Directive Systems & Engineering

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What are power dividers and phasing lines and how are they used?

When you want to stack antennas for higher gain/sharper pattern, the antennas must be fed in phase for the two signals to add properly. When you connect two 50 ohm antennas together, the impedance drops in half (ohms law). If combining four antennas, the impedance drops to 12.5 ohms.

Our power dividers/splitters are open air, one quarter wavelength transformers that provide a single 50 ohm input and either 2, 3 or 4 connectors on the output to connect your antennas. The insertion loss of a power divider is negligible and all of our units are tested on our HP network analyzer for a minimum of 30dB of return loss (less than a 1.06:1 SWR!!!), unlike some power dividers available that advertise an SWR of 1.2:1. An N connector is only "rated" at about 1kW at 144 MHz. Running 1500 watts is putting a strain on the connector so why add to the issue by raising the SWR which can cause arcing and extra heating in the connector. While on the subject of power rating, an open air divider will handle many kilowatts of power. It's the N connectors that are the limiting factor. We don't rate ours at 3kW as others since that power level ***WILL*** destroy the connectors eventually. Directive Systems will be offering QRO powers dividers with 7/16" DIN connectors for those looking for an extra margin of safety.

"Phasing lines" are really the cables that connect your antennas to the power divider/splitter. These are 50 ohm cables and should be in multiples of an electrical half wavelength so the impedance of the antenna is repeated at the end of the line. In practice, if you cut the lines from the same run of coax and cut them exactly the same length through 432 MHz you are probably fine. We can "phase match" cables by cutting them to within +/- 1 degree using our network analyzer. If you are stacking four antennas, one over top of each other, the power divider will be in the center and the center two antennas will be closer to the power divider than the upper and lower most antennas. In this case, the center two phasing lines can be *EXACTLY* one *ELECTRICAL* wavelength shorter and the signals will still be in phase and add properly. The top and bottom antennas will be time delayed by nanoseconds, but the DX will never know the difference! For a traditional H frame, make all the lines the same length.

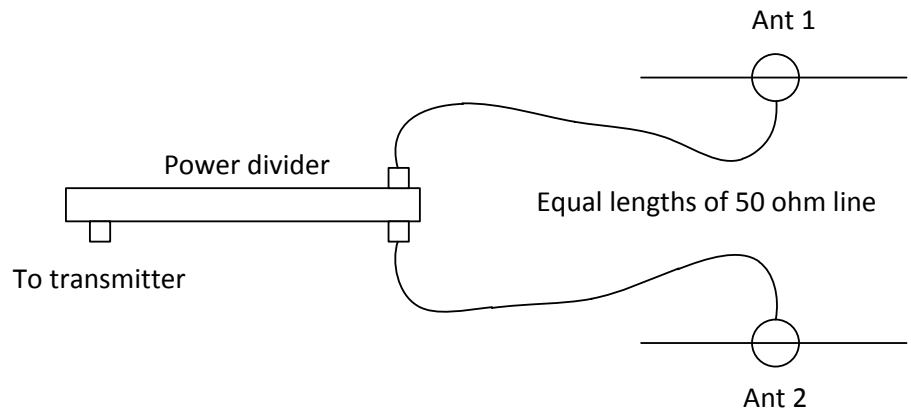
There are two variations to this theme.

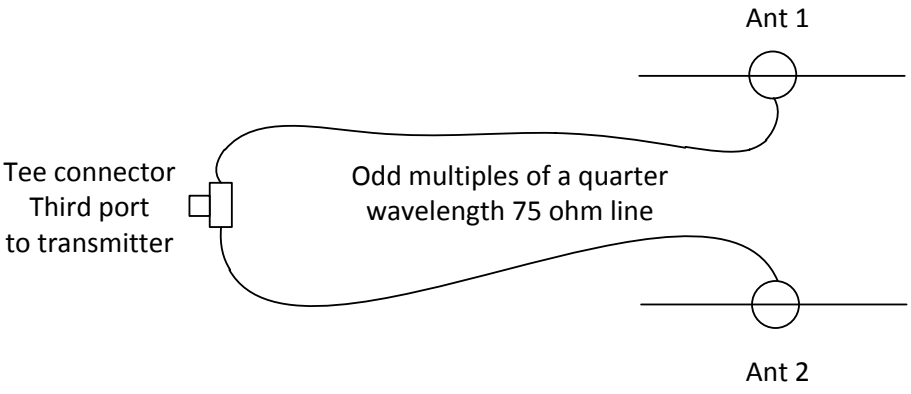
First, when stacking a pair of 50 ohm antennas, you can use odd multiples of 75 ohm cables to connect the two antennas together and just use a Tee connector in the middle. Times makes LMR400-75 which is a good choice for this. You can also get LDF3 in 75 ohms, but connectors are a bit pricy. The down side of this method is the more quarter wavelengths you add, the narrower the bandwidth gets and the more critical your calculations become.

Second is when stacking four 50 ohm antennas. All four antennas are fed with 50 ohm coax the same length and preferably multiples of an electrical half wavelength. Two antennas are connected with a Tee and the other two connected with a Tee. You then use two, one quarter wavelength sections of 50 ohm line to connect the two Tee's to a third Tee which then goes to your transmitter.

See the diagrams on the following pages.

Proper ways of feeding pairs of antennas using coaxial lines.





Proper ways of feeding four antennas using coaxial lines.