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Research Article

Design of Transmitter and Receiver to Reduce ISI in Multi-Carrier CDMA System

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Abstract: In this paper we have consider a MC-CDMA where Inter-symbol interference is one of the biggest problem when the system is subjected in Awgn and Rayleigh Channel. Here we have considered the efficient Transmitter and Receiver to reduce the inter-symbol Interference without considering the use of equalizer. When the number of users gets large, each user tends to choose more than one carrier, which do not suffer deep fading, while interference suppression is performed across the chosen carriers by the corresponding receiver. Results have shown that with efficient equalizer the inter-symbol interference can be reduced.
Keywords: CDMA, AWGN, ISI, Rayleigh

INTRODUCTION

In a CDMA communication system, a unique a code is allotted to each user. The original signal is spreaded at transmitter and de-spreaded at the receiver. [1]. Spread spectrum techniques use a transmission bandwidth that is several orders of magnitude greater than the minimum required signal bandwidth. These systems were designed using spread spectrum because of its security and resistance to jamming. The technologies like CDMA has increased the standards for wireless communication system in terms of high data speed, mobility both for short range and long range communication. With the increasing uptake of so-called smart phones in recent times, it has been repeatedly identified that state-of-the-art cellular networks are fast being rendered incapable of consistently delivering the excessively high throughputs demanded by the Internet-savvy users of such devices [3]. If we're all to use our mobile devices to work and play anywhere, we want to access to streaming services and all our own "stuff", instantly, on devices as small as a Smartphone or as large as the screen in an auditorium – properly formatted for the size of the screen, of course. We're already socially networked, 24 hours per day, 7 days a week [4].

REVIEW OF WORK

CDMA is the platform on which 2G and 3G advanced services are built. It is the fastest growing wireless technology and it will continue to grow at a faster pace than any other technology [5]. CDMA can effectively reject narrow band interference. Since narrow band interference affects only a small portion of the spread spectrum signal, it can easily be removed through notch filtering without much loss of information. CDMA devices use a rake receiver, which exploits multipath delay components to improve the performance of the system In a CDMA system; the same frequency can be used in every cell, because channelization is done using the pseudo-random codes. Reusing the same frequency in every cell eliminates the need for frequency planning in a CDMA system; CDMA systems use the soft hand off, which is undetectable and provides a more reliable and higher quality signal [6]. Mr. Anwarul analyze the performance of single user and multiple user and he suggest that BER performance is to ensure ISI, resilient transmission with guarantee channel identification ability to and symbol recovery at the receiver in frequency selective multipath environment [7]. Mr. sarojini e.all has implemented a various modules of DS-CDMA Communication System and his research also shows that DS-CDMA may provide efficient area utilization on FPGA [8] .Mr. B. Vinod Kumar work shows that MC-CDMA overtakes OFDM and performance is also enhanced based on BER performance comparison of CDMA and Wi-Max [9]. In Mr. Vaibhav et.all work a CDMA Transmitter and Receiver is implemented where data was transmitted and received . He concludes that number of bits using same topology is used than it is possible to reach the standard rate specified for CDMA [10]. Mr. Yee proposed a novel digital modulation technique called MC-CDMA where each data symbol is transmitted at multiple narrow band subcarrier and each subcarrier is encoded with phase offset of 0 and 180 degree based on spreading code[11]. Mr. Linnartz et.all analyze the performance of Doppler spread and computes its effect on the BER for MC-CDMA transmission and here he focused on linear receiver MMSE (minimum mean square Error) criterion[12]. Mr. sourour proposed a new MCDS-CDMA where transmission Bandwidth is more efficiently utilized and the effect of frequency selective multipath interference can be mitigated and frequency time/diversity is achieved [13].Mr. ashwani et.all study suggest thay QPSK technique has better performance than other technique like BPSK, FSK etc [14]. Mr. H Geiger proposed a grating based DS-Code generation using a binary sample Bragg grating for encoding and decoding with time grating for CDMA [15].Mr. Sennur Ulukus proposed an alternating minimization based iterative algorithm that update the transmitter and corresponding uses of user [16]. Mr. Buljore work shows that for BPSK modulation a single sensor LS detector can provide around the gain of 2 to 4 db as compared to classical matched filter [17]. Miss laxmi has studied the performance of DS-CDMA and BER is evaluated for chaotic DS-CDMA system that use both coherent and non-coherent CSK deduction technique and result has shown that Coherent Correlator for CDMA have better performance than non-coherent Receiver [18].In Mr. Purneshwari work, In AWGN environment, when gold sequence is used, for the one user the practical BER value is nearly approaches to the theoretical value of BER. In RAYLEIGH environment, when gold sequence is used, at the initial SNR value the practical and theoretical value of BER are same, as the SNR increases the practical BER value increases as compared to the theoretical value of BER. When the gold sequence is considered in AWGN environment, with single user, initially the practical BER value is same as the theoretical value, and with increasing SNR the practical value increases as compared to the theoretical value of BER. When either sequence is used in the system for AWGN and Rayleigh environment, initially the BER theoretical and practical value are nearly same. But, as the SNR value increases in case of the AWGN, the practical BER value increases rapidly as compared to the theoretical value, and in case of Rayleigh the practical value approaches to the theoretical value [19].

