The D2T Antenna

Ideal for radio amateurs, short wave listeners and commercial HF / VHF radio users where space is at a premium, the D2T is a physically small antenna that covers a very wide range of frequencies and has some gain and a reasonable front-to-back ratio. Sounds too good to be true? Peter Dodd, G3LDO, investigates

And now for something completely different, the D2T antenna made by Giovannini Elettromeccanica of Florence, Italy. This company's main line of business is military and commercial HF antennas and they do make some big antennas. For example their 630/LP/10 log-periodic, which covers 6.5 to 30MHz, has a maximum element length of 22m, a boomlength of 15m and weighs 370kg. The rotator for this antenna would turn my house!

They also make a large range of antennas for the amateur radio market, including a full-size two-element quad for 80m to 10m . No wonder there are some big signals coming out of Italy!

description

The D2T is a much more modest antenna, designed specifically for the radio amateur who has limited space for antennas. This antenna claims to be able to operate over the frequency range 1.5 to 200MHz with an average SWR of around 1.6:1 and has gain and directivity in the upper HF bands - it appears almost too good to be true. The specification is given in **Table 1.**

The construction of the D2T is different from any other mini-beam that you will have seen. It comprises two equal 6m-long elements spaced 2m apart. The first element is fed from the transceiver feed line via an RF transformer / balun. The second element is fed from the first via two metres of transposed open wire feeder, similar to the ZL Special antenna.

The second element has an 820 ohm non-inductive terminating resistor as shown in **Fig 1**. Each of the wire folded elements is supported on glass fibre tapered rods.

construction

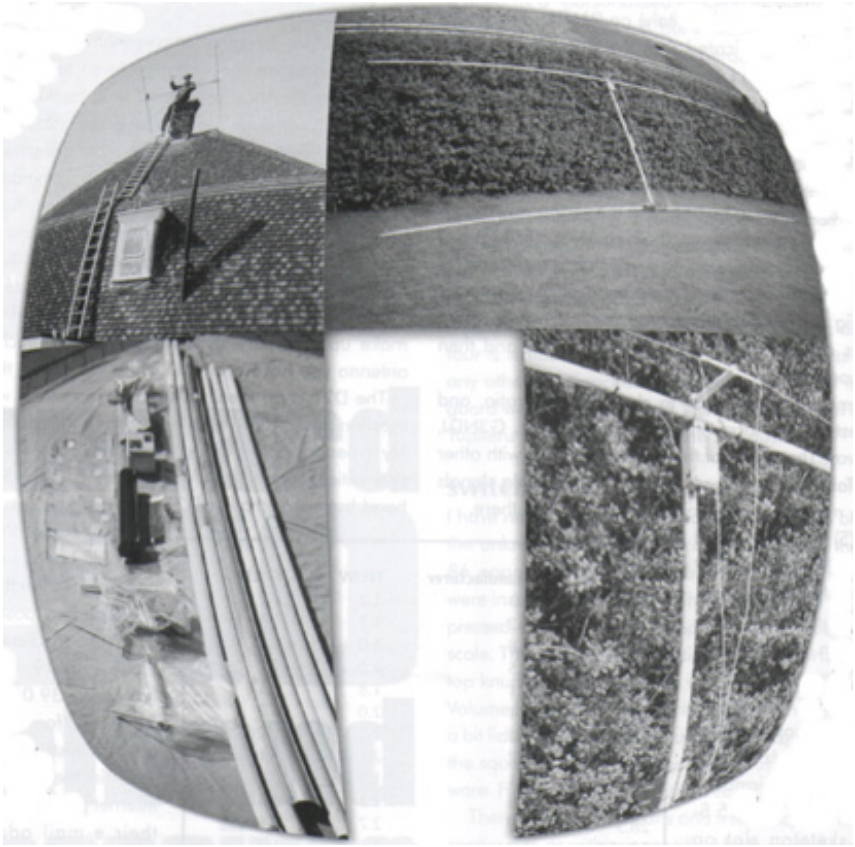
The antenna kit, comprising fibre-glass tubes, an aluminium boom, the terminating resistor and the balun / transformer are shown in the photo. All the other parts, including all the nuts and bolts are enclosed in polythene bags carefully labelled with 13-digit part numbers.

The assembly instructions are very detailed and there were no problems encountered in the construction of this antenna. There is also a detailed drawing, with details of the positioning of every nut and bolt. In addition there are a number of photocopies of close-up photographs of different parts of the antenna, which are very useful if you find the detailed descriptions a bit confusing.

