Implementation of OFDM-based Superposition Coding
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Introduction

Superposition Coding ---- Superposition coding is one of the multi-user communication techniques to meet the ever-growing demand for wireless services. Two user's information is superimposed together and transmitted simultaneously. Theoretical results show the advantage in terms of throughput. However, such performance gain is under the strict assumptions of perfect synchronization and error-free feedback, which may not be practical in some cases. Hence we need to evaluate the performance experimentally.

Software-Defined Radio (SDR) ---- SDR aims to solve the two most challenging issues facing wireless communications today: compatibility and spectrum usage. SDR can be easily modified and it does not require sophisticated hardware programming knowledge.

PHY Layer Implementation

PHY layer implementation is based on GNU Radio architecture, which is a signal processing package for SDR system. Universal Software Defined Radio (USRP) is a hardware device designed for GNU Radio. It is used as the RF front-end in PHY layer.

We choose OFDM modulation in our design. Both transmitter and receiver are written in C++ and interfaced with Python with components shown on right and following parameters:

- 16 tones per OFDM symbol;
- Bandwidth = 1MHz;
- Far user power = 0.8 * total power;
- Constellation type: BPSK, QPSK;
- IEEE 802.11a Standard convolutional code;
- Coding Rate : ½.

Future Work

- Upper layer design (Link layer & MAC layer), including developing superposition MAC protocol:
  As we know, Internet packets with source IP address and destination IP address in the IP header. However, it probably needs two destination IP addresses due to multicasting. Hence, IP header need to be redesigned in MAC layer. Power allocation between two users also need to be considered and included in IP header for building constellation mapping at transmitter and receiver.

Reference


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