

Analysis of Peak-To-Average Power Ratio in OFCDM System

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Abstract - The era of high-speed data transmission in communications is approaching day by day. OFCDM is very promising technique for 4G standard like LTE (Long Term Evolution) and WIMAX (Worldwide Interoperability for Microwave Access) also has some issues like frequency-offset and PAPR (peak-to-average power ratio). High peak-to-average power ratio (PAPR) of the transmitted signal originates from the superposition of many independent subcarriers. Due to PAPR reduction ICI and ISI both reduces drastically. In this paper, it is shown that PAPR is less in OFCDM System as compare to OFDM System. Various reduction techniques is used for reduction such as DCT (Discrete Cosine Transform), SLM (Selective Mapping), Modified SLM etc. So by using these techniques we can further reduce PAPR ratio.

Key Words: DCT, Modified SLM, PAPR and SLM.

1. INTRODUCTION

Future 4G systems require transmission of richer multimedia services which certainly implies an increase in data rate. The 4G systems will support multimedia services like high-speed Internet access and broadcast services from information sites. OFCDM is a multicarrier transmission scheme where user data is spread in time and frequency direction before it is transmitted on multiple sub-carriers using OFDM transmission. Orthogonal frequency and code division multiplexing is a very attractive technique for high speed data transmission in mobile communications due to various advantages such as high spectral efficiency, robustness to channel fading, immunity to impulse interference, and capability of handling very strong multi-path fading and frequency selective fading without having to provide powerful channel equalization.

1.1 PAPR (PEAK-TO-AVERAGE POWER RATIO)

The PAPR is the relation between the maximum power of a sample in a given OFCDM broadcast symbol divided by the average power of that OFCDM symbol. PAPR occurs in a multicarrier system when the different sub-carriers are out of phase with each other. The input symbol stream of the IFFT should have a uniform power spectrum, but the output of the IFFT may result in a non uniform or pointed power spectrum. Most of transmission energy would be allocated for a few instead of the majority subcarriers. This problem can be quantified as the PAPR measure. It causes lots of problems in the OFCDM system at the transmitting end. Also transistor work as an amplifier in linear mode but when peak deviation about average is significantly high and the signal level moves into non linear region, an amplifier output gets distorted and we will not get faithful amplification. Hence high value of PAPR in OFCDM system results in, amplifier goes in non-linear region. Thus OFCDM losses its orthogonality which leads to Inter Carrier Interference(ICI) in the system and inter symbol interference(ISI) that is more severe than due to pre symbol interference of OFCDM. PAPR is problematic because there are no such amplifiers or digital to analog converters (DAC / ADC) which have wide range of linearity. so due to limitation of linearity of amplifiers and converters, one way to combat PAPR is power back - off, in which if power exceeds to linearity range of amplifiers /converters then it back - off by limiter circuit & maintain it in linear range of the device . Another way to reduce PAPR is to increase the linearity range of amplifiers / converters but it is very rigorous to design & very costly too.

2. CDMA SYSTEM

Code Division Multiple Access (CDMA) as a modulation technique is proposed in most of the 3rd generation mobile phone system. It is a technique in which transmission of information takes place simultaneously over the same available channel bandwidth. CDMA

systems make use of spread spectrum (SS) technique for transmission of information by employing spreading codes. Each user is assigned with a unique spreading code which acts as a signature code for that individual user. The CDMA system experiences Multiple Access Interference (MAI) and Inter Symbol Interference (ISI) because of the non-orthogonality of the spreading codes. Both the MAI and ISI are the functions of auto-correlation and cross-correlation values of the spreading code respectively.

The performance of CDMA based wireless systems is largely based on the characteristics of user specific spreading codes. These codes spread the original information signal to a large bandwidth and also provide unique identity to the various channels originating from base station as well as mobile station. At the receiver side, the original information signal is recovered by correlating the received signal with the synchronized replica of the spreading code.

