The Radio Hotel – The Antenna - Part 4 by W5RH

Polarization and Height Above Ground

Parts 1 thru 3 have focused on the Antenna "Recipe" (in March) and some "Basic and Controlling Characteristics". Two additional antenna Controlling Characteristics are Polarization and Height Above Ground which control the radiation pattern shape. Both are used to control what we finally "get out" of the antenna.

Take an ordinary ½ wavelength dipole for HF and extend it horizontally between 2 trees in your back yard. The dipole's radiation will be "horizontally polarized"….meaning that the E-Field will be parallel to Earth/ground reference. Note, however, that as the HF wave travels through the Ionosphere it can rotate to vertical polarized and back to horizontal depending on its' path angle and path length and the layers of the Ionosphere it encounters. **(Google: Antenna EH Fields – the total field radiated – Wikipedia has a good explanation)**.

Now, rotate the dipole to be completely vertical (well, imagine rotating it – this is easier that actually rotating it). The antenna E Field radiation is now vertically oriented and the antenna is said to be "vertically polarized". Similar to a vertical antenna on your car for use on 2 Meters. 2 Meters is a good example of the use of the correct polarization. If your car antenna is vertical and the repeater antenna is vertical, then maximum transfer of signal will occur. If you use a horizontal antenna to try and access the repeater you will be at a 3dB disadvantage due to the loss occurring simply by being the wrong polarization. As mentioned above, on HF, where the radiation travels thru the Ionosphere, the polarization is not so important to the receiving station, but is important for the transmitting station. How? That's next.

An antenna that is horizontally polarized will take advantage of the gain that is provided by the near field reflection (off the earth) that adds to the direct radiation field. This additive reflection is dependent on the antenna physical height about ground to give the most gain at a specific angle. As you move a horizontal antenna further away from the Earth it will produce a radiation field that will become lower and lower in main lobe radiation angle – meaning better for DX. **(Google: Antenna radiation angle)**

For further in depth reading of these height versus angle of radiation properties have a read of the excellent ARRL paper: "Antenna Height and Communication Effectiveness". Find it at
https://www.arrl.org/files/file/antplnr.pdf

With a vertically polarized antenna, its' radiation launch angle is quite low when it is mounted right at the earth. That is an advantage of vertical antennas, they have that low DX launch angle right at the earth level, so you get that DX pattern right at ground level. The slight disadvantage of the vertical antenna is that it radiates in all directions at once and, therefore, does not have the gain associated with Yagi type "directional" antennas. But, if a vertical is what you can put up in your yard due to HOA or "better 2/3rds" restrictions, then put up that vertical and work the world.

So in summary, orientation of the antenna wire or metal element gives us the polarization and height above ground gives us the main lobe radiation angle and shape of the radiation pattern. Pretty straight forward stuff. This basic antenna theory can be found on the web and in many antenna books written for the layman and technical Ham both. Find a book that suites your level of understanding and dig in.

Next time – More on Gain, Angle of Radiation and Radiation Patterns

*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.*