Distributed Capacity Twisted Loop

An indoor 40 meter antenna for five bucks.

by Jim McLelland WA6QBU

I am one of those unfortunate hams who lives in a neighborhood which does not allow visable outdoor antennas. To make matters worse, the HF bands continue to deteriorate, and I have found it increasingly difficult to communicate after dark without a decent 40 meter antenna. Therefore, I had to find a solution: The Distributed Capacity Twisted Loop. The DCTL was designed for indoor and portable use on the lower high frequency bands. The requirements were: The antenna had to be small, cheap (less than $5), easy to build, constructed of easy-to-find parts, simple to adjust, and work reasonably well.

The following project constructs a flexible loop style antenna that hangs up almost anywhere (I drape it from my bookcase) and can work all over the Western U.S. and Hawaii on 40 after the higher bands have closed up. Moreover, I hear some DX and I can null out (down 30 dB) broadcast stations by rotating the DCTL on a camera tripod. It is quiet to boot! Interested? Read on! Or better yet, spend $5 and an hour of your time and build one yourself.

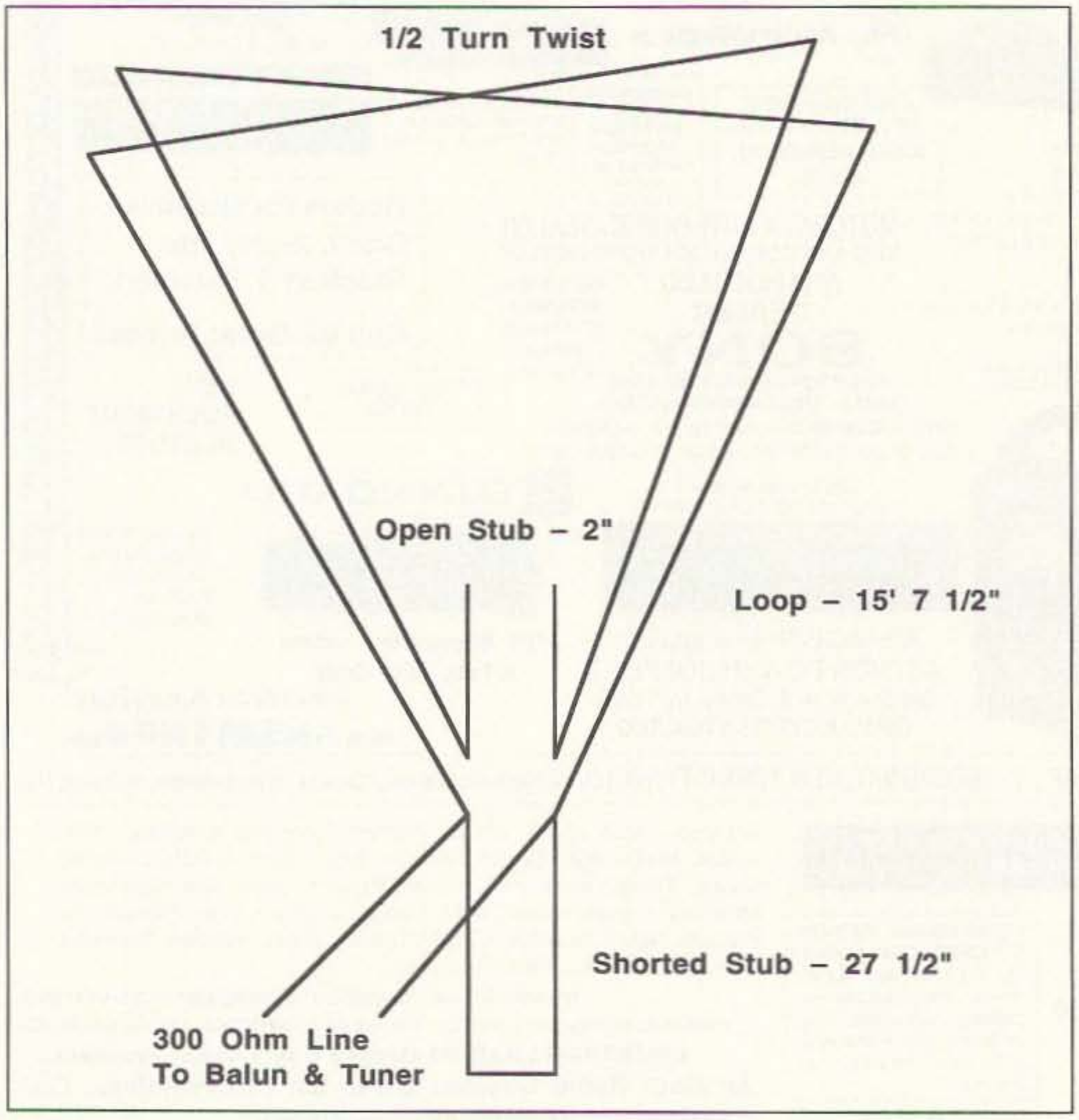

Figure 1. The Distributed Capacity Twisted Loop 1/8 wave antenna stands five feet high.