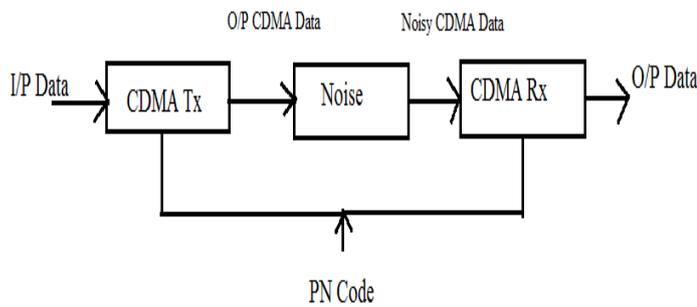


Fig 1: CDMA System

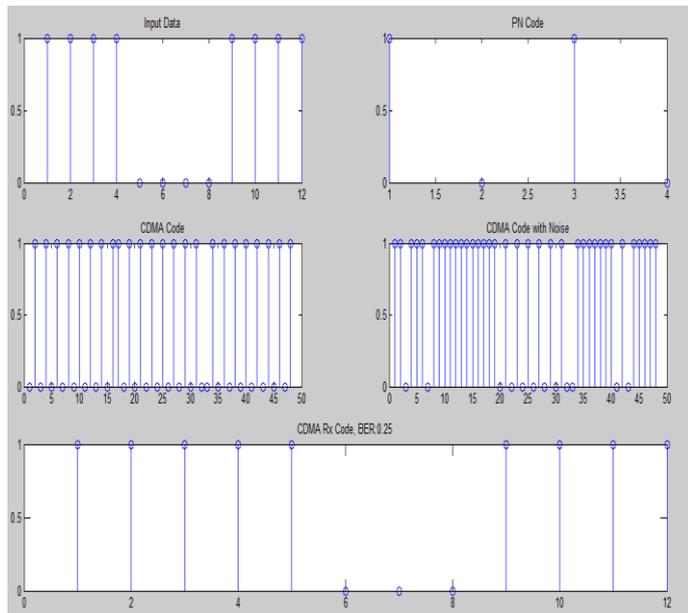


Fig 2: Creation of CDMA System

3. OFDM SYSTEM

Orthogonal Frequency Division Multiplexing (OFDM) is a multi-carrier modulation technique for high data rate wireless communication because of its robustness to frequency selective fading, high spectral efficiency and less computational complexity. It has already been adopted as the standard transmission technique in the wireless LAN systems and the terrestrial digital broadcasting system. It is also being considered as one of the candidate transmission techniques for the next generation of mobile communications systems

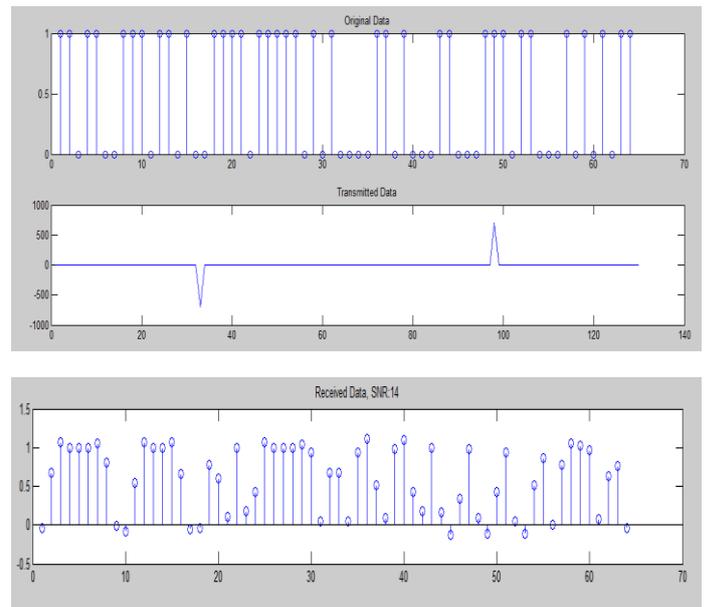


FIG 3: CREATION OF OFDM SYSTEM.

