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Performance Analysis of Modulation Technique in MC CDMA

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Abstract

The (MC-CDMA) is an advanced broadband wireless transmission technology combining (OFDM) and spread spectrum techniques. The MC-CDMA family can have several competitive properties, e.g., robustness against the frequency selective fading channel, flexibility in system design, low detection complexity, and lower peak-to-average power ratio. MCCDMA support multi-class traffic with different bit error rate .The study of BER performance ,SNR performance, Standard Deviation Of Phase Error performance , Peak Power Compression performance , Mutipath performance over different modulation techniques are obtained. The peak power compression ratio is the ratio of the peak power of the signal before clipping to the peak power of the clipped signal. In this peak power compression and standard deviation of phase error is computed. When the simulation take place the clipping signal effects the output power amplifier being over driven, therefore peak to RMS power of the signal is reduced and it allows the signal with a more power to transmitted Also Simulation results shows that the BER performance is sensitive to SNR, Peak Power Compression, type of modulation technique and number of users. we can say that the standard deviation of phase error for 2 bit and 1 bit is almost linear , It means peak power clipping ratio follows the linear effect to the standard deviation of phase error. As delay samples is increased BER is reduced, as BER is reduced peak power compression ratio is increased and peak to RMS power of the signal is reduced. It show that minimum BER obtained with the BPSK modulation technique.

Keywords: MC-CDMA, OFDM, DS-CDMA , BER, CDMA, MAI, SNR.

1. Introduction

Over the last eight or nine years a new commercial marketplace has been developed called spread spectrum. Spread spectrum deal in security of digital signals that is now being exploited for industrial and commercial purposes, therefore spread-spectrum signals are those signals which are distributed over a wide range of frequencies and then collected onto their original frequency at the receiver. For spread spectrum signal, given below criteria should be met:

- The bandwidth of the transmitted signal is greater than the information bandwidth.
- Some other function than the information being transmitted is employed to determine the resultant transmitted bandwidth.

Spread Spectrum transmitters use similar transmit power levels to narrow band transmitters. Because Spread Spectrum transmits the signals at a lower spectral power density, in Watts per Hertz, than narrowband transmitters. Spread and narrow band signals can occupy the same band, with little or no interference. The above reason of Spread Spectrum give interest in today life.

The family of (MC-CDMA) is an advanced broadband wireless transmission technology combining (OFDM) [2]and spread spectrum techniques. The MC-CDMA can have several competitive properties, e.g., robustness against the frequency selective fading channel, flexibility in system design, low detection complexity, and lower peak-to-average power ratio.

MC CDMA Transmitter In this the input data stream is converted in to frequency domain by serial to parallel converter . then this signal is multiplied with the spreading chips which are having different OFDM sub carriers , resulting in MC CDMA signal as shown in fig1 To overcome the effect of inter symbol interference the signal is cyclically extended by more than the channel delay spread[5].

MC CDMA Receiver In this the OFDM Receiver is an additional combining operation to isolate the data Transmitted for the user interest, therefore by using guard interval the receiver selects the signal which is free from inter symbol interference as shown in fig 2.

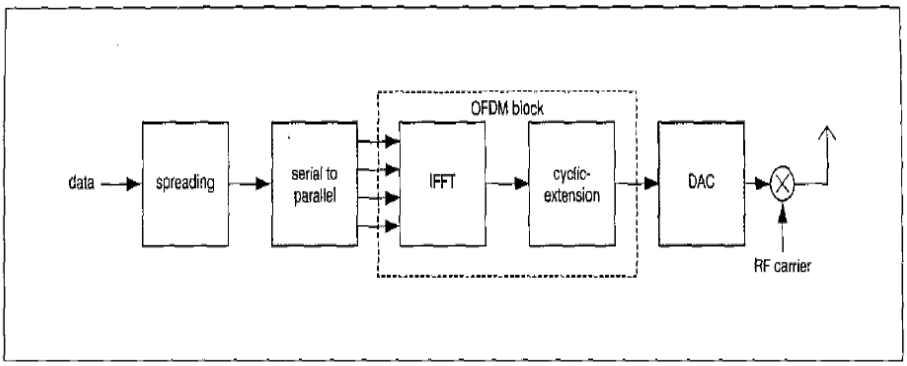


Figure 1: Transmitter of MC CDMA.

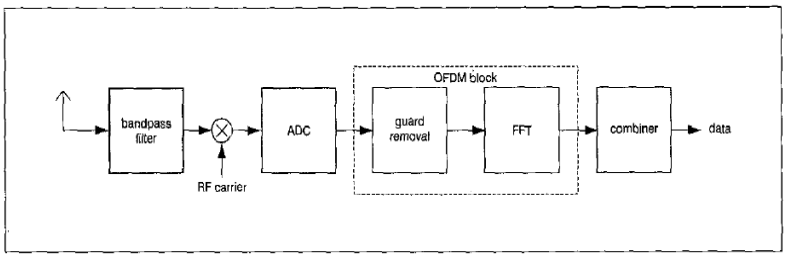


Figure 2: Receiver of MC CDMA.

