Optimization of Ultra-Wideband Phased Arrays in MIMO Configuration with Coding for Increased Channel Capacity

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There is a continuing and growing demand to increase the achievable channel capacity of wireless communications systems. To do so, innovative system architectures with signal encoding and processing techniques have been considered to realize higher channel capacities. In this context, Multiple Input Multiple Output (MIMO) systems provide increased data throughput by exploiting spatial diversity to create multiple communication channels used simultaneously. To further increase channel capacity, traditional MIMO systems can be used in conjunction with channel coding schemes and estimation techniques. Also, spatial filtering or beamforming can be used when phased arrays are employed. Beamforming provides the flexibility to steer signals towards a desired spatial directions to effectively increase signal-to-noise ratio (SNR).

In this paper, we present a communication system that combines beamforming along with MIMO and channel coding techniques. In addition, an ultra-wideband array is employed to further increase capacity and throughput. Multiple communication channels are also employed by dividing the array aperture into smaller subarrays. Since smaller subarrays reduce antenna gain, channel coding with convolutional codes are introduced to improve the SNR and link reliability.

At the conference, a study of the optimal array configuration and sub-array choices will be provided. Our goal is to maximize data throughput and SNR. Bit error rate (BER) simulations will be presented to evaluate the performance of the proposed system to determine 1) optimal number and size of subarrays, 2) maximum number of users, and 3) maximum transmission data rate. Our simulations will be cross-verified with measurements obtained from a hardware testbed consisting of an in-house phased array and software defined radios (SDRs).