The Giovannini D2T wideband antenna looks like antennas that it isn't, and doesn't look as though it could possibly perform as it does. However, says W4RNL, appearances can be deceiving.

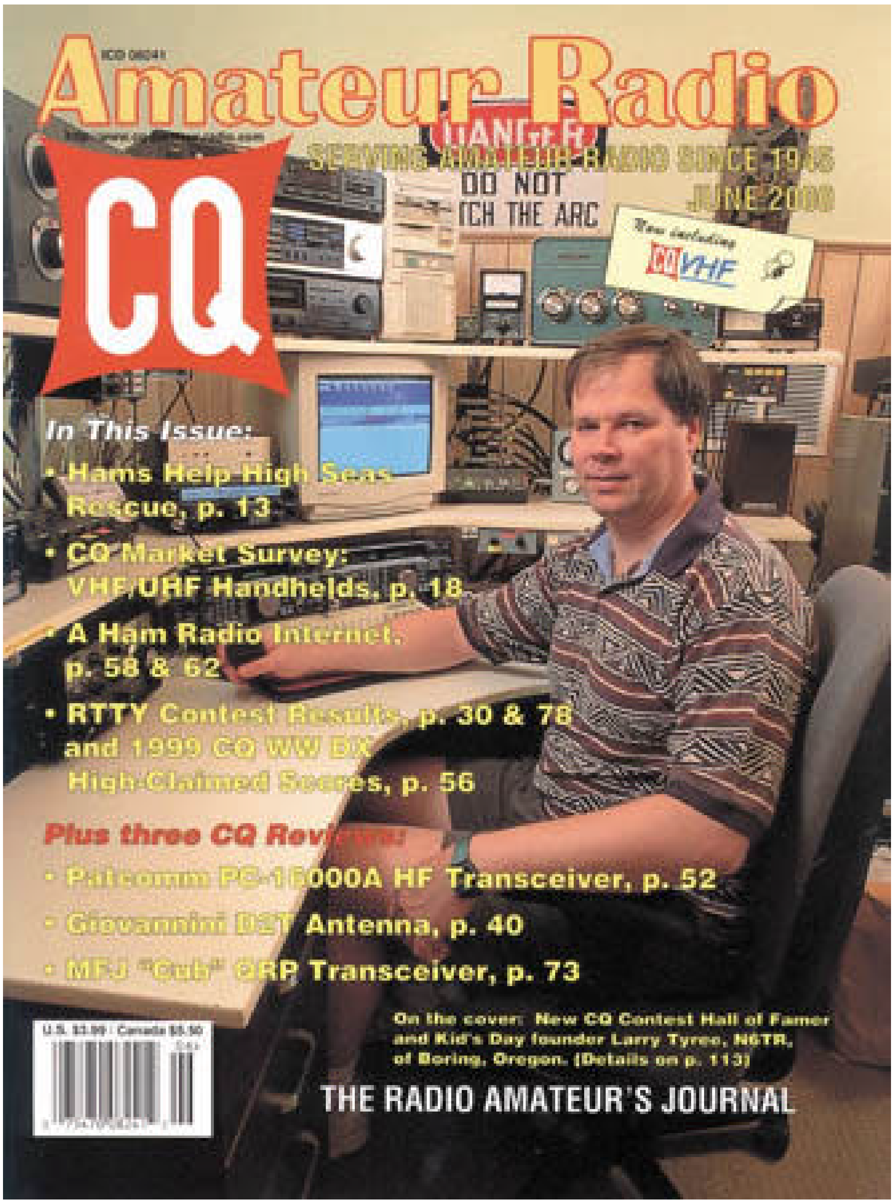
CQ Reviews:

THE GIOVANNINI D2T ANTENNA

BY L.B. CEBIK, * W4RNL

Let's begin with a pop quiz. What appears to have the size and shape of a 12 meter two-element beam-but isn't? What appears to have the wiring scheme of a ZL-Special-but isn't? The answer is the D2T, an innovative antenna from Giovannini Elettromeccanica of Italy.

From the outset, we should understand what the antenna is, and what its intended use is, in order to make any reasonable comparisons. The appearance, as we just noted, can mislead us. The D2T belongs in a class with a number of wide-band antennas providing a low 50 ohm SWR continuously across a wide frequency range. The D2T offers such coverage from 1.5 to 200 MHz. In principle, the antenna uses the same fundamental technique that we encounter in the wide-band "folded dipole" made by B&W, Giovannini, and others. The top portion of fig.1 shows the general layout of this basic antenna. One typical length is 90 ft., although longer versions up to nearly 200 ft. are available. A non-inductive resistor in the 800 to 900 ohm range provides a termination that sets the feedpoint impedance as well.