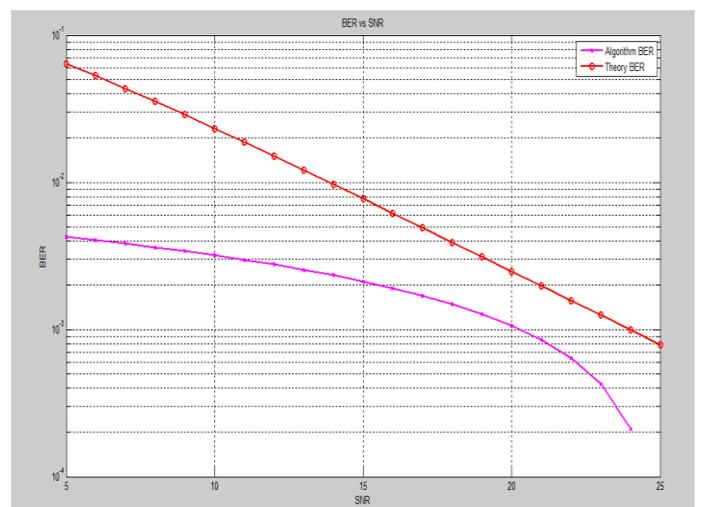


FIG 4: BER Vs SNR GRAPH

3. OFCDM SYSTEM

The broadband orthogonal frequency- and code-division multiplexing system with two-dimensional spreading (time and frequency domain spreading) is becoming a very promising technique for high-speed wireless communications due to its advantages over OFDM.

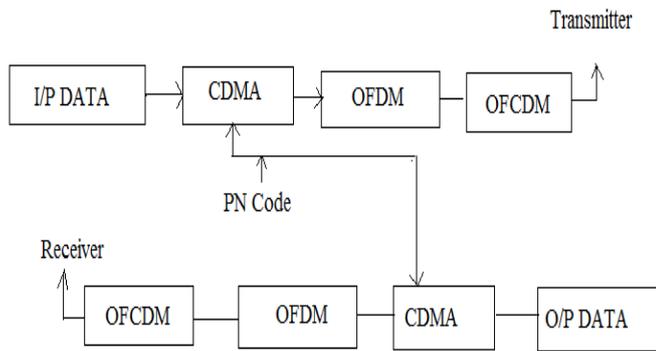


FIG 5: DEVELOPMENT OF OFCDM SYSTEM

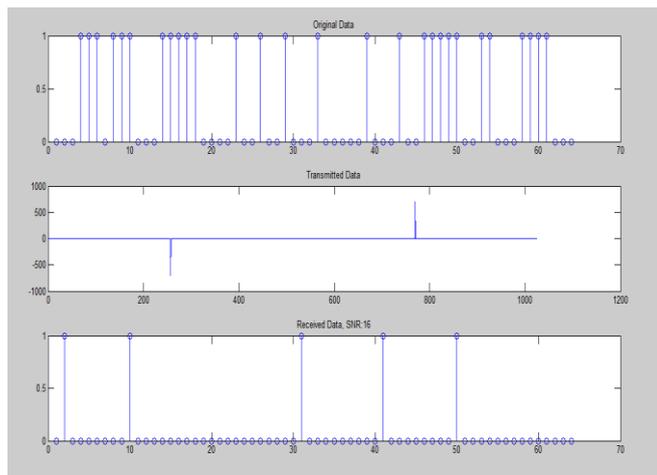


FIG 6: CREATION OF OFCDM SYSTEM

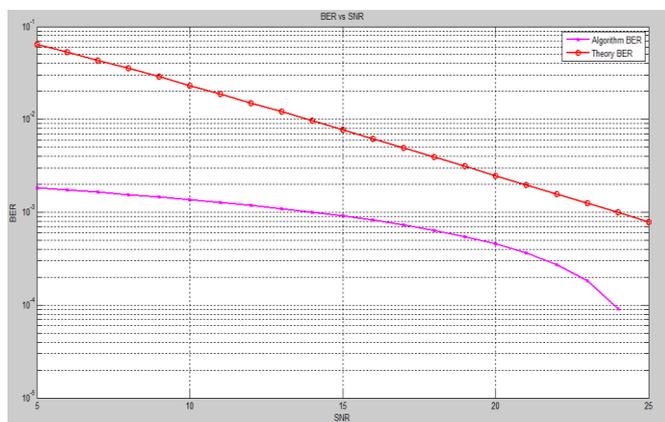


FIG 7: BER Vs SNR GRAPH

4. CONCLUSION

Peak to Average power reduction ratio and BER Ratio in OFCDM System is less than OFDM System. Hence OFCDM System is better than OFDM System. Less PAPR result in better system performance. CDMA System, OFDM System and OFCDM System is successfully constructed and simulated.

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