My Hustler / DX Engineering Vertical Antenna Project

I am returning to amateur radio after a hiatus of thirty-five years. When I bought my home 16 years ago, I had no plans for amateur radio. I closely read the CC&R’s (Covenants, Conventions and Restrictions) and at the time they did not sound very onerous or restrictive to me.

Fast forward 15 years – I have just re-earned my general class license (late November 2004). I talked with my wife about the need for an amateur radio station. To my surprise, she was very supportive of my “new” hobby. I talked with the friendly people at Ham Radio Outlet near Portland, Oregon. Considering my budget and operating requirements, I selected an ICOM 746 Pro, PS-125 Power Supply and an AH-4 Autotuner. This was my winter season gift and my wife bought me the package! (Thank you, loving wife!)

Pat Nobel of HRO suggested that I might try to use my rain gutter system as my first antenna. I did connect the rain gutters and they did load, but they were not very effective as an antenna. I worked some local contacts, but I felt it was mainly ground wave propagation because most contacts were within a 600 mile radius. I was only slightly disappointed. Next, I tried a wire underneath the eaves of the house and did better as far as distance, but I still was unhappy. I chatted with other hams and they stated it was the solar cycle and that conditions would improve. After listening to their comments on the states and contacts that they had worked, I decided that I needed a real antenna. I thought the CC&R’s stated that I could not have any roof antennas, poles with overhead wires, structures, or wires visible from the house, etc. After careful re-reading, I found a loop-hole that would allow a ground mounted vertical antenna. If the neighborhood association squawked, I would make the vertical look like a flag pole, complete with flag. Based upon the reviews I studied on the internet and with my all important budget in mind, I ordered a Hustler 5-BTV.

My wife is a registered nurse and works evenings at a local hospital. Can you imagine her surprise when she opened the drapes on the Sunday morning, looked out of the bedroom window and saw my newly installed, shiny aluminum vertical antenna. Our backyard is landscaped in local natural, native vegetation, so she didn’t look at the vertical antenna with the same loving affection and pride that I did. I stuttered an apology and assured her it was only a temporary location (winked to myself with fingers crossed).

This antenna did receive better than my random wire antenna and was omni directional, but still did not perform as well as I expected. I bought an MFJ-259 Antenna Analyzer, measured the SWR, and discovered it was horrible. I then began adjusting the sections of the vertical. I really don’t know how many times I took the antenna down, made an adjustment, and put it back up. My back was really sore for days from this project, but it was worth it. According to the SWR analyzer, there was a good flat low SWR across all
bands. I was so proud of myself, that I created a spreadsheet and graphed the results. It was a really pretty graph and I was ready to brag. However, I still couldn’t hear as much as I thought I should. On some frequencies the random wire with the AH-4 autotuner was definitely a lot better. There is that old adage: “if you can’t hear ‘em, you can’t work ‘em.”.

My aching back informed me that I needed a different method of putting up (and down) my vertical. I visited the QRZ website site to get a mailing address for a QSL card and saw a picture of what I needed in an ad for DX Engineering. I ordered a Tilt Base for a Hustler vertical (part number: DXE-TB-1P). I was going to install it the next time the vertical needed to come down.

Looking around on the DX Engineering website, I discovered the article “20 dB for $48.60” by Steve Katz, WB2WIK. Steve surprised me by describing the SWR behavior of my vertical exactly. He stated that if it had “nice, smooth, low curve plotting VSWR against frequency, that’s a sure sign that it stinks.” Well, my antenna must be really odiferous and I couldn’t even smell it.

By now, you probably have reached your own conclusions that I am not the brightest when in comes to antenna theory. So in late May I posted a question on eHam.net in the Elmer’s forum” titled “Vertical Antennas and Radial Configurations”. I received 11 great replies with the consensus being, “you need radials” and “plenty of them”. One sage expert recommended that I “get a DX Engineering radial plate” which I ordered. (part number: DXE-RADP-1P. It’s a: “Stainless Steel Radial Plate with Coax attachment”)

I informed my lovely wife that I was going to dig up the vegetation and/or hide wires in and amongst the vegetation outside our bedroom window to install radials. She gently reminded me that the antenna was in a “temporary location”, and very kindly but assertively stated “You are not going to put radials down in that location or tear up a single leaf of foliage!” Since this is my second and best marriage (to the best wife in the world), I quickly saw her point-of-view.