An RF transformer with a transformation ratio of about 16:1 provides a reasonably good match to 50 ohm coax over the entire frequency range. Since the non-inductive resistor dissipates some of the power supplied to the antenna, the performance varies across the range of use (usually 1.8 to 30 MHz for the size antenna shown in fig.1), with decreasing gain as the frequency decreases.

Military and government services often employ such antennas to reduce the number of antennas and the number of adjustments necessary to assure that the antenna is well-matched to transmitting and receiving equipment. Short-wave listeners often use them for much the same reason, with the added benefit that this class of antenna provides a better signal-to-noise rati than many other types at lower frequencies, in part by preventing front-end overload. Most modern receivers have excess gain to make up for the reduced overall signal strength. Hams with limited space have used this type of antenna with success for general QSO purposes. the lowest bands present a challenge, since gain drops rapidly, but numerous hams accept that trade-off for the convenience and compactness of the installation.

Giovannini's innovation in this class of antennas is a further size reduction. As shown in the lower half of fig.1, the elemen is a continuous loop of wire formed into two parallel sections, each about 19.8 ft. long. Close-spaced and crossing wires connect the feedpoint loop with the loop holding the terminating resistor. Since the wires running front to back are closely spaced, they do not radiate significantly, although their continuously varying spacing makes a determination of their

characteristic impedance a complex task. The front-to-back spacing is about 6.6 ft., and the entire package takes little more room than a 12 meter beam. The actual antenna places the parallel wires for each of the loops in a vertical plane. They are supported by three-piece fiberglass tubes,
which attach to a metal boom. the lower wires connect to the sealed RF transformer on one side and to the non-inductive resistor (within a fiberglass tube for good cooling and rain protection) on the other. The elevated wires meet at a Tee fixture, where they become the front-to-back crossing section of transmission line. The actual phase shift of signal along the front-to-back wires varies from one frequency to the next. Thus, while the antenna resembles a ZL-Special, its operation is quite different.

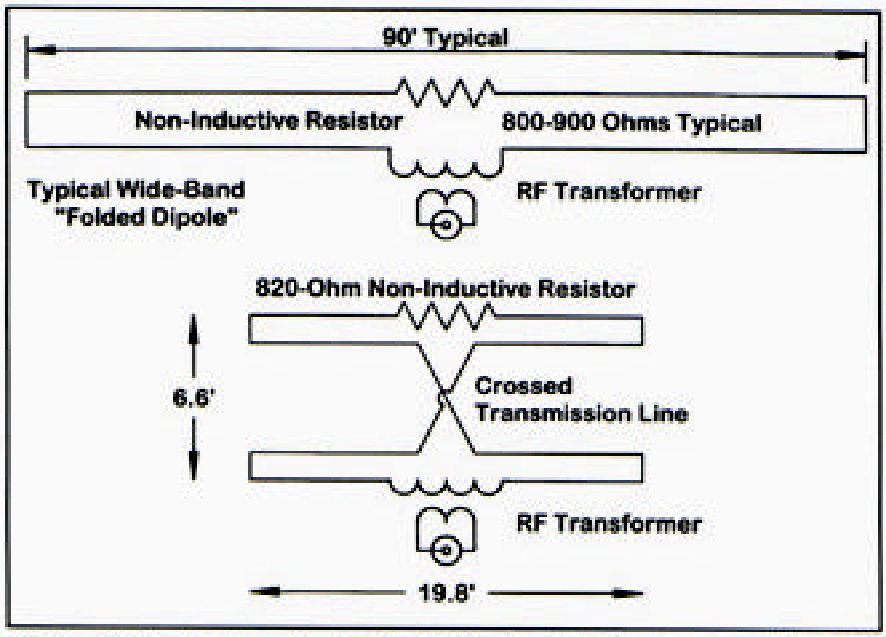


Fig. 1– Outline sketches of a standard folded terminated antenna and the D2T.

I have modeled a version of the antenna to check the potential patterns that might emerge. In free space the antenna shows some directivity toward the RF transformer side at lower frequencies (below 10 MHz). As the frequency is increased in the HF range, the antenna shows both gain and usable directivity in the direction of the terminating resistor. At fairly standard amateur and SWL mounting heights of 30 to 40 ft., the lower frequency directivity tends to disappear at low angles of radiation.

