

## NEWSLETTER ARCHIVES

### Optimisation Of The Double - 8 Antenna Design For 23cms

The design of the compact double-8 antenna for 23cms was first described on page 369 in the Dubus UHF Compendium book Parts-1 and 2. The antenna effectively comprises of a stack of 4 full-wavelength rectangular loops fed in the centre with 50-ohm coax and has a mesh reflector. It also has a quarter-wave stub balun to form a balanced feed. The text in the Dubus compendium was somewhat confusing in that it showed a picture of a single antenna but the quoted gain of around 14.5 dBd in the text referred to a pair of double 8 antennas. This would equate to a gain of 11.5dBd (i.e. gain over a dipole) for a single antenna.

A further article was published in CQ ATV 180 in 1997 by John, G8MNY which clarified the design and dimensions of the loops. Each pair of loops is formed from a 49cm length of 2.5mm mains cable with the insulation left on and bent into a figure of 8. This type of antenna has quite a good gain since it has quite a narrow vertical beamwidth when mounted with the loops stacked in the vertical plane which gives horizontal polarisation. The mesh reflector dimensions given are 8 x 14. No measured performance figures were given.

The double 8 antenna was considered as a potential replacement for the existing bowtie antennas currently used on the GB3CT repeater during the present trials reported elsewhere in this newsletter. The double 8 should potentially have at least 3dB more gain on axis and was thought possibly to be more amenable to modification to wider beamwidth in order to increase the local coverage angle. This type of antenna could also provide a very simple, cheap, and compact antenna of reasonably high gain for the individual user out stations.

A trial antenna was built by Jack G4TVC to the dimensions in the CQ ATV article. The author built up a mini antenna test range in G3GRO QTH with a 15 over 15-element yagi signal source antenna fed with a few watts of CW at 1296Mhz from a FT736R transceiver on 23cm at a distance of about 10metres. This was calculated to be in the far field of the test antenna which was mounted on a heavy duty camera tripod about 5ft above ground. The output from the double 8 antenna was measured by a HP435A power meter with a scale calibrated in dBm. The height of the test antenna above ground was then varied to confirm that any effects due to ground reflections were minimal.

The horizontal and vertical beamwidths were then measured with the originally specified spacing between antenna elements and mesh reflector of 25mm. The beamwidths were found to be 63 degrees in the horizontal plane and 35 degrees in the vertical plane which was in line with the values given in the original Dubus article. The effect of reducing the effective reflector size was then investigated by bending back the mesh reflector in an attempt to increase the horizontal beamwidth but it made surprisingly little difference. The width of the reflector was then reduced to 120mm, again with virtually no effect on beamwidth. The polar diagram patterns were very smooth with very little evidence of side-lobes.

The gain relative to a test dipole substituted for the double 8 antenna was then measured as closely as possible although there were variations due to ground reflections in evidence. A mean figure of around 10dBd was measured which given the uncertainties was very close to the predicted figure. This is a very useful gain for such a compact antenna.

