Interference Mitigation for 5G Millimeter Wave Communications

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There is growing interest in millimeter wave bands (27.5 – 28.35 GHz, 37 – 38.6 GHz, 38.6 – 40 GHz, and an unlicensed band at 64 – 71 GHz) for 5G and WiGig operation. Additionally, there is concurrent interest for portable devices and reduced power consumption. Towards this goals, it is desirable to integrate antenna arrays with RF backend and Analog-to-Digital Converters (ADCs) in a cost effective manner. Further, to overcome propagation losses, high gain millimeter wave arrays are desirable.

To address the above goals, we propose a high data rate system that can operate across an instantaneous bandwidth of 10 GHz. To do so, we introduce multiple coding stages. More specifically, we propose a hybrid channel coding and a code division multiplexing (CDM) technique to achieve up to 40 dB of coding gain by minimizing Signal-to-Noise (S/N) degradation. We also propose a signal channelization process using many individual channels/bands, each spanning the spread bandwidth. This is achieved by up-converting the signals to different frequencies (channels) using a set of local oscillators (LO). At the front-end, these signals are amplified and frequency multiplexed into a single ultra-wideband (UWB) signal for transmission.

In this paper, we discuss the proposed high data rate system for high data rate operation. More specifically, simulations and measurements were performed to assess the impact of CDM under various interference scenarios using Gold code sequences. The employed test set-up configuration included two separate transmit chains for upconverting the baseband signals to the same frequency from different users. Using these tests, we examine the trade-offs using different set of codes with realistic components (e.g. filters) and finite resolution digitizers. Also, degradations due to intentional and unintentional interference are considered.