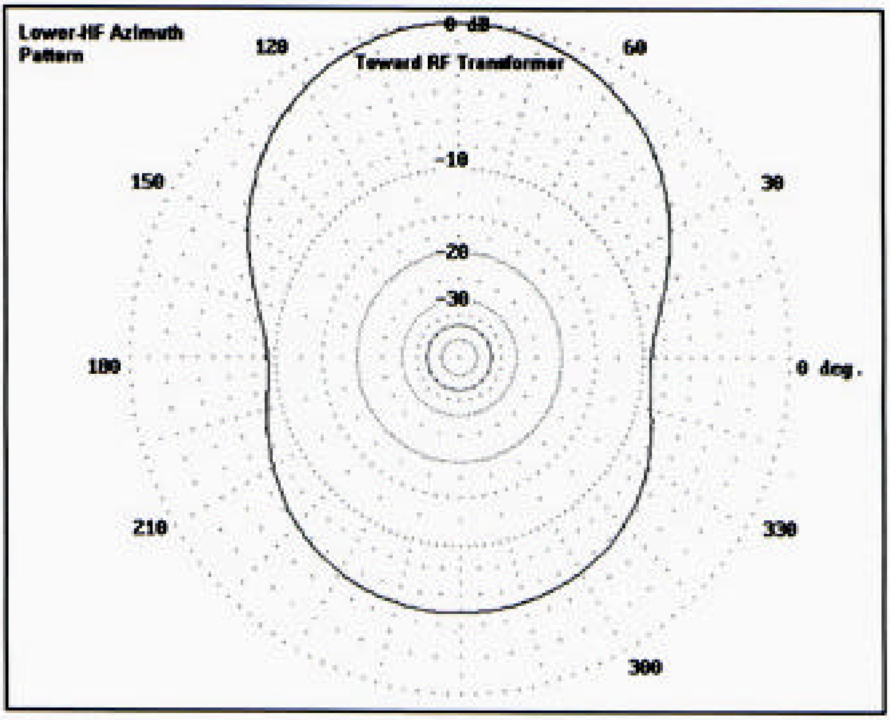


Fig. 2– Free-space azimuth pattern of the D2T at a lower HF frequency (below 10 MHz).

Fig. 2 shows a representative pattern modeled for the 30 ft. test height used here. The directivity becomes very usable at highe HF frequencies, as shown by fig. 3. In both cases I have purposely not shown the exact frequency or gain of the system, since there are limitations to the accuracy of the model. Although reliable as a general indicator of potential performance, the model cannot capture effects of the lower wire being laid against the fiberglass support, which may slightly increase the electrical length of the lower wire in each of the loops (in a manner related to the use of insulated wire). Hence, do not claim precision for the modeled results.
Models, nevertheless, do clearly show what happens as we raise the frequency of our signals. The 2:1 SWR curve extends to 200 MHz,
so 2 meter operation is quite feasible. Fig.4 shows the 6-lobe pattern. Since the antenna is light enough (19 lbs.) to use a simple rotator, it is feasible to have a single compac antenna for all of the common HF and VHF ham bands, as well as one that covers all of the shortwave and lower VHF listening frequencies.

Assembly

Giovannini has devoted the majority of its efforts to antennas with military and governmental applications, with amateur antennas comprising about 30% of its business. The company manufactures an impressive array of large quad and log-periodic antennas, samples of which can be seen at its web site (http://www.antenna.it). The military requirement for a durable antenna structure shows up in the D2T materials. The boom is about 1.6 in. in diameter, while the center portions of the fiberglass element support rods are over an inch in diameter. The boom-to-support brack-ets are clam-shell clamps welded at right angles, using $^{3}/_{16}$ in. steel. (Actual material dimensions are in millimeters, and only rough English-unit equivalents are given here). Were I to try to replicate the antenna with home shop construction techniques, my version would be lighter, but most likely it would be far less durable.

Antenna assembly is straightforward, and the instruction set is very detailed. The instructions might benefit from a review by an American or British technical editor to replace some unusual expressions with those more commonly found in US or English writing.
However, having to read each instruction twice to assure comprehension does have its advantages in terms of keeping the assembly process error free.
Assembly involves joining the major support elements (including mounting the resistor and transformer assemblies), cutting the wire for the elements, and mounting the wires. The steps proceed in a logical fashion . You will need some metric wrenches-namely, 17, 10 and 7 mm sizes. You will also need a 6 mm drill bit, but a $^{7}/_{32}$ in. bit will do the job. Mounting the wire elements involves a bit of soldering at junctions of the wire, which is roughly equivalent to AWG # 14. You also will tie down the wires to the supports with a large collection of cable wraps. The process took me most of a morning-about 4 hours total work time, including time to review instructions and look carefully at the photos. As with any antenna assembly, it pays to check and recheck each step in the process.

