Larry D. Wolfgang, WR1B, tc@arrl.org

A Homebrew, Light Duty Metal Brake Revisited (August 2012)

When using a metal brake like the one described in the August 2012 issue of *QST*, or the previous article from the October 1996 issue, there are several references that can be helpful. George Averill, K4EOR, described the need for a bend allowance when calculating the overall length of sheet metal required for a project. He describes making bends in a piece of the sheet metal you plan to use, and measuring the difference in flat length versus the length and height of the bent piece.

A good approximation for the Bend Allowance (BA) is given in *Blueprint Reading for the Machine Trades*, by Russ Schultz.[1] Schultz gives an equation for BA that assumes the neutral axis to be 44% of the metal thickness.

$$BA = (0.017453R + 0.0078T)N \quad \text{[Eq 1]}$$

where:

R = Inside radius of the bend
T = Metal thickness
N = Number of degrees of the bend.

In *Marks' Handbook for Mechanical Engineers*, they give the neutral axis as between 35% and 45% of the metal thickness.[2] — *73, William Abbott, KB1KOY, 48 School St, Hudson, NH 03051;* **wabbitt@comcast.net**

Changing to a Delta (Sep 2012) Slant Delta Loop

After reading the article on delta loops in the September 2012 issue of *QST* (Sajid Rahim, VA3QY/A22EW/H5ANX, "Changing to a Delta," Technical Correspondence), I was inspired to do a little experimenting of my own. I needed an antenna for 15 meters and had hopes of scheduling some contacts with friends in New England from my location in Texas. A delta loop looked like it might serve. It turned out to be one of the easiest antennas I have ever built.

Another Delta Loop Idea

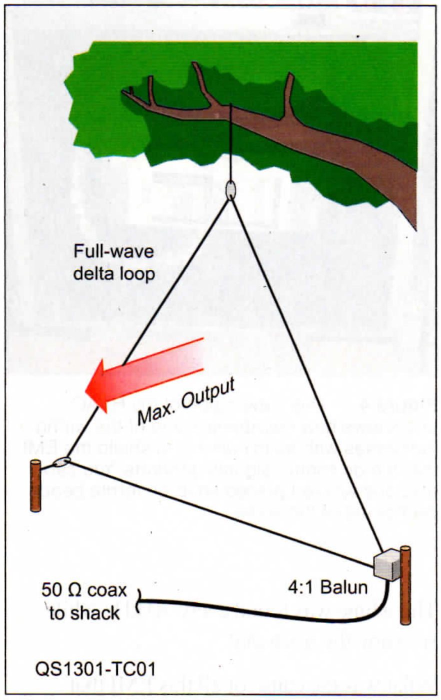

Figure 1 — This drawing shows the final configuration. The antenna is tilted out of the vertical plane by about 30°. Maximum signal strength is in the direction opposite to the tilt.

Figure 2 — If the antenna wire were black or gray, it would be even harder to see. Good for an inconspicuous installation. I needed to add the white ribbon so I wouldn't blunder into it while walking around. Note the "high tech" rocks holding the antenna down.

I decided to focus on the corner-fed full wave delta loop as described in Sajid's article. I liked the idea of a ground-independent system, as he mentioned. A little *EZNEC* modeling predicted that this configuration would, indeed, work very well close to the ground — even, in fact, with the bottom (horizontal) leg *on* the ground! Also, by tilting the plane of the delta off vertical it seemed that I could realize some forward gain over a strictly vertical orientation, while the elevation pattern still showed a maximum at a fairly low angle. This seemed too good not to try. Figure 1 shows the configuration. The best part of this antenna is that it's very easy to put up.

Step 1: Measure one full wavelength of wire at the target frequency, plus some extra to allow for final trimming. I used #18 AWG insulated doorbell wire. Because of the insulation on the wire and the closeness to the ground, the total wire is shorter (by about 5%) than the length predicted by the formula given in Sajid's article. (For a 21 MHz loop, I needed 46 feet of wire.) Mark a spot one third of the distance from one end.