Description

Referring to the schematic (Figure 1) will probably tell you all you need to know. Since this is an experimental antenna that I am continuing to adapt to different situations and bands (160 meters is in the works), many construction details are left to the builder.

The DCTL is a 15 ' 7" equilateral triangle made from 300 ohm TV lead-in (Radio Shack 15-1153); this is the narrower 5/16" variety. Spacing affects the dimensions so stay with this type of lead-in. The resonant frequency can be lowered by making the open stub longer. With no stub, the antenna resonates at 7.250 MHz, and with a 2" stub, it resonates at 7.050 MHz. I use a 1" stub and a tuner to go anywhere I want on the band. I also use the same low-loss twin-lead into the balun on my tuner—which I strongly recommend because the bandwidth is less than 100 kHz.

The DCTL has an impedance of 5.5 ohms and matching to 300 ohm line is accomplished with a 27-1/2" shorted stub across the feedline at the antenna. This is known as a "hairpin match" and adds some inductance to the antenna and lowers the resonant frequency. With a 50 ohm system (see "Tuning and Experimenting"), the hairpin stub is shorter and therefore the antenna requires a longer open tuning stub (capacitance) to make up for the loss in inductance.

A very important point that must not be overlooked is that the loop has a half-turn twist in it. This means that the feedline is not only connected to opposite ends of the loop but also to opposite sides. To be sure you are doing this right, use an ohmmeter to check for *no continuity* before you hook up the shorted stub and feedline. This lets the insulation act as a high quality capacitor between the antenna legs, which lowers it's resonant frequency. With this system, approximately 1/8 wavelength acts like a half-wavelength system. The open stub just adds a little more capacity to the open opposite ends of the antenna so it can be tuned across the band.

Construction and Installation

To make this antenna work properly, solder all connections and insulate well with

electrical tape and shrink tubing. Measure very carefully, remembering that an extra 2" can put you clear out of the band. Hang as an equilateral triangle with the apex and feedline down, staying away from metal such as housewiring, vents, downspouts, flashing, rain gutters, and windowsills. Lastly, do not use staples to hold the thing in place. As a safety note, *remember that loops have high voltages and high currents. Therefore, don't let anyone (including dogs, cats, kids, or the XYL) touch it.* I've used it with a 100 watt rig with no smoke or sparks yet, but I'd still be very careful.

Tuning and Experimenting

If you only have an antenna tuner, balun and SWR bridge, build the DCTL as described, tune it for 1:1 SWR using low power (I fried my internal balun by not doing this), and look for a QSO. As a side note, an external balun is better than the small internal units most tuners have. Another good alternative is to put RF beads or two of the clip-on RF forms Radio Shack sells on the coax leading to the rig. Any ground wires then go only to the rig, leaving the tuner isolated.

If you want to play a little, here's some more information: I used an MFJ Antenna Bridge for all my initial measurements. A longer open stub lowers the resonant frequency, a longer shorted stub raises the impedance and lowers the frequency, and the shape affects everything somewhat. If you want to use 50 ohm coax directly, use an open stub of 9", a shorted stub of 8-1/2", and clip 1/4" pieces off the open stub until minimum SWR is centered where you want it. You should also coil some coax at the feed point to make a balun (or use one of Radio Shack's cute little forms that I mentioned earlier, winding 10-15 turns of RG-174 on them). Actually, however, I can't tell the difference with or without the balun. Theoretically, the null point on one side of the loop disappears but there is so much pattern distortion inside a house that it really doesn't seem to make any difference. Remember that if you want to use this antenna without a tuner, its bandwidth is only about 100 kHz. If you have a tube rig with a pi-network and a balun, it's no problem, but the new solid-state rigs are another story.

Field Tests

The first station I worked was near Seattle, about 1,000 miles away. Signals were good (7-9) on both ends and the op could hardly believe that my antenna was only 5' high. The next guy was in Salt Lake—same story. Later the same evening I worked a station in Hawaii—he kept saying, "You've got what kind of antenna?" The signals were not very strong but they were quite readable, except for the Pennsylvania station that couldn't hear either of us and kept calling CQ.

As a final note, if you can carefully rotate the antenna, you can really null out broadcast stations. While holding it over my head and rotating it (good thing nobody saw me doing this), I could reduce a 20/9 broadcast station to S7. I think I've got something here, folks. 73