



# The Radio Hotel – The Antenna - Part 6 by W5RH

## Verticals – How Low (angle) Can You Go?

We have all heard the phrases “Verticals radiate poorly in all directions” and “Verticals save space”. Well...Yes and No. (BTW, if you are new to hobby and have not heard these phrases, just wait, you will)

Verticals can radiate poorly in all directions, if not properly installed. And they do save space in the air, but make it up with what is needed on the ground in the “image” part of the vertical antenna system.

As the typical vertical is  $\frac{1}{4}$  wavelength (wl) long, it by itself is not a resonant system. To be resonant you need at least  $\frac{1}{2}$  “electrical” wl, which means we need another  $\frac{1}{4}$  wl of wire – “Radials” to be more correct. Not wire in the air, but on the ground. So, yes, verticals do save space “up there” but not down here, if installed correctly, or better said, installed with the best performance in mind.

The real benefit of verticals in the HF bands is that their main launch angle -- aka “angle of radiation” -- is very low and that is with being mounted right on the ground. Reflect back to the last 2 months of **TRH** talking about horizontal antenna’s launch angle and patterns -- having to get  $\frac{1}{2}$  wl or more above the Earth to get a lower angle of radiation. For DX, low angle is what we want – Ionospheric propagation of electromagnetic radiation is similar to a mirror’s reflection of a flashlight and the lower the angle the further it gets reflected. Plus, this low angle of radiation is in “every” direction – 360 degrees around the globe. OK, the “gain” (see last month’s **TRH**) isn’t so hot because it radiates everywhere, but you can’t snort at the low angle. So how best to optimize this low angle? 50% of the vertical system is the radial field -- those wires spread out in all directions on the ground, above the ground or below the ground (choose your poison). The better radial field you have the better the vertical antenna performs. There have been countless articles written about this situation by some of the stalwarts of Ham Radio Antenna Theory – (Google – Messieurs Brown, Severns, Orr, Cebik, Belrose and Christman)

Rob Sherwood, of the Sherwood Receiver Test fame, wrote in [Ham Radio May 1977](#) about an easy solution to the radial field dilemma of collecting the high return currents at the high current portion of the vertical system, which is right at the base of a  $\frac{1}{4}$  wl vertical. It is a ground screen for about a 10 foot radius. (Google -- Sherwood Ground Screen)

In your Google searches you will find that all of these folks mentioned want to increase the efficiency of the return current collection and, therefore, provide a radiation pattern that has a very low angle of radiation. A poor radial field not only attenuates the whole radiation pattern, but you will see that the lowest angles (1 thru 5 degrees, and sometimes higher) are attenuated drastically. One contest team (“Team Vertical”) puts verticals in salt water right at the shoreline to achieve that low, low radiation angle. They do quite well in that salt water is a very good medium for near field RF current collection and far field reflection, etc. An alternate method is to raise the radials above the ground (elevated resonant radials or “counterpoise”), but the caveat here is that the lower the frequency the higher the radials must be above the ground to avoid the ground interfering with their proper operation. (A note for the Low Banders)

Discussion about verticals and radials can go on forever, but our Editor, John - K5IZO, says I must stop for this month. However, a 12 part treatise series was written in 1968 and 1969 in [CQ Magazine – Vertical Antennas](#) by Capt. Paul Lee – W3JM. It has also been compiled into a book - “The Vertical Antenna” published by CQ. If verticals are your thing, it is well worth reading the book or the articles.

### Next time.... Shortening the antenna or Let’s get Loaded with Coils and Hats

*The purpose of **The Radio Hotel** is to give you a practical kickstart into exploring the workings of antenna systems. It is a series, so go back and read the previous columns to get the whole picture, as one month relies on the previous month’s information. Google the buzz words and find out what they mean. Read up on antenna system theory to see how it all works together. You will be glad you did.*