The tools required to construct this antenna include a range of spanners, a small screwdriver, a soldering iron and a drill. This last item is used to drill a hole in the aluminium boom to match holes in the fibre-glass element support clamps once the fibre-glass element supports have been accurately aligned. A nut and bolt is inserted into this hole to prevent the elements being moved in high winds.

The multi-stranded copper wire comes in one roll (part number 6002704000 046) and has to be cut into four pieces "exactly equal to 6.2m" and two pieces "exactly equal to 2m". I was concerned about my ability to cut lengths of wire "exactly" to a given length but overcame the problem by making a wire jig on the drive in front of the house using bricks. The secret is to measure twice and cut once. The ends of the wire are either soldered to lugs, to connect to the transformer or the terminating resistor, or to connecting tubes to connect to the phasing lines.

The wire elements are fixed to the fibre-glass elements using plastic tie-wraps . Once the antenna is assembled, that's it! No adjustments or tuning are required.



installing

The complete antenna weighs 8.5kg (19lb) and was fixed on a rotator on the chimney of the house without difficulty, and without any additional help. From previous antenna tests I knew that this is not an ideal location, due to nearby telephone wires and the close proximity of electrical wiring and plumbing inside the house. On the other hand it would probably be typical of the sort of locations a compromise antenna such as this would be used.

I had no difficulty installing the antenna. I used a different mast-to-boom clamp, using U-bolts, rather than using the one pro-

(Clockwise from bottom left) : The kit of parts for the D2T antenna. All the small parts, including all the nuts and bolts are enclosed in polythene bags, carefully labelled with a 13-digit part number ; Fixing the antenna ready for testing. The antenna is mounted on a short mast on a KR-600RC rotator, which is fixed to the chimney using a double clamp ; The completed D2T antenna ; Close-up showing construction details

vided. The reason for this was that the original clamp uses heavy-duty bolts with locking nuts that would have to be tightened using two big spanners while, at the same time, supporting the antenna.

performance

Some initial checks were made on several bands using the MFJ-249 SWR Analyzer. The SWRs measured are shown in Table 1, compared with the manufacturer's SWR data and the SWRs measured by Rinaldo Briatta, I1UW, in another independent review.

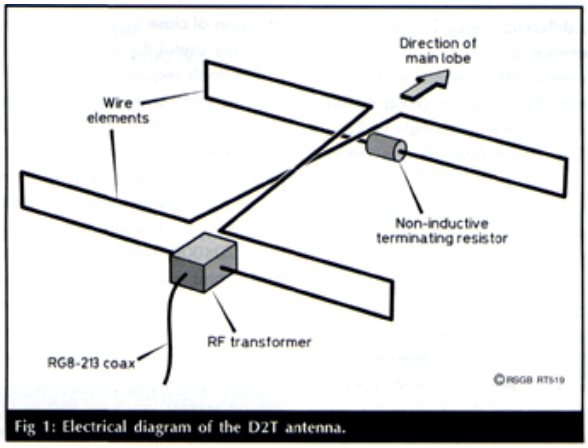


Fig 1: Electrical diagram of the D2T antenna.

The instructions state that the SWR can vary with height, ground characteristics and nearby objects. I tried reading the SWR while rotating the antenna but it varied very little. The SWR indicated that it should be well within the range of the built-in tuner of my transceiver, a Kenwood TS-850S.

The transceiver was connected and I had 59 each way contacts with EA9AU (Spanish North Africa) and I0YKN (Italy) on 21MHz. Initial tests on receive, using the S-meter, indicated that the front-to-back (F/B) ratio on 28MHz was poor, although I was able to work DX stations such as VU2 (India) and LU (Argentina) on 28MHz; ET3 (Ethiopia), CX3 (Uruguay), JA (Japan) and BA (China) on 24MHz, ZL1 (New Zealand), HL2 (Korea), JA (Japan) and W (USA) on 21MHz and ZL4 (New Zealand) on 18MHz in the following five days. All these QSOs were made using 100W.

However, the antenna appeared to be beaming the wrong way round. I checked the instructions and noted the specification gives a F/B of just 5dB on the higher frequency bands, so no great claims are made for F/B. I also found that the second element behaved as a director rather than a reflector - see Fig 1 - I should have read the instructions more carefully! The D2T antenna was repositioned relative to the rotator, and then things seemed more 'normal'.

I then looked for a more objective way to check the F/B ratio, and arranged a series of tests with a local amateur station, Chris, G3NDJ, located about 18km away. The results of these tests, and tests with other stations are shown in Table 2. There were always too many big signals on the 14MHz band to make any meaningful measurements there.

