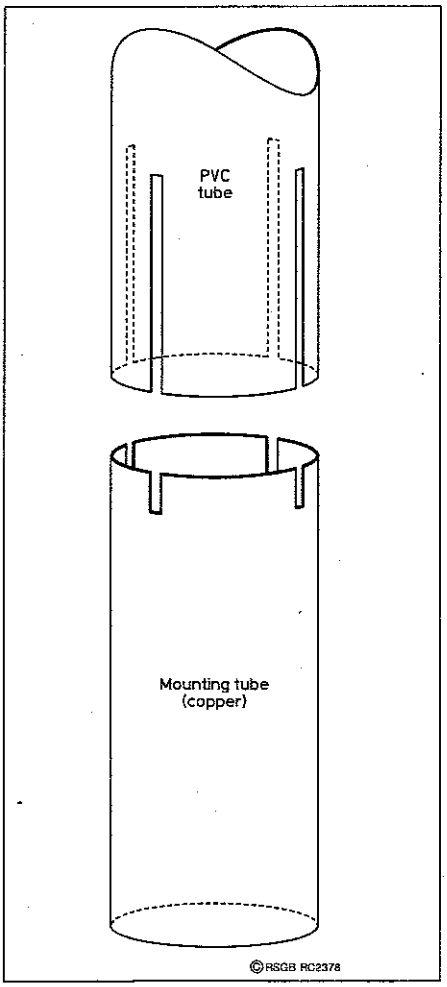


Fig 5: Slots for four radials in the mounting tube and the PVC cover.

SOURCING IN THE UK *[G4LQI]*

[1] 28mm copper tubing is available from plumbers' supplies distributors in (expensive!) 3m lengths. Your plumber may have an off-cut.

[2] 32mm OD white PVC tubing is sold in 2m lengths by B&Q.

[3] Stainless steel jubilee clips are sold by yacht chandlers.

[4] 1/8in OD copper tubing is suitable. Sand and flatten the part that will be within the 28mm tube. Central heating pilot thermostats are frequently replaced and discarded by CORGI fitters, and each has enough tubing for four radials. Try to get two, as your first attempt at flattening and bending may fail.

[5] Wire of 2.25mm diameter is not available in the UK. The nearest is 14 SWG (2.03mm), which should be OK. 1.75m of enamelled 14 SWG wire is available from Maplin (Cat. BL16S). When using enamelled wire, be sure to remove the enamel from where the tap is going to be, before winding the coil!

[6] Professional silicone rubber (Maplin YJ91Y or ES 035168G) is ideal, but bathtub sealant will do. ♦

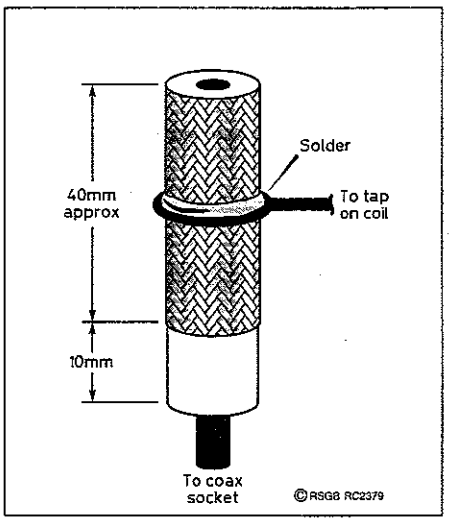


Fig 6: The 145MHz tuning capacitor can be made from RG58 coax.