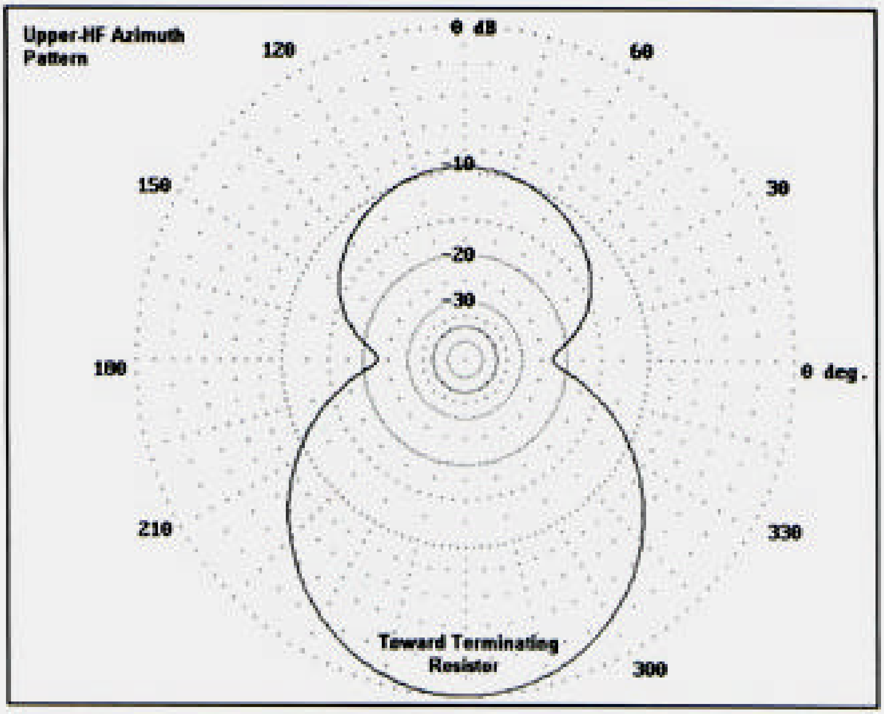


Fig. 3– Free-space azimuth pattern of the D2T at a higher HF frequency (above 25 MHz).

Photo A shows the collection of parts before assembly. I used my (two-car) garage floor as the assembly table. I laid out carefully measured lines for wire cutting on the floor, since the wire comes in one long piece. The user must cut fairly precise lengths for the element portions for each end of each loop and for the crossing line that connects the front and aft loops. A 35 watt soldering iron or pencil is sufficient for the snall jobs of binding the wire-end loops. However, before soldering, lay out the entire piece of wire to be sure of the fit. Since there is more than enough wire, I cut my pieces long and prestressed them to remove all kinks before trimming them to the final length
Pre-stressing the wire for the D2T requires only enough pressure to remove the kinks created by shipping it wrapped around a piece of corrugated cardboard. My process simply was to cut each wire long, since Giovannini supplies excess wire. I taped one end and clamped it in the shop vise, then wrapped the other end around a wooden dowel and tugged several times until the kinks were gone when I let the wire go slack again. Finally, I measured and cut the wires to length by clipping off the small amounts at the ends that were deformed due to clamping
Since the process does not require very large pressures, almost any alternative technique that removes the kinks in advance of final cutting and assembly will work as well.

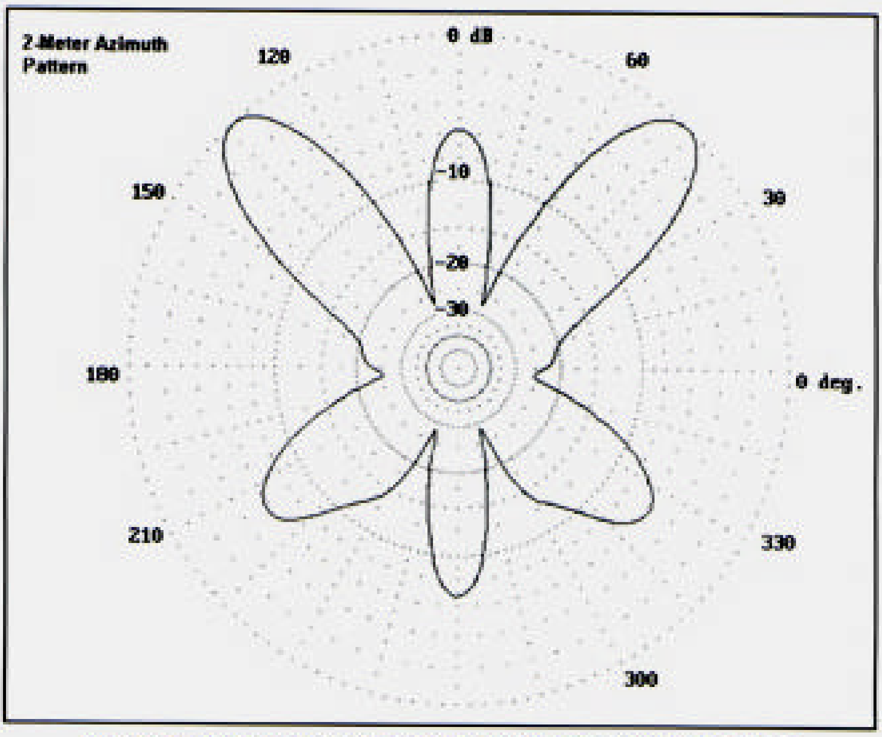


Fig. 4– Free-space azimuth pattern of the D2T at about 2 meters.