2. Simulation Parameters

- **BER** BER is a performance measurement for telecommunication systems. It is defined by the ratio of the bits that have error relative to the total number of bits received in transmission. A small BER contributes that the system has a small probability of receiving bits in errors , hence the performance of the system is good. Further , A large BER says that a large probability of of receiving bits in errors , hence the performance of the system is poor.

$$BER = \frac{\text{Num Err}}{\text{Num Data}}$$

MCCDMA is capable of offering low BER for the single user and this BER can be further reduced by increasing the SNR . Reduction of noise cannot decrease the BER.

- **Peak Power Compression** The peak power compression ratio is the ratio of the peak power of the signal before clipping to the peak power of the clipped signal . In this no noise or multipath signal is added . when the simulation take place the clipping signal effects the output power amplifier being over driven ,therefore peak to RMS power of the signal is reduced and it allows the signal with a more power to transmitted when the simulation is repeat better accuracy is achieved.
- **Standard Deviation Of Phase Error** Standard Deviation Of Phase Error is the difference between the receiving error and transmitting error This contains any noise or abortions' due to channel . It is used for the generating the histogram of the phase error. It can be adjusted so that the phase is centered around the phase locations of the data. We have different phase for all the three techniques
  - BPSK -180 to 180 degree
  - QPSK -45 to 315 degree

Standard Deviation Of Phase Error = Diff Ph Rx - Diff Ph Tx

Where Diff Ph Tx : Actual phase difference between each transmitted symbol .

Diff Ph Rx : Actual phase difference between each received symbol .

- **Mutipath** Multipath effects are due to the reflection and diffraction of signal due to near by objects such as building or vents . They introduce significant error in code and carrier measurements .
- **SNR** SNR is the ratio of RMS power of original signal to the RMS power of noise to be added .

3. Result Discussion

The peak power compression ratio is the ratio of the peak power of the signal before clipping to the peak power of the clipped signal . in this no noise or multipath signal is added . when the simulation take place the clipping signal effects the output power amplifier being over driven ,therefore peak to RMS power of the signal is reduced and it allows the signal with a more power to transmitted . when the simulation is repeat better accuracy is achieved.

BER Vs Peak Power Compression Due to Clipping

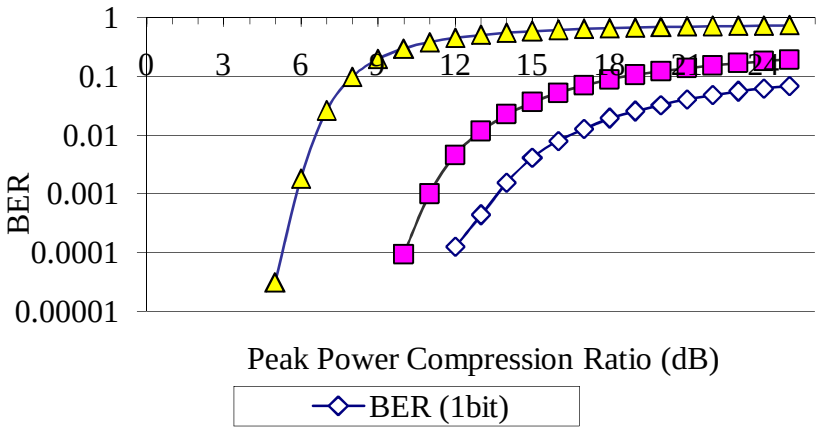


Figure 3: Graph between BER Vs Peak Power Compression Due To Clipping.

