Phased MW Receiving Verticals

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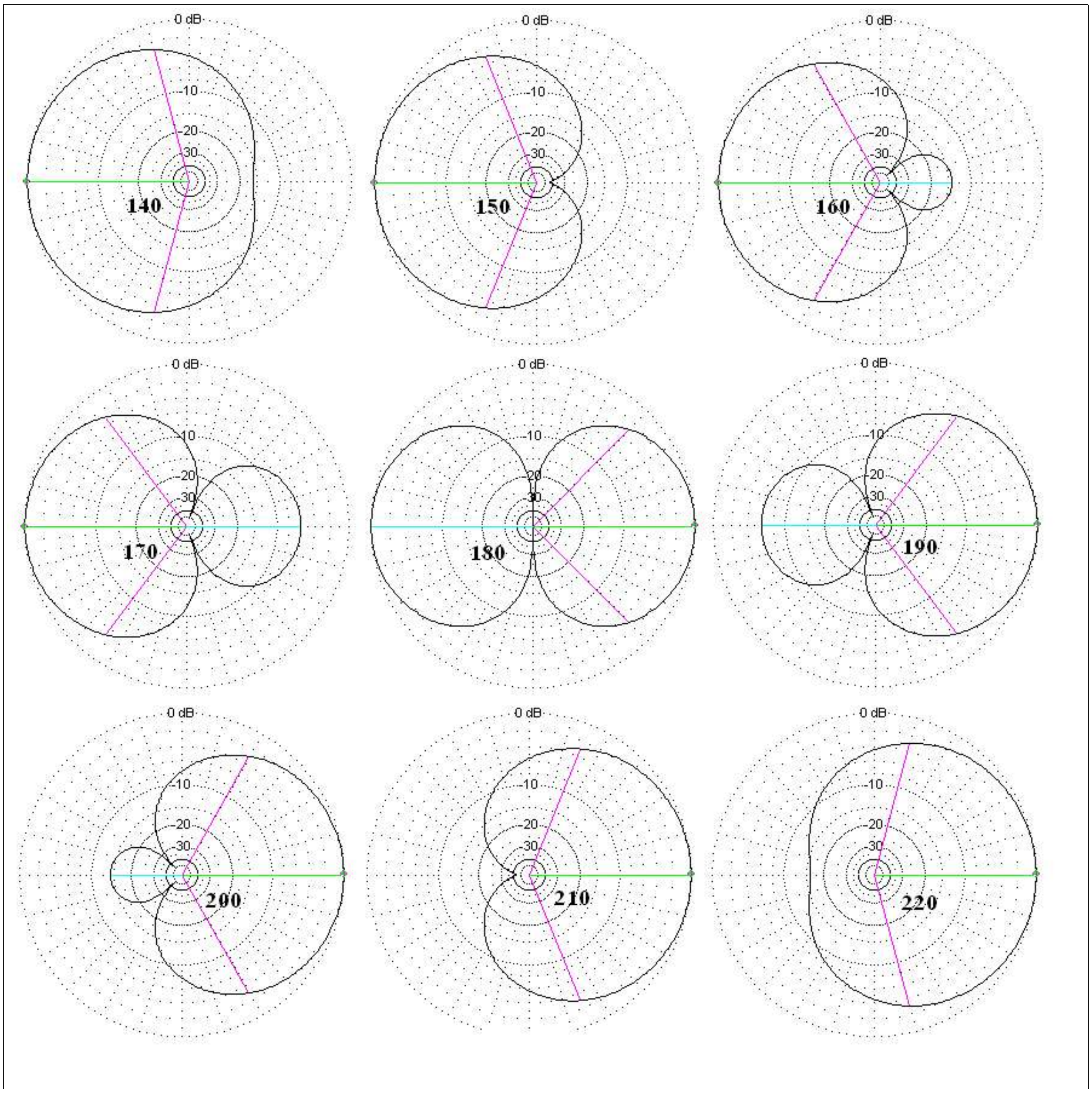
The graphs below show the azimuth reception patterns at 10 degrees elevation angle of a pair of phased noise reducing verticals, 15 meters tall, separated by 50 meters, for a frequency of 500 kHz. The numbers near the centers of the patterns are the phase shifts required to generate the patterns. Similar reception patterns can be generated at any frequencies throughout the MW band, as well as for higher frequencies and some lower frequencies.



Superficially the patterns appear to be the same as when a short vertical is phased against a loop antenna. But that is not the case, as I will explain below. The easiest way to see how the vertical + vertical pattern differs from the vertical + loop pattern is to consider the vertical + vertical pattern for a 180 degree phase shift, and the "equivalent" vertical + loop pattern. The equivalent vertical + loop pattern is gotten (approximately) by reducing the vertical signal level to 0. All that remains is the figure 8 loop pattern for a 0 angle of elevation, which looks like the vertical + vertical pattern for a 180 degree phase shift and 0 angle of elevation (not shown, but like the 10 degree angle of elevation). But in 3 dimensions the two patterns are entirely different. The 3 dimensional vertical + vertical pattern can be created by rotating the 0 degree elevation angle pattern about the horizontal line through the center of the two lobes. But the (vertical +) loop pattern is like a doughnut (torous) with no hole in the center, just a single point corresponding to the nulls 180 degrees apart. So with a vertical + vertical, the nulls produced by a phaser correspond approximately to deforming a larger flexible sphere (ballon) by pushing a smaller rigid sphere against it, while with a (vertical +) loop, the nulls produced by a phaser correspond to deforming a doughnut with no hole in the center. It is easy to see that in these two cases the nulls of the vertical + vertical are infinite in number and make a 180 degree arc through the zenith, while the (vertical +) loop has only 2 nulls approximately 180 degrees apart. So the (vertical +) loop nulls in only two directions, with reduced signal levels in 2 cones centered on the 2 nulls, but the vertical + vertical nulls all signals along the arc through the zenith and reduces all signals within a wedge shaped slice through the zenith. Because of their greater nulling capacity it seems reasonable to expect that phased verticals will have better long term null stability. As a matter of fact, I have observed this for daytime groundwave signals. I believe this is also the case for nighttime skywave signals, but it has been more difficult to verify conclusively.

Consequently, a pair of noise reducing vertical antennas separated by 50 meters appears to be a better choice for a phased MW receiving array than a vertical + loop array. But if nulling at lower frequencies, down to 100 kHz or lower, is desired, then a vertical + loop array is the hands down winner because 50 meter spaced verticals become less and less effective nullers at frequencies below 500 kHz. Also, if it is not possible to put up 15 meter verticals (no suitable tall trees), then noise reducing inverted L antennas, parallel, spaced 50 meters apart, and pointing in the same direction perform about the same as spaced verticals for nighttime skywaves, though their daytime groundwave nulls stabilities are not as good as spaced verticals.

Of course, it is unlikely that any of these small phased arays will perform as well as a two wire SWA beverage antenna using a modified Misek phaser and located at one of the outstanding MW DX locations like Kongsfjord. But there is no way I can put a beverage antenna on my 300 foot by 200 foot lot, and even if I had sufficient real estate, a SWA beverage would not benefit me much because I am far away from any ocean, and I have to "look" into and through tons of interference often over long land paths to try to "see" most of the DX that I want to hear. So at my location a pair of phased verticals spaced 50 meters apart is as good as it gets.