Step 2: Find a tree limb or a pole about ¼ λ above ground. At 21 MHz, this was about 11 feet. This distance is not critical; it's just low enough to tilt the delta loop out of the vertical plane. Pass the wire over the support so that the spot you marked is at the peak.

Step 3: Form the rest of the wire into an equilateral triangle as shown in Figure 1. Since the bottom corners are on the ground, you can use a couple of rocks to hold them in place, as shown in Figure 2.

Step 4: Connect a 4:1 balun to the two loose ends and run 50 Ω coax to the transmitter. Trim the antenna wire for minimum SWR, using an antenna analyzer or low power from the transmitter.

Step 5: Get on the air!

Maximum radiation is perpendicular to the plane of the loop. According to *EZNEC*, slanting the antenna at about 30° from vertical gives an increase in gain of about 2 db

[1] Russ Schultz, *Blueprint Reading for the Machine Trades*, 3rd Ed, 1996, p 288, ISBN: 0-13-287541-1. The current update is the 7th Ed, Oct 2011, ISBN: 978-0132172202.

[2] Eugene Avallone, Theodore Baumeister and Ali Sadegh, Editors, *Marks' Standard Handbook for Mechanical Engineers*, 11th Ed, Nov 2006, ISBN: 0071428674 / 9780071428675.

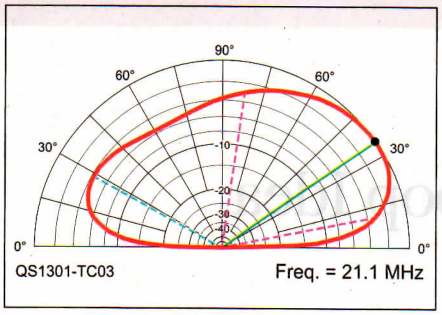

Figure 3 — The elevation pattern shows a maximum gain of 2.34 dBi at 34° elevation. This is only 0.25 dB less than if the antenna were in free space (at an infinite height above ground). It's nearly 2 dB more than if the antenna were strictly vertical (not slanted).

over a straight vertical orientation. Figure 3 is the *EZNEC* elevation plot, using the *EZNEC* "real ground model" (conductivity = 0.008 S/m, dielectric constant = 13).

It's worthwhile to keep in mind that, as mentioned in Sajid's article, this loop will also tune up nicely at twice the fundamental frequency, although with some changes in the radiation pattern. With the right length of wire, 20 meter/10 meter dual-band operation seems an attractive possibility.

I suggest this would make a nice antenna for low power operation, perhaps for Field Day or a backpacking expedition. It's quick and inexpensive, and if you have a need to rotate it, just pick up the rocks and walk it around! It is a pretty effective antenna. With the setup I've shown here, running 75 W from my location in Texas, I have worked hams in Japan, Germany and South America, besides attaining my original goal of making contacts to New England. — *73, Larry Coyle, K1QW, 167 Black Hawk Ct, Dripping Springs, TX 78620*; **k1qw@arrl.net**

Heating Ventilation Air Conditioning (HVAC) EMI Generation

In the summer of 2010 we moved to a new home with a bit more space. As I was becoming accustomed to the new place and its obstacles, one of these I was not ready for. I had chosen to establish the radio room adjacent to the utility room because it provided all the necessary items, such as space, access to the outside for the antenna coaxial runs and electrical wiring just to name a few. I was looking forward to another season of Top Band DX contesting, but that was short lived. To my surprise when I powered on my Kenwood TS-940 for the first time there was a loud hiss/whine coming from the speaker and it didn't matter where I tuned, whether it was on 1.8 MHz or right through to 30 MHz.

