Preface

The demand for broadband wireless communication system is growing with an extremely rapid pace. These systems are required to be operating in an environment which is characterized by high carrier frequency, data transmission rate and mobility; altogether such an environment can be modeled by a frequency selective fast time varying fading channel. However, the symbol duration reduces and bandwidth increases with the increase of the data rate, and dispersive fading of the wireless channels will cause more attenuation and severe inter-symbol interference (ISI) for these broadband signals. The effect of dispersive fading is less in narrow band (large symbol duration) signal. But for multimedia communication (provided by 3G services), broadband signals are required. Also the number of users is increasing day by day, hence CDMA or WCDMA is a must for these services.

Therefore, to reduce the effect of multipath fading channel and to accommodate as much as number of users, the parallel transmission with multi-carrier has been evolved. Two such multi-carrier systems which are adopted by many wireless standards are Multi-Carrier Code Division Multiple Access (MC-CDMA) and Orthogonal Frequency Division Multiplexing (OFDM). OFDM signals are more robust to frequency selective fading and easy to generate in comparison to MC-CDMA. In OFDM, the entire channel is divided into many narrow-band sub-channels, which are transmitted in parallel to maintain high-data-rate transmission and, at the same time, to increase the symbol duration to combat ISI. The main advantages of OFDM are bandwidth efficiency, robustness to frequency selective fading channel, and easy equalization at receiver.

In spite of several advantages, the OFDM system has some major problems those must be resolved. The first issue is high peak-to-average power ratio (PAPR) of OFDM signal. This high PAPR reduces the efficiency of high power amplifier and degrades the bit error rate (BER). Second problem is to find exact timing of OFDM symbol at the receiver. This is called timing offset estimation. If one FFT window takes samples from two different OFDM symbol, it will generate ICI and ISI at the output. Third major issue is carrier frequency offset (CFO) estimation at the receiver. The CFO must be estimated and corrected otherwise orthogonality will be lost and BER increases. The overall impact of these stated problems is the generation of ICI. Therefore, suitable methods are required to mitigate ICI at the receiver, by improving these three aspects of OFDM.

In this study, an effort has been made to improve the overall performance of OFDM system by combating the above mentioned problems of OFDM.