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MIMO Gain and Bandwidth Scaling for RFID Positioning in Dense Multipath Channels

Abstract—This paper analyzes the achievable ranging and positioning performance for two design constraints in a radio frequency identification (RFID) system: (i) the bandwidth of the transmit signal and (ii) the use of multiple antennas at the readers. The ranging performance is developed for correlated and uncorrelated constituent channels by utilizing a geometry- based stochastic channel model for the downlink and the uplink. The ranging error bound is utilized to compute the precision gain for a ranging scenario with multiple collocated transmit and receive antennas. The position error bound is then split into a monostatic and bistatic component to analyze the positioning performance in a multiple input, multiple output (MIMO) RFID system. Simulation results indicate that the ranging variance is approximately halved when utilizing uncorrelated constituent channels in a monostatic setup. It is shown that both the bandwidth and the number of antennas decrease the error variance roughly quadratically.

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