Simulation Project Proposal: IEEE 802.11ad

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Overview & Background

I would like to simulate a subset of the physical (PHY) layer of the IEEE 802.11ad wireless networking standard. 802.11ad, added to the 802.11 standard in 2012, was developed to provide a multi-gigabit wireless system. The system operates between 60 and 70GHz has a 2GHz bandwidth, sacrificing range for tremendous throughput. This standard was the first of the so-called Wigig networks, a family of 60GHz Wi-fi protocols. While there seems to be little by way of adoption, Qualcomm has begun to integrate the standard into their line of products, and in-house virtual reality has been cited as a promising use-case for high throughput wireless networks.

Technical Details

At the PHY layer, 802.11ad contains a few different variants. The directional multi-gigabit (DMG) specification contains single-carrier (SC), OFDM and low-power formats. Specifically, I would like to simulate the DMG SC PHY layer. This layer offers 12 different modulating and coding schemes (MCS). Fig. 1 shows a block diagram of the receiver architecture, which I will implement.

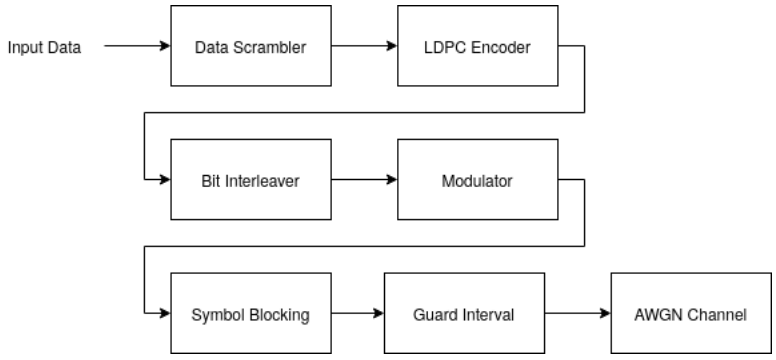

Figure 1: Transmitter block diagram for IEEE802.11ad

The data scrambler uses a following generator polynomial ($x^7 + x^4 + 1$) to break up the input bitstream. SC-PHY uses low-density parity check codes (LDPC) to perform forward error correction (FEC). The code rates can be any of the following, depending on the choice of modulation scheme: 1/2, 5/8, 3/4, 13/16, 7/8. The bits are then passed through an interleaver, and onto a modulator. Modulator can use $\pi/2$-shifted BPSK, QPSK or 16QAM. Then, the data is split into 448-bit blocks, and a 64bit guard interval is placed between. The guard interval consists of a Golay sequence, and modulated with $pi/2$ BPSK. Then, the frame is passed through the AWGN channel, and is then decoded.

Performance metrics include bit-error rate curves for the various modulation and coding schemes (MCS) outlined in the specification, and bit rate.