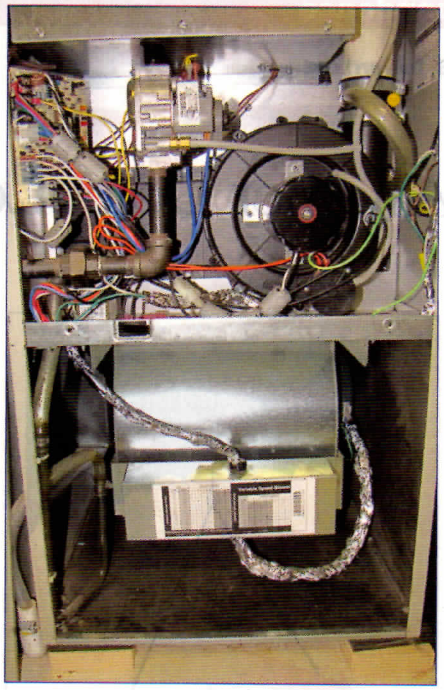

Figure 4 — This view inside of my HVAC unit shows how I wrapped some of the wiring harnesses with aluminum foil to shield the EMI that the dc control signals generate. You can also see where I placed snap-on ferrite beads over some of the wires.

The whine was found every 30 kHz while spinning the main dial.

What was the cause of all this EMI that suddenly appeared one hot afternoon just after setting up my radios in the shack for the first time? It became very apparent when I heard the HVAC system shut off, and the EMI came to an abrupt stop.

This interference was not coming from an outside source such as the house next door, but from my own home. Realizing that the EMI was coming from the HVAC unit only 3 meters away in the next room really bothered me. On further investigation, when the HVAC unit energized again the noise heard on the radio seemed to be synchronized to the sound of the variable speed blower motor as it ramped up in speed.

My new home was equipped with a more up-to-date high efficiency HVAC unit than my previous location, which had a much older mid-efficiency unit and was equipped with only a two speed blower motor that caused no EMI.

Needless to say I was not impressed with this situation. Researching solutions on the Internet only produced minimal results regarding the EMI hash that was being generated. I called the manufacturer of the unit (TAPPAN), and heard that they had never entertained this complaint before. I knew then it was up to me to resolve this problem as they would be of no help.

The variable blower speed control was created by converting the applied 120 V ac to a steppable dc voltage module mounted inside the motor itself, which when energized controlled the blower's speed from 500 to 1870 rpm.

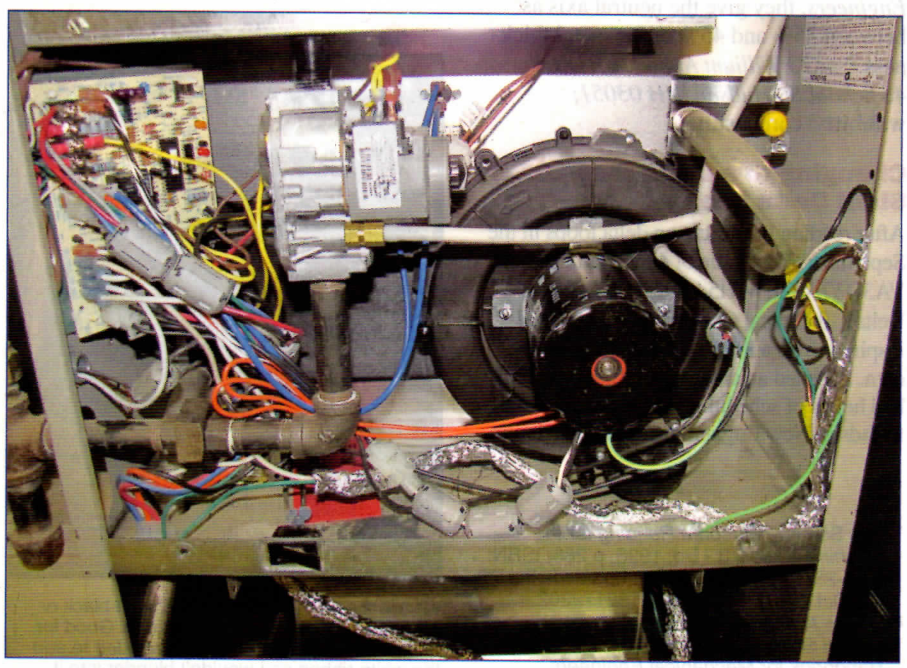

Figure 5 — This view shows more detail of the wiring in the top portion of the unit.