Fiberglass 80 meter Vertical - Revised: 2015-11-06

One antenna in use at K0MPH is a fiberglass 80 meter vertical. The supporting structure is made of fiberglass tubing but the radiation is from a wire taped to the tubing. The supporting structure is made of progressively smaller sections of 8 foot fiberglass tubing for a total height of 45 feet. Three guy ropes are fastened at about 25 feet to help keep the assembly vertical. Since the height of the antenna is not a full quarter wavelength, a small loading coil is wound around the tubing at about 28 feet, to make the antenna resonant in the 80 meter band. Twenty 40 foot radial wires are either buried or lay on the surface of the ground. Some of the radial wires are in a "natural" wild flower area and those are not currently buried. Some of the radial wires are in a lawn area, and they are buried. Some of the radial wires are shortened or bent because they run into objects in the yard or the property line. A remote controlled automatic antenna tuner at the base "tunes" the antenna for the other end of the band.

The supporting structure is an example of how a tall vertical can be designed to be easily erected by one person. The structure may be used for other antenna applications.

BASE

The base connects the antenna structure to the ground. It consists of 4 by 4 inch treated wooden post buried 2.5 feet in the ground. Two feet of the post is above ground. Two 1 by 1 inch by 2 foot angle irons are bolted to the sides of the post and extending above the post by one foot. Between the angle irons is a two foot long section of Schedule 40 PVC 2 inch inside diameter pipe. The PVC pipe is reinforced at the top, the middle and the bottom with PVC couplings glued to the PVC pipe. A bolt at the top of the angle iron provides a pivot point at the middle of PVC section. A bolt at the bottom anchors the PVC vertically. Spacers keep the PVC pipe aligned between the angle irons. The bottom section of the antenna structure fits snuggly inside the PVC. The PVC and angle irons are painted black. The base materials and wire were purchased at a home improvement store.

When the structure is horizontal, the bottom bolt is removed. The structure is raised by pivoting on the upper bolt. Once the structure is vertical, the bottom bolt is installed. Installation is a bit tricky because a small motion at the bottom bolt results in a large motion at the top of the structure (45 feet up).

The base supports the vertical antenna structure in low wind with out guy ropes attached.

SUPPORTING ANTENNA STRUCTURE

The supporting structure consists of ¼ inch wall fiberglass tubing. The largest tubing at the bottom is 2 inches outside diameter (OD) and the smallest tubing at the top is 0.50 inches OD. All sections are 8 feet long except the 1.25 inch OD section is 1.5 feet long. They are telescoped 9 inches inside each other. It was found that it was necessary to have 0.5 inch diameter tubing at the top to make it possible for one person to raise the pole without help. When the upper section was 0.75, the pole was too heavy to lift from the bottom. The fiberglass was purchased from MGS (Max-Gain Systems)
http://www.mgs4u.com/index.html

The picture above shows white nylon guy ropes. The nylon rope was later replaced with smaller Dacron rope.

The bottom four sections are glued together with Liquid Nails (available at the hardware store). Be sure to let the glue thoroughly dry a couple of days before putting any stress on the joints. The top three sections are also glued together with liquid nails. The top section of the bottom four has a three inch slot sawed in it for hose clamp connection to the top three sections. This enables the bottom four sections to be installed first and the guy ropes adjusted before adding the top sections.

After the guy ropes are adjusted on the bottom sections, the bottom section can be lowered with one guy rope disconnected. The top three sections can be connected to the bottom sections, the wire radiator and loading coil taped to the structure, and the entire structure can easily be raised again.

To raise the whole structure just get under it and push-up. The simulation said the raising force is about 50 pounds but I detect that the raising force may be a bit higher. The pole is quite flexible and it takes a while for the top end to leave the ground. Raise it slowly and steadily.