So, I needed to move the vertical and put down a radial system. On a side area of our house there was a decrepit metal shed that used to hold our lawnmower and other equipment (i.e. edger and roto-tiller, garden tools, etc.). There was also a disused section of property (overgrown) where our kid’s pool, a former garden, and other family projects went to seed years ago. It wasn’t very big and my wonderful wife wanted to do something with this area for a long time and we never got around to it. It was a very messy area, so I let her convince me it would be a good idea to move my antenna to this area. We would then landscape it once the antenna and radials were in place. As a bonus, she would not be able to see the antenna from any of the windows, patio, deck or most other locations on our lot. Furthermore, the antenna would be more hidden from neighbors and less likely to draw the ire of the covenant enforcers. For the sake of marital harmony and bliss, this sounded like a wonderfully good idea.

Over the course of several weeks, we killed the weeds in the overgrown area with black plastic, cut down and removed escaped wild shrubs, reorganized and de-junked the garage to accommodate the implements and equipment from the shed. We tore down and
recycled the metal shed and I leveled some of the ground. We put down landscape cloth over the whole area with the initial plan of covering the radial system and the rest of the area with bark dust.

Now, I was ready to put up my antenna. I carefully measured the area and determined where the post should be. I cut the landscape cloth and pounded two and a half feet of the requisite four foot post. I attached the DX Engineering “tilt bracket” to the post and mounted the antenna to the tilt bracket. (What a slick piece of engineering! It is so easy to take the antenna up and down.) I measured SWR again and found that my SWR had degraded some, but was still usable. I added the DX Engineering “Stainless Steel Radial Plate” and found the SWR continued to degrade. I then tweaked in the antenna and found the SWR was getting worse and rising alarmingly.

I decided that I would add two radials for every hole in the radial plate. I made a rough calculation that I would need 2000’ feet of radial cable. In reading the literature on the internet, 14 gauge stranded wire in black or green was recommended. I bought, from a local commercial electronics supply store, four 500 foot spools of 14 gauge green stranded PVC jacketed wire and 50 each of 3M ¼” Yellow Ring Terminals for #10-12 wire. I improvised a wire feeder that was basically a piece of conduit through the center hole of both wire spools, hung over a recycling bin (courtesy of our local waste management company). Two detents (slots) in the bin held the conduit in place. I would strip about ¼” of insulation from the end of the two radial wires with a wire stripper, twist the wires together and double compression crimp the two radial wires into one connector. I would then “pull” the wire from the outside edge of the area towards the radial plate in the center and secure with hardware that was provided with the radial plate (plus extras that I ordered.) I would then fasten the radials down with landscape staple about 18” to 24” from the radial plate. Then I would stretch the wire in a straight line from the connection to the radial plate. I used an imaginary center to the radial plate which gave me two points, the bolt on the radial plate and the center of the radial plate from where I made the straight line outwards. I would stretch the wire in a straight line and put a lawn
staple at the end and half way down the wire. When the wire could run under the fence and still be on my property, I made it significantly longer. I would place landscape staples to keep the wire running in a straight line and not overlap an adjoining radial. I completed the radial system and covered the area with bark dust. I needed to trim some trees to get the required distance between the trees and the antenna (about 8 to 10 feet). I had to be careful because these were the neighbor’s trees with branches hanging into our yard. Eventually the project was completed (I thought). I had two to three inches of bark dust over my radials, and to brag a little, it didn’t look too bad to me. But the critical question was “How would it perform?”

As I adjusted the vertical again using my MFJ SWR Antenna Analyzer, results were really disappointing. My SWR went from really bad to worse on all the bands except 20 meters, which was mediocre. (I bought the 30 meter kit to add to my 5-BTV and now it was a 6-BTV.) I wrote an email to Hustler Antennas (Service@newtronic.com) and included pictures and an SWR graph, describing my problems. They sent me a chart of the trap measurements and I discovered that the 15 meter trap needed an adjustment to bring it into specification. After I adjusted the 15 meter trap, I was still not pleased on the whole with the SWR of the vertical. Basically, I was told after my fourth or fifth telephone conversation, that I had a radial ground system that was too good! Hustler tech support told me that in Florida, they usually recommended no radials. In the deserts of Arizona they recommended a lot of radials. I was told to disconnect all the radials, try to adjust the antenna to optimal SWR, and selectively connect the radials to get the SWR to be where it should be. I offered to send him the existing SWR chart before I connected the radials and added the 30 meter trap. (I know that the support people at Hustler could help me adjust my antenna to the proper SWR, but the methods that they wanted to use was not the route I wanted to travel. Please note, I believe that the Hustler 6-BTV is a great value and so do many other hams.) I really wanted to use my all of my radials; I worked hard to put them down and the literature that I read stated the “more the better” to a point of diminishing returns.
About this time I heard from Paul, NO8D (toptech@dxengineering.com). Paul noticed a 2m/70cm antenna on a mast connected to my house that was in the operating field of the vertical. Paul postulated that I might be getting some interaction between the two which was affecting the SWR of the vertical. I moved the VHF/UHF antenna out of the area and checked the SWR. What a difference moving the antenna made! I re-adjusted the antenna for 10, 15 and 20 meters and got a really decent curve. It was great!

