A Investigation on the Correlation-Coefficient and Power Metrics for MIMO Antennas in a Reverberation Chamber

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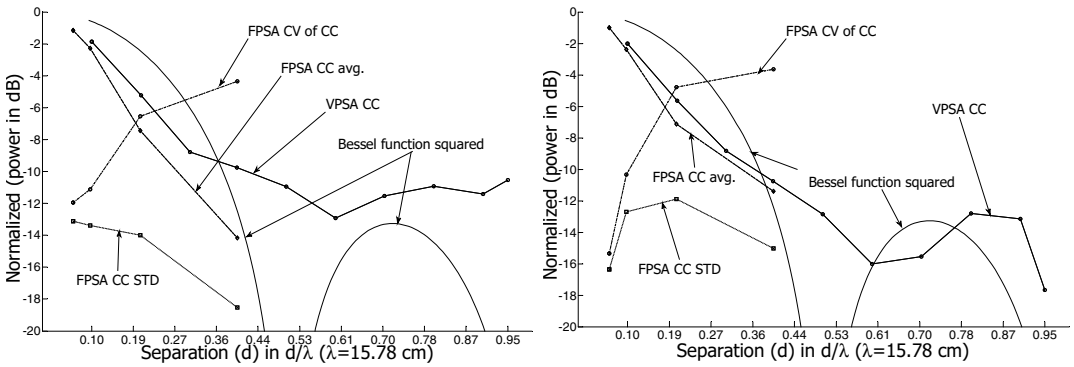
Many MIMO antenna specifying aspects have been investigated . These aspects include capacity, diversity gain, BER between multiple antennas, K-factor and their mutual relations in both a reverberation chamber and an anechoic chamber. In this presentation, the correlation-coefficient (ρ_{CC}) of the transmission coefficients will be compared to the complex transmission-coefficient squared (TCS) by investigating the behavior of the coefficient of variance (C_v) for the two measures. The C_v is calculated by normalizing the standard deviation by the mean for the different positions in the reverberation chamber. The transmission coefficients S_{13} and S_{23} are obtained from a three-port vector network analyzer measurement done between two monopole antennas (connected on ports 1 and 2, on a single ground-plane) and a brass-horn antenna (on port 3). Three sets of monopoles are at fixed separation distances on a ground plane (called fix separation parallel-monopole antenna (FSPA)), and are representative of good, bad, and average multiple-input multiple-output (MIMO) antenna's. Another antenna with an adjustable separation distance between the monopoles (called variable separation parallel-monopole antenna (VSPA)), allows variation of the MIMO antenna over a range from good to bad. For both types of MIMO antennas, the ρ_{CC} as function of the monopole separation follows the trend of the analytic model (Bessel-function). The ρ_{CC} is better (i.e., a smaller value) at larger separations as can be seen in Figure 1a and 1b. With increasing separation the C_v increases to values of approximately 0.4 to 0.5, which implies that the ρ_{CC} is becoming less accurate. However, if we look at the case were there are 6 typical RF absorbers-sections added for loading, the C_v of the TCS almost doubles while the C_v of the ρ_{CC} stays more-or-less the same. In conclusion, for a small separation between the monopoles, especially in a heavily loaded environment, the ρ_{CC} would likely exhibit less uncertainty as a performance metric for a MIMO system, than the TCS measurement.



(a) With 0 absorbers

(b) With 6 absorbers

Figure 1: These plots show, as a function of monopole separation d/λ, the central frequency behavior of: the C_v based on the ρ_{CC} over the nine positions, and the standard deviation and mean over the same nine positions (both measured with four FSPA), the ρ_{CC} for the VSPA, and the analytical model (Bessel-function).