Every part is well labeled with an ID number, and small parts come in a series of labeled plastic bags. In addition, the manual contains a number of detail photographs and an engineering sketch to further assist the assembly process. The builder can easily correlate the instruction steps to photos and sketches in order to verify correct assembly every step of the way.
Giovannini recommends the use of a stand to place the antenna at work height. Photo B shows the antenna in the process of construction on the stand that I built about a year ago for just such purposes. Since my assembly support mast is only 1.25 in. in diameter, I used my own center plate and U-bolts. Giovannini supplies a heavy-duty version of the boom-to-element clamps for the
boom-to-mast mounting, but it is better suited to larger diameter masts. Photo C is a view of the antenna being mounted to my tilt-over

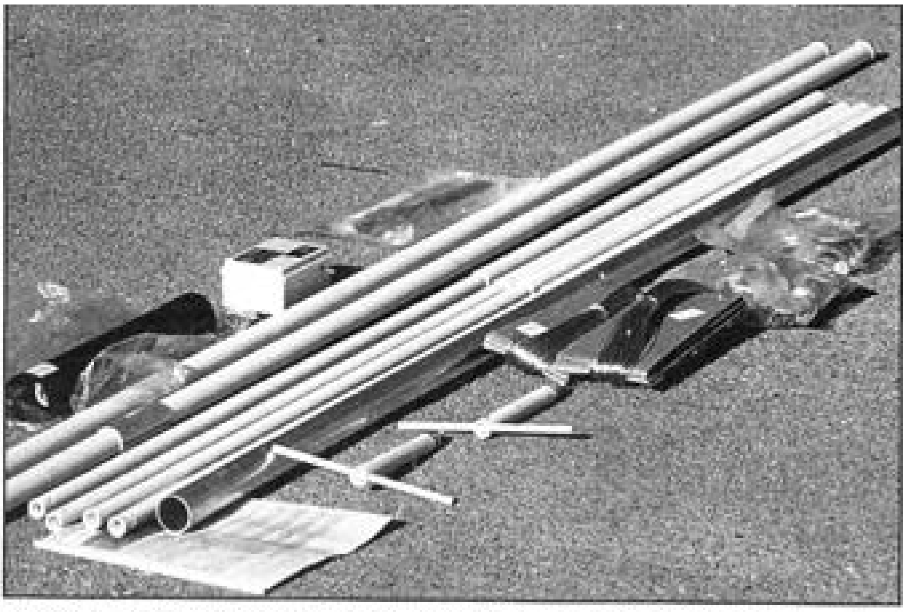


Photo A– A view of the antenna parts awaiting assembly. (Photos by the author)

small-antenna test mast. The combination o aluminum boom, copper wire, and white fiberglass supports creates an unusual first impression, compared to more common antenna types.

Performance

To provide myself with some base-line expectations, I performed a frequency sweep of the modeled antenna from 2 through 30 MHz , in 1 MHz steps. The 1 MHz spacing between steps overlooks potential oddities at intermediate frequencies. However, the performance curves were relatively smooth. The 820 ohn VSWR, for example, changed slowly and regularly, with peaks at 22 and 20 MHz, but never over 2.2:1. Giovannini recommends the use of a long 50 ohm feedline so that the SWR at the transmitter end of the line neve exceeds 2:1. The line I used was a bit shorter than recommended-about 135 feet overall. The sweep, performed on a freespace model, showed a pattern reversal around 20 MHz. However, the transition is so slow that the change could not be observed operationally.

Below the changeover frequency, gain drops off and the elevation angle increases rapidly, so the directional lower-HF pattern was not operationally observable. At 20 meters the antenna appeared to perform similar to a dipole, with a front-to-sede ratio in the 5 db region.

Performance appeared to be roughly equal to that of an HF5B on 20.

At 10 meters the antenna appeared to be quite directional, with a front-to-back ratio similar to that of a 2-element Yagi- somewhere between 6 and 10 db. Forward (toward the resistor) compared well with an HF5B butterfly beam, and the front-to-back ratio appeared similar, especially with local area signals. I checked into the local Great Smoky Mountain net, and no one detected that I was using the D2T rather than my usual antenna.

