Extended Range UltraWideBand (UWB) Wireless Communication Systems

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Introduction

Ultra Wide Band (UWB) is a new wireless communication technology for transmitting digital data over a wide frequency spectrum with very low power. The features of the UWB are as following:

- Frequency spectrum is between 3.1– 10.6 GHz
- High data rate of 500Mbps within 10m possible
- Power spectral density less than -41.3dbm/Mhz
- Unlicensed operation

The aim of the project is to design and simulate a long range UWB system that can operation at large distances 100-1000m but at lowered data rates. Key issues are

1) Power efficient modulation for UWB based on multi-dimensional techniques so range can be increased

2) Channel estimation in fast fading channels. Because the bit rate will be lowered we expect the channel to vary significantly over one bit period

3) Look into methods for performing synchronization for these long range systems.
The objective of the project is to provide a clear method of the operation of long range UWB radio technology with the proposed systems. We use Matlab computer program to do simulation so that we can show the performance of UWB with various modulations and do the analysis and discussion. Finally, we can contribute to UWB technology through our simulation results.

Our long range UWB system requires a transmitter and also a receiver system. Because we concentrate on 2 dimensional modulations with two orthogonal pulses and this can be seen from the block diagrams. In the receiver structure we can also see the key channel estimation and synchronization systems.
BPSK is selected as it can be combined with an effective channel estimation technique that operates well in fast-fading conditions. In addition using selective RAKE is better than the all RAKE and partial RAKE because it offers a good balance of performance and complexity at the receiver. Coding techniques can also be explored improve the performance of UWB in long distance communication.