The 30 meter and 40 meter bands were still high even after I adjusted the traps. Embarking on a course of action which probably voided my 1 year warranty with Hustler (Newtronics), I began trimming the 30 meter tube (not the trap) 1 inch at a time. When I had trimmed off four inches, I was able to adjust the SWR to have its sweet spot right within the 30 meter amateur band. This left me the challenge of 40 meters.

The second suggestion that Paul advised was to install a coil at the base. He sent me a description and picture of a coil to bring down the SWR on the 40 meter band. I analyzed the picture and printed it out. I took it with me to my local hardware store where I purchased the materials to make this coil. I used a schedule 40 - 1” plastic pipe union as a coil form. Through experimentation, I found that I needed 5 clockwise turns from the back to front of the form using 12 gauge solid copper wire. I had to drill a hole in the base of the antenna to mount one end of the coil, the mounting
bracket on the base of the 6-BTV already had a convenient hole that I could use. Starting the coil with 8 turns to begin with, I kept reducing the turns until I found the optimum amount which was 5 for me. I then made a new coil with 5 turns and silver soldered the connectors. For fine tuning the inductance of the coil, Paul at DX Engineering stated that I should compress or expand the coil as needed. I elected not to make or attach a coil form.

I retuned my vertical antenna, adjusting it from bottom (10 meter) to top (80 meters). I took measurement of the SWR results which were significantly better across all bands. I like to work CW, thus I tailored my “sweet spot” SWR to the CW section of the amateur bands. I am confident that if I was a “phone type” amateur I could have adjusted the vertical to have the SWR “sweet spot” in the phone spectrum of the amateur bands.

This is what I used to make the 40 meter coil. The hardware is stainless steel and can be found at a local “Ace” or “True Value” hardware store. I used:
2 each of ½” long, ¼” X 20 bolts
1 each 1” long, ¼” X 20 threaded spacer
4 each of ¼” star type washers
1 each of ½” #8 SS machine screw
1 package of ¼” yellow crimp-on connectors
1 package of #10 yellow crimp-on connectors
5 feet of 12 gauge, black jacket PVC solid copper wire
The coil form was a 1” schedule 40 plastic pipe union.

I sent Paul at DX engineering another email with my new SWR graphs. I was elated when he emailed back. “The SWR that you have looks great. I would suggest that you can just start using the antenna and enjoy the fruits of your labor.”

How good is my Hustler Vertical now? I am hearing DX that I have never heard before using the same internet DX spotting program. I seem to be making more foreign and domestic contacts. I am now working foreign countries in South America, Asia, Balkans, Russia and Europe with this reworked vertical antenna. I have been able to get through to some foreign station in large pile-ups running barefoot (less than 100 watts). Since I just finished this project two weeks ago, I really don’t have enough experience to state how much better it is now than before, but I am really amazed on how much more I hear. In a couple of months, I feel confident that I will be able to quantify how much better the antenna is performing. I
believe that (and the literature supports) that many radials reduce the angle of radiation (and reception) to a more useful angle which helps bring in DX better.

If I had a larger area to make the radials longer, I am sure my results would be better. I feel that the vertical antenna performs well in this restrictive space and with the constraints of neighborhood covenants.

I am hoping that my experiences can help other hams if they are interested in achieving the best potential of vertical antennas. I am not an expert on vertical antennas. This story is of the means and methods that I used (with a lot of help and advice) to solve my unique problems. I have been told that every antenna installation is different. The techniques and actions that was successfully employed for me, may not work for you.

If you have any questions, please e-mail me at: mfuller@pictishbeast.net and I will try to answer them in a timely manner. Please remember, I am not an engineer and really not very technical. I am only an expert in my own installation.

73,

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