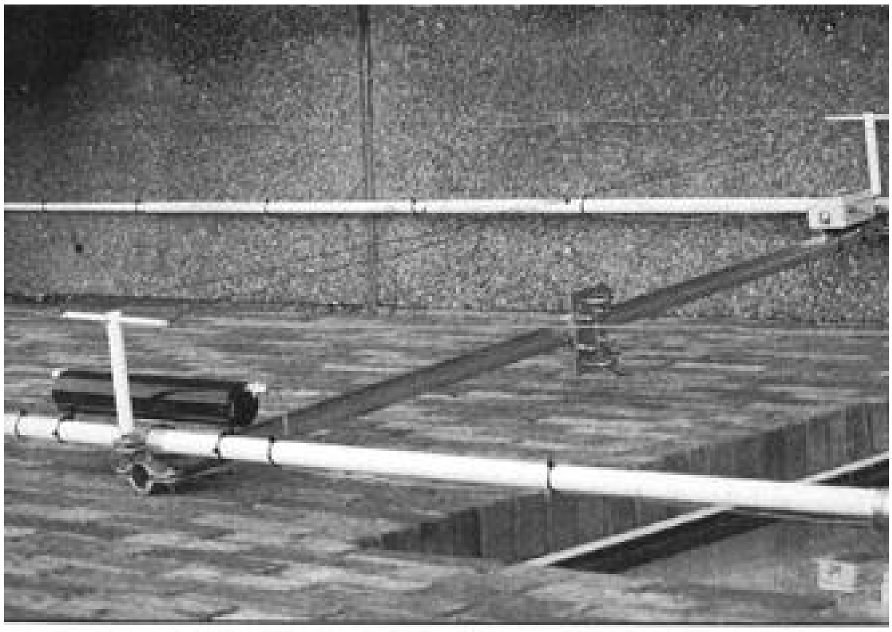


Photo B– The D2T on its assembly stand.

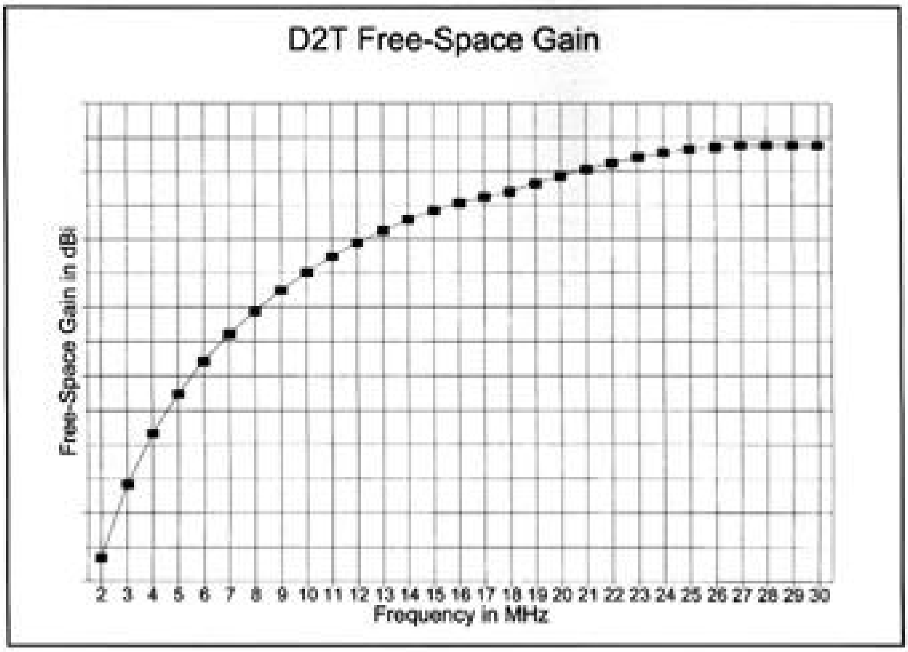
Photo C– The D2T mounted to the test mast prior to raising for tests.

The real challenge is operating on 30 through 80 meters. Fig. 5 shows the free-space gain curve for my model of the D2T. I purposely omitted the gain numbers, since the important feature of the curve is the increasing rate of gain decline as the frequency decreases.

Although contacts from 20 meters upward were easy to make, contacts below 10 MHz proved more difficult. The smaller overall size of the elements creates a gain curve that falls off more rapidly with decreasing frequency than the gain curve for a standard 90 ft. wide-band “ folded dipole “ , as shown by the second curve in fig. 5. A comparison of the 25 MHz azimuth patterns of the D2T and a standard 90 ft. terminated horizontal antenna appears in fig. 6.