The front-to-side (F/S) was very good on all bands from 14 to 28 MHz; measuring better than 20db on the S-meter.

As regards gain measurement, i compared it with my skeleton slot antenna, which is an elongated loop, as described in The Antenna Experimenter's Guide (1). The skeleton slot antenna has a calculated gain of 11.5 dbi on 28 MHz (including ground reflected gain, and as installed at my location). The D2T was 1 to 1.5 S-points down on the skeleton slot on 28 MHz. These measurements are not very precise but they do show that the manufacturer's figures are reasonable.

I had a lot of fun with this antenna. I seemed to be able to work all the DX that i could hear although i concentrated on the bands 18 MHz and above because this is where my interest lies. I had many contacts on 7 and 3.5 MHz but these were restricted to around Europe.

I ventured on to the CQ WPX SSB contest over the weekend of 26 / 27 March on the 21 and 28 MHz bands: a contest is a good environment for testing an antenna. Over a period of about two hours i was able to contact many DX stations such as ZS6 (South Africa), 3B8 (Mauritius), VP5 (Turks and Caicos), VP2V (British Virgin Islands), LU (Argentina), PY (Brazil), HC8 (Galapagos Islands) and many Ws (USA).

how does it work ?

This antenna is such a different concept in multiband minibeams that i tried to make a computer simulation of this antenna using EZNEC.

The simulation performance was similar to the real antenna but exhibited F/B patterns that were worse than the real antenna. The F/B on one band could be improved by placing a small capacitor in parallel with the load resistor but that upset the F/B on other bands. If I had tried to model this antenna before I built it I would have concluded (incorrectly) that the antenna configuration was unsuitable for broadband applications.

There many be some who would question the wisdom of placing a resistor in an antenna configuration to tame the wild excursions of impedance that normally occur in a multiband antenna without traps. They might conclude that it is lossy and not worth considering for amateur applications. Yet one of the most effective antennas I know is the non-resonant rhombic - which uses a terminating resistor. The important thing to remember is that the D2T antenna is a high impedance antenna, so all other losses are small.

If you consider the case of a small trapped mini-beam the radiation resistance is very low. For a given effective radiated power the current through the elements must be very high. This means that the resistance of the material used to make up the elements is significant : in effect with a low impedance antenna you have a built-in series resistor in the elements.

The D2T is an ideal antenna for someone who has a restricted size location and has to install an antenna that does not require adjustment. My experience of installing other mini-beams is that the adjustments are very critical and they can only be tuned for the SSB or CW sections of the band but not both. The D2T antenna has no such restrictions.

Freq MHz	Manufacturer	I1UW	G3LDO
3.5	1.3	1.2	1.7
3.7	1.2	1.2	1.5
7.0	1.8	3.0	1.8
10.1	1.5	2.0	1.7
14.0	1.1	1.8	1.1
14.35	1.1	2.0	1.2
18.1	1.2	1.2	1.2
21.0	1.7	2.5	2.1
21.4	2.1	1.2	2.5
24.95	1.9	2.5	1.3
28.5	1.9	2.7	2.6
50.150	1.2	1.5	1.7
145.1	1.9	2.6	2.6

Table 1: Manufacturer's claimed SWR figures, and those measured in two independent reviews.

Frequency	D2T Specification	Measured Front to Back Ratio
21MHz	5dB	18dB
24MHz	-	12dB
28MHz	5dB	3dB

Table 2: D2T manufacturer's specification and measured front to back figures on the three highest HF amateur bands.

The fact that the antenna will work on the lower HF bands - even though its performance is less than a resonant dipole - is also a very positive feature.

Thanks to Giovannini Elettromeccanica , Via e Mattei 9, 50039 Vicchio (Florence), Italy; tel: +39 055 844124; fax: + 39 055 8448797, for making the antenna available for testing.

The D2T antenna is featured in the Giovannini Elettromeccanica internet page at http://www.antenna.it and their e-mail address is: giovannini@antenna.it. In the UK, the D2T will be available from Waters&Stanton PLC at £ 395 inc VAT. Writo to 22 Main Road, Hockley, Essex SS5 4QS; tel: 01702 206835, or e-mail: sales@wsplc.demon.co.uk for details.

further reading

[1] The Antenna Experimenter's Guide by Peter Dodd, G3LDO. Available from Radio Today sales, price £15.00 - for details of how to order see Book Browser on pages 60 / 61.