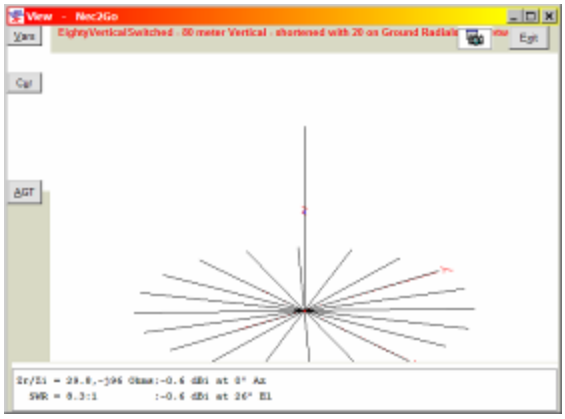
The structure is painted black for UV protection and to make is less visible. Find the antenna in the following photo.

The Dacron guy rope has UV protection, is dark colored (less visible), and is not as stretchy as nylon. The Dacron rope was purchased from The Wireman http://thewireman.com/products.html. Guy ropes are anchored to the ground using small screw-in earth anchors available from the home improvement store. According to simulation, the force on the guy ropes is about 100 pounds at 80 mile per hour wind (no ice). So far the antenna has been up six months and has experience one Minnesota winter. The most serious problem is that top end of the structure gets caught in the tree when the wind blows from the north. Here is a picture of the guy anchor.

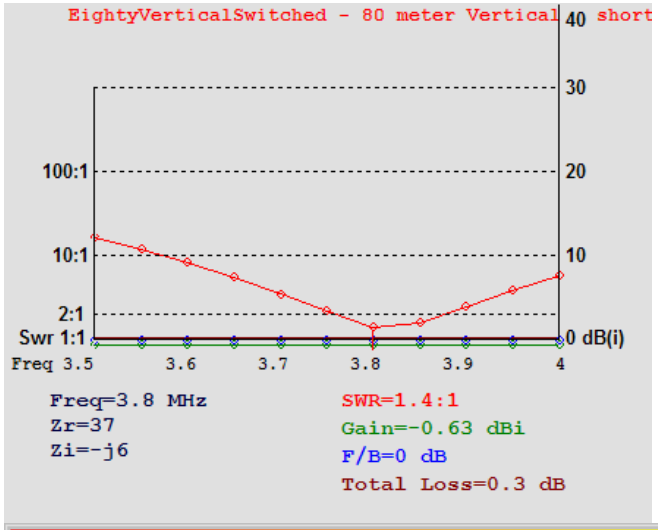
ELECTRICAL

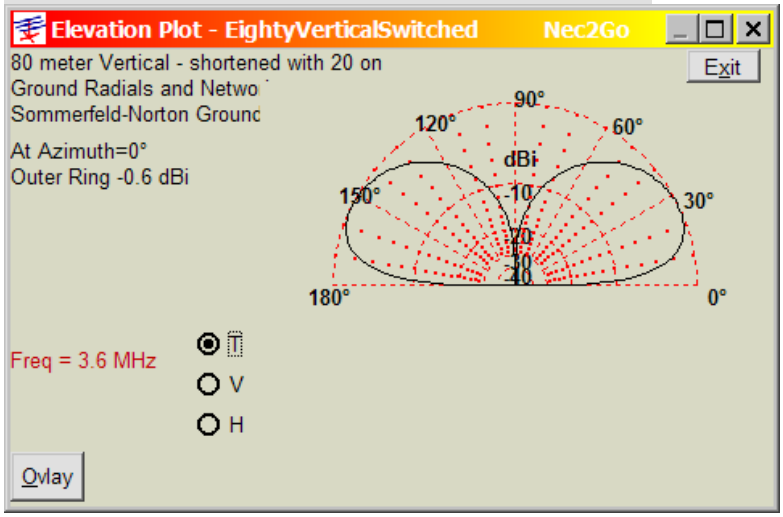
The figure below summarizes the electrical Nec2Go modeling of the antenna. All wires (radiator, radials, and loading coil) are #14 AWG house wiring including the black insulation. The radiator wire is loosely wrapped around the supporting structure, one turn every four feet and taped to the supporting structure every two feet. Since the supporting structure sways in the wind, it is important to keep the wrap loose.

Wrapping likely changes the tuning a bit but is needed so that the wire doesn't dangle away from the supporting structure.



The figures below show the predicted SWR and radiation pattern. Some trimming of the tuning coil was needed to make the antenna resonant at 3800.