In receiving comparisons on 80 and 40 relative to a ground-mounted GAP VI, the D2T showed less signal strength as the frequency decreased. On 80 meters the receiver preamplifier was always necessary to bring received signals close to the level provided by the vertical antenna. On 30

meters, where the GAP VI provides no operation and the SWR is over 5:1, received signals appeared to be about equivalent to those of the D2T.
I patched in an extra 70 ft. of coax cable in order to verify the VSWR claims. With 200 ft. of 50 ohm coax the SWR at the operating position remained below 2:1 on all ham bands, including 2 meters. In fact, my MFJ-259 showed no peaks above 2:1 through its range
(to about 170 MHz), although the anticipated periodic highs and lows (from 1:1 to about 1.9:1) showed up well. Removing the extra cable produced a few frequencies with just a small rise above the 2:1 level-no problem for any short-wave receiver or a transmitter with a built-in antenna tuner.
I used the antenna to sample short-wave listening, since my receiver provides full HF coverage. As expected, the overall lower signal level actually improved reception under some conditions. Compared to my regular antennas, it seemed easier to separate stations. Although I did not measure the signal-to-noise ratio, the general level of QRN also seemed less with the D2T. At my location, Radio Havana often requires the use of the receiver attenuator and even then may peg the S-meter during the Arnie Coro, CO2KK, broadcast.
With the D2T the signal level was lower and seemingly more consistent.



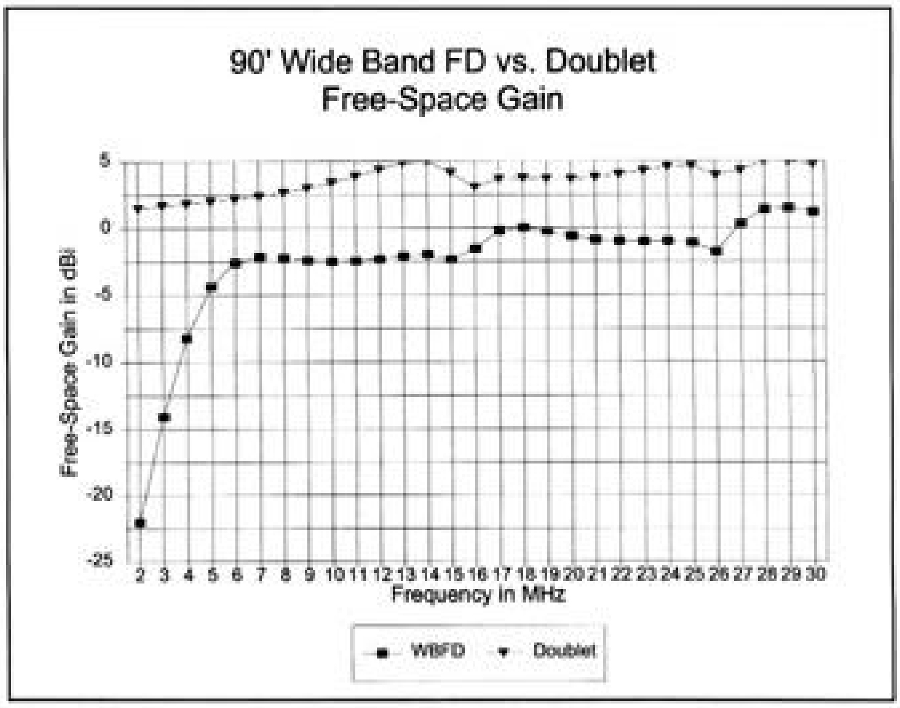


Fig. 5– Modeled gain levels of the D2T and a 90 ft. "folded dipole" terminated antenna. Due to possible imprecisions in the model, the gain numbers on the Y axis have been omitted. The general trend should be reliable.

Conclusions

These notes are, of course, user impressions based on comparisons with antennas designed for amateur band use. Nonetheless, the D2T appears to be a very good small SWL receiving antenna that is likely to be fairly inconspicuous once in service.
Both my modeled performance forecasts and my experiences coincided well with the published figures in the D2T manual. In operation, the specified 5 db front-to-side ratio in the mid-HF region and 10 db front-to-side ratio in the upper HF region were verified easily. The front-to-back ratio in the upper HF region appeared stronger with local signals than with DX, but easily exceeded the specified 5 db in both cases. I have no way of directly measuring gain, but the comparisons with a two-element fan Yagi and a multiband vertical antenna are indicative of reasonable performance for an antenna of its size.
SWL performance seemed especially good, as I easily was able to sort out lower HF SW broadcasting stations, without interference from adjacent strong signals.
My only reservation concerns the potential for amateur operations on 80 and 40 meters. Receiving performance, even using only the internal transceiver pre-amplifier, appears quite adequate. However, the transmitting performance of the D2T drops off faster at lower frequencies than does the performance of a 90 ft. wide-band "folded dipole". This fact is quite reasonable considering the smaller size of the D2T, even if its elements were spread into a straight line. Lower HF operation will be a challenge at even 100 watts output.If the user has a bit of space left over, installing a loaded short vertical for 80 and 40 can improve the situation. Since the D2T receives well in terms of signal-to-noise ratio, an A-B receiving switch might be in order to determine the clearest signal (in contrast to merely the strongest) to enhance reception.
None of these schemes, of course, will equal the use of full-size narrow-band antennas for each amateur band. However, the D2T was not built to compete with antenna farms. Instead, it was designed expressly for the individual with severe space restrictions that permit perhaps a single antenna of small proportions. **Within the class of terminated folded wire antennas, the D2T is an <u>interesting and ingenious</u> addition.**