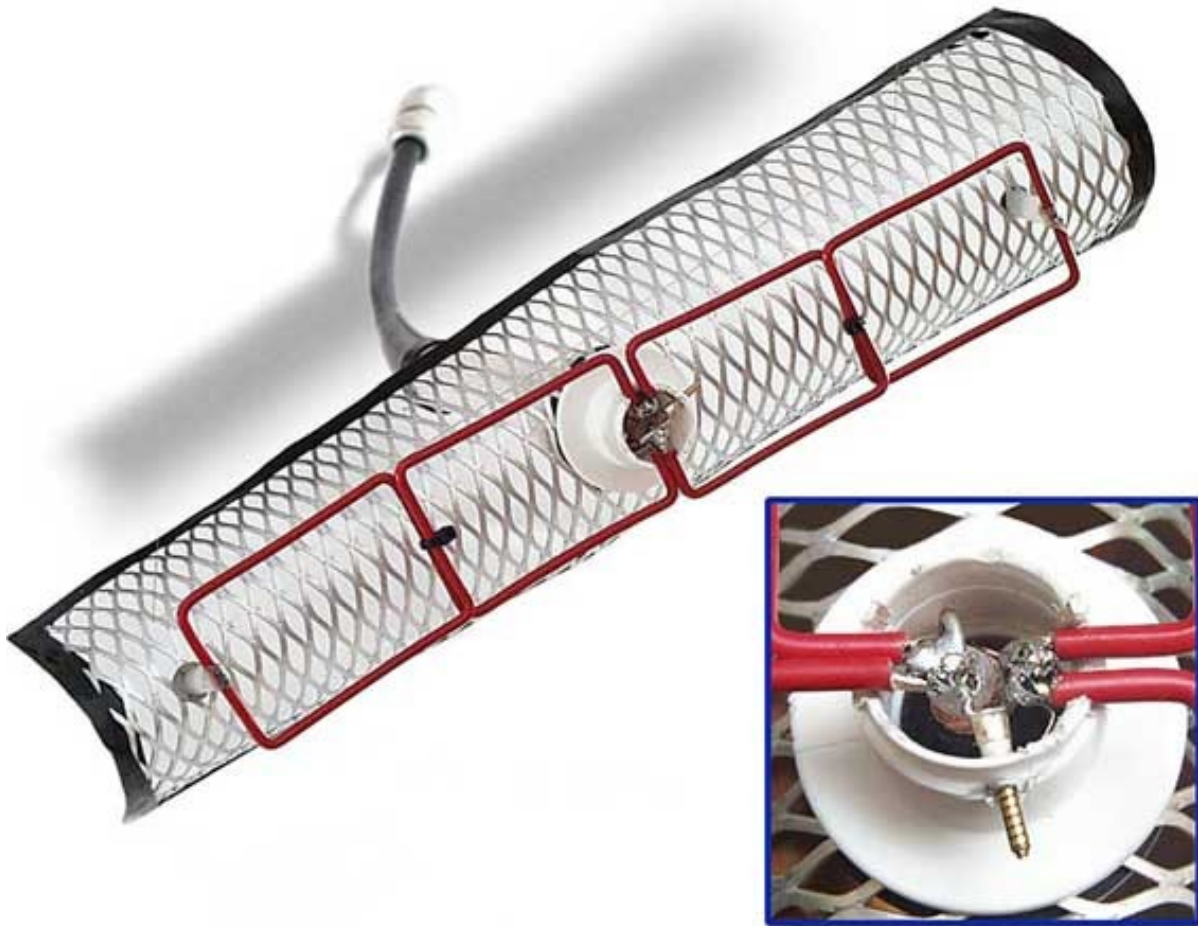
Finally the VSWR was measured. Initially the VSWR with the original dimensions was measured and found to be greater than 2 to 1. The reflector spacing was varied and an optimum found at 20mm and the support stalks shortened to the new value. The effect of varying the reflector effective size was also examined by bending the edges back away from the loop elements. It was discovered that the VSWR improved as reflector was curved backwards even with the smaller reflector mentioned above. There was quite a sharp optimum when the reflector was bent into a half ellipse rather than a semi-circle with the dimension across the minor axis of the ellipse of 75mm and depth 55mm approximately. The general arrangement can be seen in Fig.1 below. The VSWR improved to around 1.5:1 over quite a wide bandwidth following these modifications. Finally a small ceramic trimmer capacitor of around 1pf was connected across the end of the coax where

loops are soldered. Optimising this capacitor brought the VSWR to less than 1.2:1 over a bandwidth of at least 50Mhz. A table of VSWR versus Frequency is given below.

FREQ	1265	1270	1275	1280	1285	1295	1300	1310	1315
Mhz									
VSWR	1.4	1.25	1.2	1.1	1.1	1.05	1.05	1.1*	1.15*

(Note : \* indicates extrapolated value)

The VSWR was optimised at 1300Mhz. The highest measurement frequency available was 1300Mhz so the VSWR values at 1310 and 1315 Mhz were extrapolated since the curve will be essentially symmetrical on either side of 1300Mhz



### Constructional Suggestions

In order to provide weather protection at the feed point, a plastic 28mm diam overflow fitting for a water cistern was first fitted through the centre of the reflector before the elements were mounted to the reflector and a short length (about 6 to 8 inches) of 22mm diam. plastic water pipe inserted and tightly clamped into the rear of the overflow fitting. This forms the mounting support for the antenna. The bare end of coax feeder cable with the loop elements attached at the other end is passed through plastic overflow fitting from the front of the reflector and then through the plastic pipe. Slots are cut into the rim of the plastic fitting to allow the loop elements where they attach to the feeder to bed down below the rim of the plastic fitting (see the close-up view of the feed point in fig.2). The adjusting screw end of the trimmer capacitor is mounted through the side wall of the plastic fitting and fixed in place with super glue to allow external adjustment after the open end of the plastic overflow fitting is eventually sealed. The open end of the fitting will be sealed by fitting a plastic disc fixed in place with the special plastic solvent used for plastic plumbing. Expanded polystyrene foam will then be inserted into the

gap between the feeder cable and plastic mounting tube to fully fill the cavity surrounding the end of the cable where it joins the loop. Any surplus polystyrene foam coming out of gaps surrounding where the wire loops go into the plastic fitting can be cut off with a knife.

Finally the type N connector is fitted to the free end of the coax and preferably a protective rubber sealing gaiter fitted over the coax and plastic mounting pipe.

Derek G3GRO - Derek can be contacted [by email](#)

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