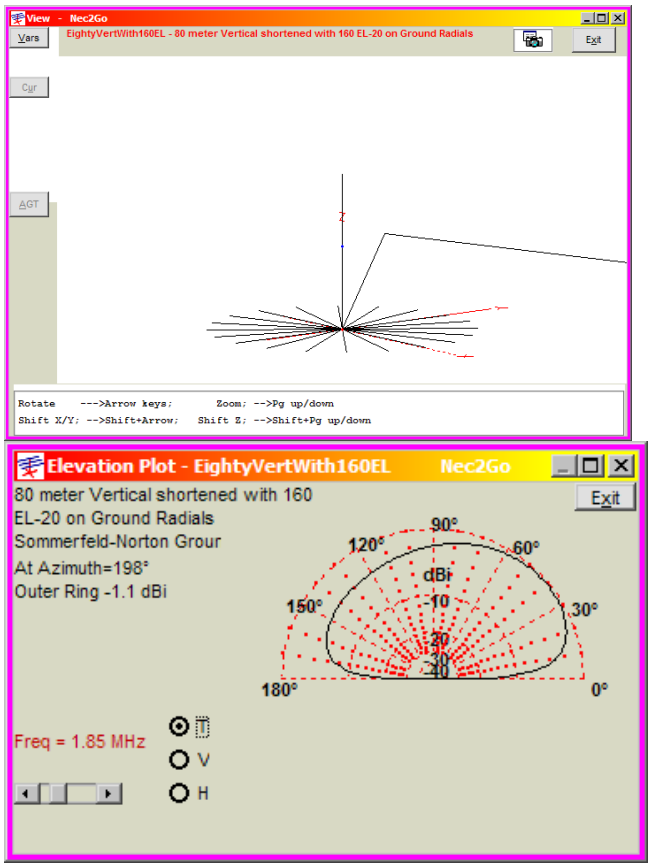
The remote antenna tuner is an LGE RT-11 capable of 100 watts. The tuner uses latching relays, so once the tuner is tuned for a portion of the band, there is no need to retune for that portion of the band, even if power is turned off. The tuner is located in a wooden box at the base of the antenna. Performance is typical of a vertical antenna on 80 meters. It has been an excellent performer in local contests during a low in the sunspot cycle.

UPDATE AUGUST 30, 2008

The antenna has survived two Minnesota Winters and several Spring and Summer storms, including baseball sized hail with no problems. It has not suffered a serious winter ice storm yet. Its performance in domestic contests is far better than a low dipole (except for close-in work). Two things have been changed this summer.

First, the remote antenna tuner wanted to keep tuning as long as power was applied. My theory is that a lightning storm damaged the remote tuner. I disconnected it and connected the coax directly to the antenna. The SWR is very high at the low end of the band but the auto tuner in the rig is able to handle the higher SWR and the extra loss is in the coax is calculated to be about 1 db.

Second, I needed a 160 meter antenna. So I connected a 118 foot insulated wire in parallel to the 80 meter vertical and strung it up in the nearby trees. First it goes up about 30 feet and then over the branches of three other trees before a rope ties it to another branch. According to modeling by Nec2Go (a very fine antenna modeling program – see **www.nec2go.com**), the added wire does not adversely affect 80 meters. Furthermore the 160 meter pattern is skewed in the direction away from the horizontal wire (east toward the center of ham radio land – Ohio). Keep in mind that the wire strung in the trees is not what I modeled but I am hopeful. I am also hopeful that the insulation stays intact on the wire strung in the trees. Below is the modeled results. I don't really expect this antenna to be a barn burner on 160 meters but it should be better than trying to load up the 80 meter vertical on 160 meters.



UPDATE NOVEMBER 17, 2010

The antenna has been performing well now for several years without maintenance. Better on 80 meters than on 160 where it is mediocre. The SWR is very high at the low end of 80 meters and even though the auto tuner in all radios corrects the SWR, there is some loss in the coax. I built an antenna tuner with four remotely selected bands of tuning, a current balun, and a step down matching transformer. In addition there is a relay to connect the coax feed line to a nearby 20/15/10 meter vertical used by the second radio antenna on 20/15/10 meters.