

Mountain RF Sensors DF Antenna

The antenna employed in the MtRF DF system is a cavity-backed annular slot antenna, based on a design originally developed by the FCC in 1979. This antenna configuration displays a cardioid directional pattern. By placing multiple taps around the periphery of the slot element, the pattern can be electronically rotated by sequentially selecting the various tap points.

For applications requiring an omnidirectional pattern, the antenna is configured to sum 3 or more tap points to produce an omnidirectional pattern. When employed as a DF antenna, a minimum of 3 taps is required to produce a bearing solution, with 4 taps being the industry norm. The Mountain RF DF system normally configured with a 6-tap antenna, resulting in lower peak RMS errors than the 4-tap configuration. The antenna can also serve in an omnidirectional mode by summing all taps.

The slot antenna is unique in the fact that it can be flush-mounted while providing 360 degrees of azimuth coverage. The antenna is vertically polarized. Optimum vertical angle is +/- 30 degrees, but it will function at angles exceeding 45 degrees, at reduced accuracy.

The slot antenna has extremely wide bandwidth, approaching 2 decades. For example, a 12" diameter slot element is useful from 10 MHz to 400 MHz. The upper frequency limit is reached when the slot diameter approaches $\frac{1}{2}$ wavelength. Above this limit, the cardioid pattern develops secondary lobes. There is no sharp boundary on the lower limit. The sensitivity drops as the frequency is lowered, and the accuracy will begin to roll off as the F/B (front-to-back) ratio decreases.

Since there is a trade-off between sensitivity and maximum frequency, users should avoid over specifying the upper frequency range since there will be a sensitivity penalty. The slot elements can be nested inside of each other, offering the flexibility to extend the upper frequency range. There is some interaction between elements, so separate elements are preferred, where possible.

The system accuracy can approach 3 degrees RMS in an ideal environment, but factors on the platform will reduce this number. This is common to all DF systems, to some extent. Strategies such as dual-symmetrical antennas can negate some of the platform influence. Where required, the system can be calibrated to the platform, something that is not often done due to expense and time constraints.

In addition to the low drag and small diameter, the slot antenna is very light. The complete antenna (element, FRP mount & electronics) is only about 2 lbs. The mounting depth is 2"-3".