ABSTRACT

Ultra Wideband (UWB) communication is one of the most important technology for high data rate transfer in short range communication. Orthogonal Frequency Division Multiplexing (OFDM) has recently been applied widely in wireless communication systems due to its high data rate transmission capability with high bandwidth efficiency and robustness to multipath delay. The UWB OFDM named Multiband OFDM (MB OFDM), is preferred for Wireless Personal Area Networks (WPAN) communication technique in the physical layer with IEEE 802.15.3a standard.

UWB channel influences new effects in the receiver as compared with narrow band wireless channels due to its large bandwidth of operation. The fading degrades the Carrier to Noise Ratio (CNR) which increases the Bit Error Rate (BER). The channel estimation is one of the important issues in wireless communication systems to have better performance. The IEEE 802.15.3a working group has proposed the UWB short range channel models by modifying the wide band Saleh-Valenzula (S-V) channel model. This thesis proposes a modified version of S-V channel model for UWB OFDM system and the performance has been analyzed. In the proposed model, the parameters in the Poisson process has been modified for ray arrival rate and
found that the developed model is optimum for modeling ray arrival rate as compared to S-V model.

The performance of the OFDM channel model using Least Square (LS) and Minimum Mean Square Error (MMSE) channel estimation methods have been analyzed in the present work. Since these channel estimation techniques are pilot based, the throughput of the system is found to be low by sending pilots at regular intervals. Also the performance of the system has been analyzed for different modulation techniques for various pilot density patterns. This has further motivated to develop the blind channel estimation techniques. The channel parameters are estimated using RLS method from the correlation matrix of the received signal vector.

The pilot based Kalman filter algorithm is proposed for better channel estimation and the Kalman gain is calculated with the knowledge of posterior and prior channel estimation. These investigations state that the Kalman algorithm provides better estimates than RLS algorithm in terms of BER and Mean Square Error (MSE).