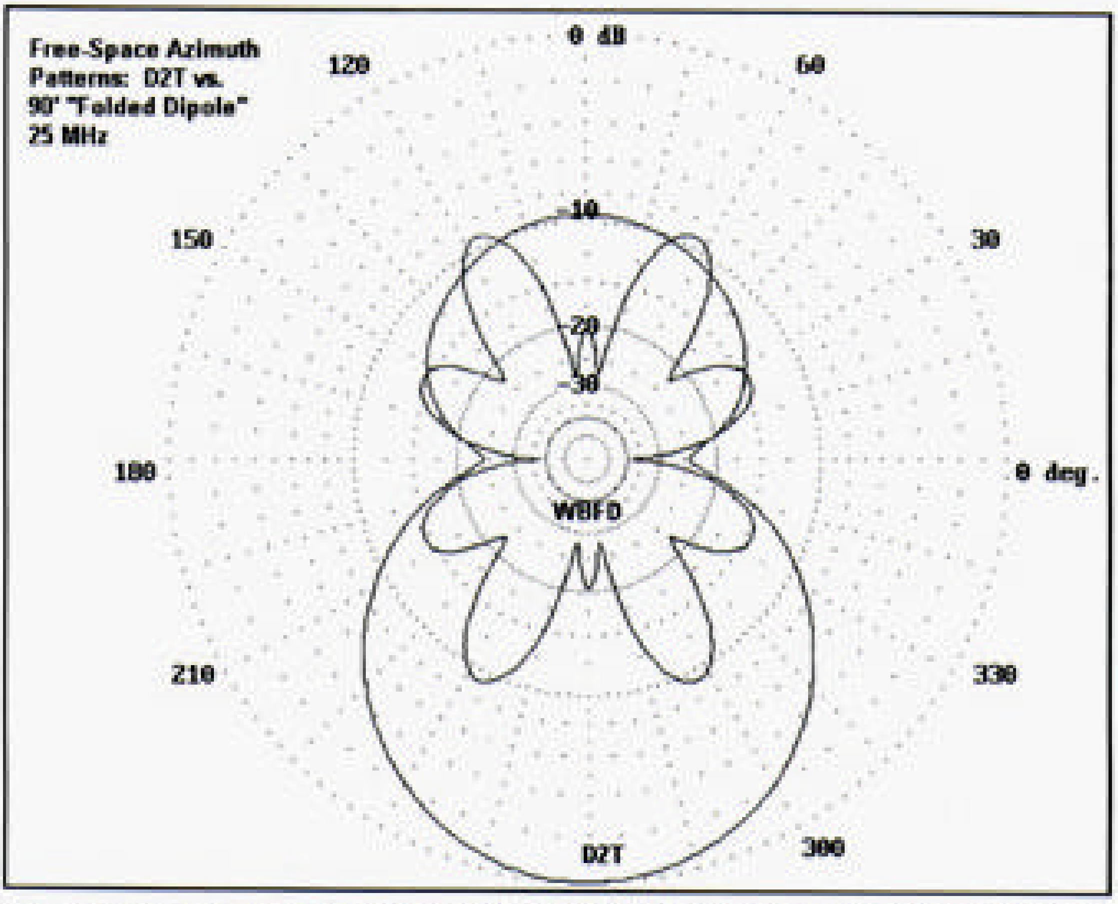


Fig. 6– Azimuth patterns at 25 MHz for the D2T and a standard 90 ft. "folded dipole" terminated horizontal antenna. Note the 9 dB gain differential at this frequency.

The D2T is manufactured by Giovannini Elettromeccanica, Via Enrico Mattei 9, 50039 Vicchio (Florence), Italy. It is distributed in the US by Murray Neece, K5MDM (telephone/fax: 915-580-9051, e-mail: < antennas@qth.com >), and retails in the US for $ 595 plus shipping (introductory price: $ 495 plus shipping). US dealer inquiries are invited. Prices outside the US are on Giovannini's website at < http://www.antenna.it >.

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*1434 High Mesa Drive, Knoxville, TN 37938-4443
e-mail: < cebik@utk.edu >