Standard Deviation of Phase Error vs Peak Power Compression Due to Clipping

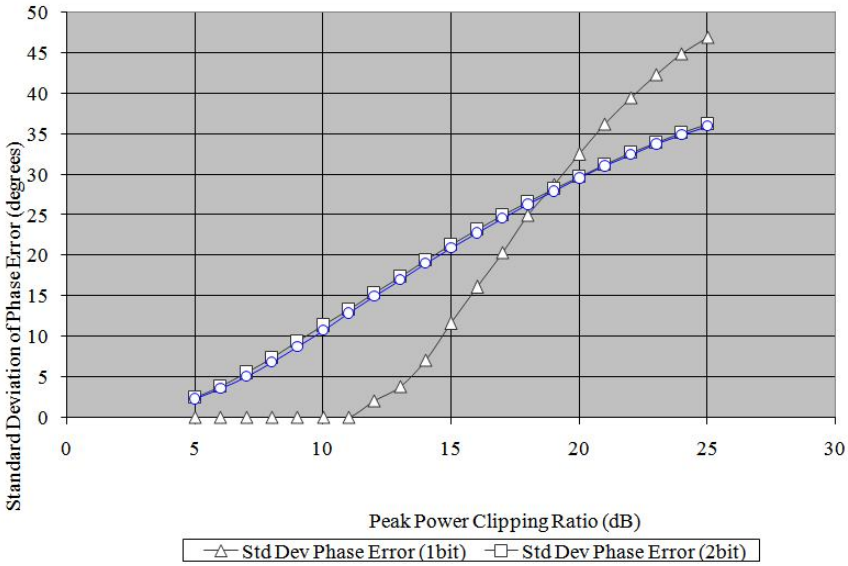


Figure 4: Graph between Standard Deviation of Phase Error Vs Peak Power Compression Due to Clipping.

In figure 5 Simulation results are shown between the BER and SNR . SNR is varied from 0 to 25 and BER is shown along y axis.. In all the cases BER is decreases as SNR increases . BER for 1 bit is reduced to 0.1 to .0001 as SNR increases from 0 to9. BER for 2 bit is reduced to 0.5 to .0001 as SNR increases from 0 to14. BER for 4 bit is reduced to 1 to .05 as SNR increases from 0 to25 . Hence we conclude that BPSK BER is better than other.

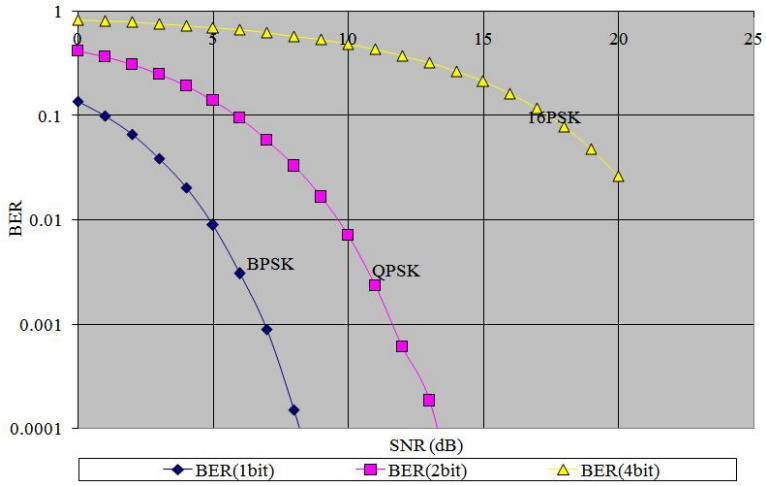
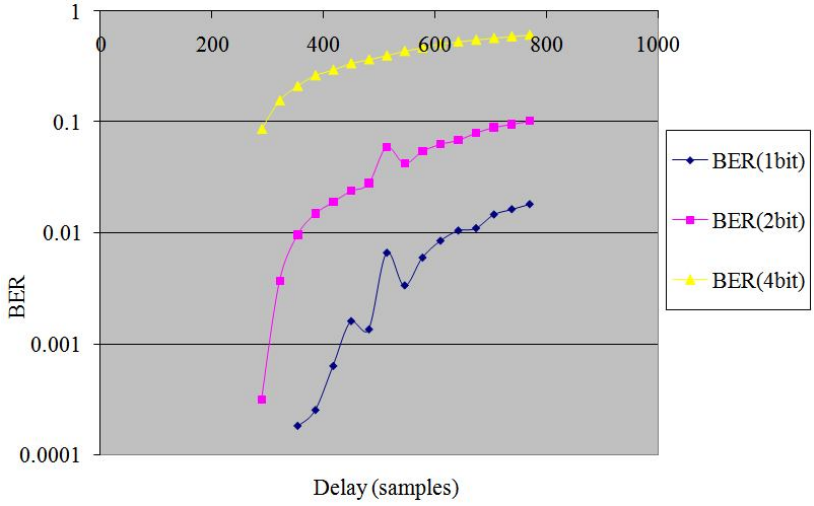


Figure 5: Graph between BER VS SNR.

BER VS MULTIPATH The multipath signal is consists of a single reflection . It simulates the effect of single reflection multipath signal which is 3db weaker then the direct signal



4. Conclusion

We can say that the standard deviation of phase error for 2 bit and 1 bit is almost linear, It means peak power clipping ratio follows the linear effect to the standard deviation of phase error. As delay samples is increased BER is reduced, as BER is reduced peak power compression ratio is increased and peak to RMS power of the signal is reduced. BER is decreases as SNR increases It show that minimum BER obtained with the BPSK modulation technique**.**

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