Abstract

The thesis presents analytical and simulation studies of various problems related to transmission and reception of Multiband OFDM (MBOFDM) signals, characterized by transmission bandwidth of 528 MHz, symbol to symbol hopping and zero pad following every symbol instead of the more common cyclic prefix. Specifically the following issues have been addressed:

1. *Design a baseband receiver for ECMA368 standard compliant MBOFDM signals that can efficiently handle the large delay spread encountered for a signal of bandwidth 528 MHz. The baseband receiver proposed by us has been demonstrated via realistic simulation studies to provide a packet error rate of less than or equal to 8% at a distance of 4.8 m for the CM1/2 Ultrawideband Channel models and 4 m for the CM3/4 models. This is a significant improvement over existing literature.*
2. *Explore mechanisms to improve robustness of the above receiver to IQ mismatch. A new carrier frequency offset estimation metric independent of IQ Gain Imbalance / Quadrature skew has been proposed. Channel estimation and equalization schemes have also been developed that can work efficiently in absence of any IQ mismatch compensation. Finally the problem of frequency selective IQ Mismatch is formulated as a frequency diversity phenomenon and demonstrated how it can be estimated and compensated for online as part of frequency domain equalization of the MBOFDM symbols.*
3. *Explore mechanisms to enhance the data rate and transmission efficiency of a MBOFDM transmitter beyond what is currently available in ECMA368. New transmission mechanisms have been proposed that can double the physical layer throughput to 960 Mbps, without any significant degradation in the packet error rate performance or reduction in multiuser capability. Methods to reduce the zero pad length after every MBOFDM symbol have also been proposed, increasing overall transmission efficiency.*
4. *Develop an analytical framework for the problem of detection of narrow band interferers with the wideband MBOFDM receiver. The proposed analytical framework can be used for detection of single as well as multiple independent interferers within the band of interest. The model also allows us to incorporate any apriori information available about the position of the interferers.*

Key Words: Ultrawideband, Multiband OFDM, ECMA368, Baseband Receiver, throughput enhancement, IQ Mismatch.