Inter-symbol interference (ISI) is a form of distortion of a signal in which one symbol interferes with subsequent symbols. This is an unwanted phenomenon as the previous symbols have similar effect as noise, thus making the communication less reliable. ISI is usually caused by multipath propagation or the inherent non-linear frequency response of a channel causing successive symbols to "blur" together. This study done by H. Kobayashi et.al deals with the problem of equalizing channels containing strong intersymbol interference. Typical of such channels are those of digital magnetic recording systems and data communication systems with partial-response signaling. First they discuss reasons that a conventional receiver with a linear equalizer cannot efficiently compensate for distortion in such channels. Then they present a new receiver configuration in which the equalizer and quantizer are embedded in an inverse filter circuit that eliminates major intersymbol interference components. The configuration allows us to use a simple iteration algorithm to adaptively adjust the equalizer [20]. *Güner Arslan reduced ISI by using* Zero-forcing equalizer, Minimum mean squared error (MMSE) equalizer, Decision-feedback equalizer [21]. Chen et.all proposed several novel iterative soft decision feedback equalization algorithms for detection of binary-valued two-dimensional images corrupted by 2D intersymbol interference (ISI) and additive white Gaussian noise (AWGN). These algorithms exchange weighted soft extrinsic information between maximum-a-posteriori (MAP) detectors employing different row-column or zigzag scan directions [22]. Partial response maximum likelihood" (PRML) can also reduced inter symbol interference [23].

PROPOSED METHODOLOGY

As shown in Fig.1. The both transmitted signal are spread, added and modulated over a AWGN and Rayleigh Channel and again at the Receiver the signal is d-spread and original signal is extracted from modulated wave.

Fig.2. indicates the scatter plot of addition of transmitted signal before the channel. As It is seen that addition of Rayleigh and Awgn channel become a worst environment for mobile communication and there is a increase of multi-path interference which results into Inter Symbol Interference.

As compared to Fig.2.,In received signal we have tried to reduced the inter-symbol Interference which can be clearly seen. The ISI is reduced due to used of efficient block at received side.

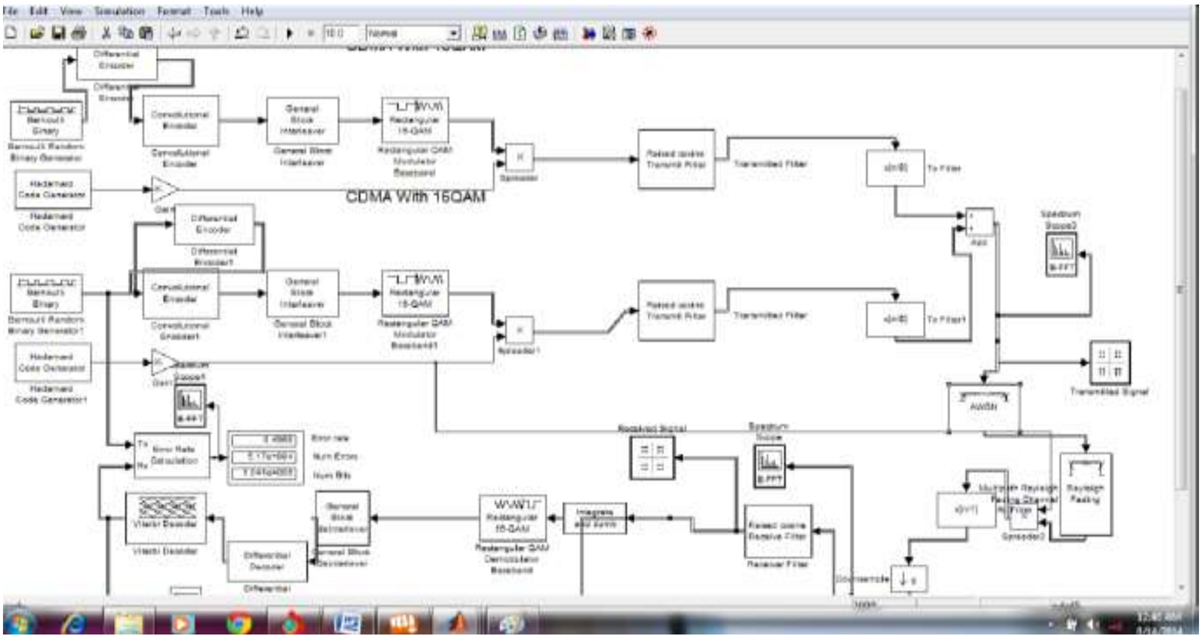

Fig-1: Simulation Model MC-CDMA for QAM-16 for Awgn and Rayleigh Channel.

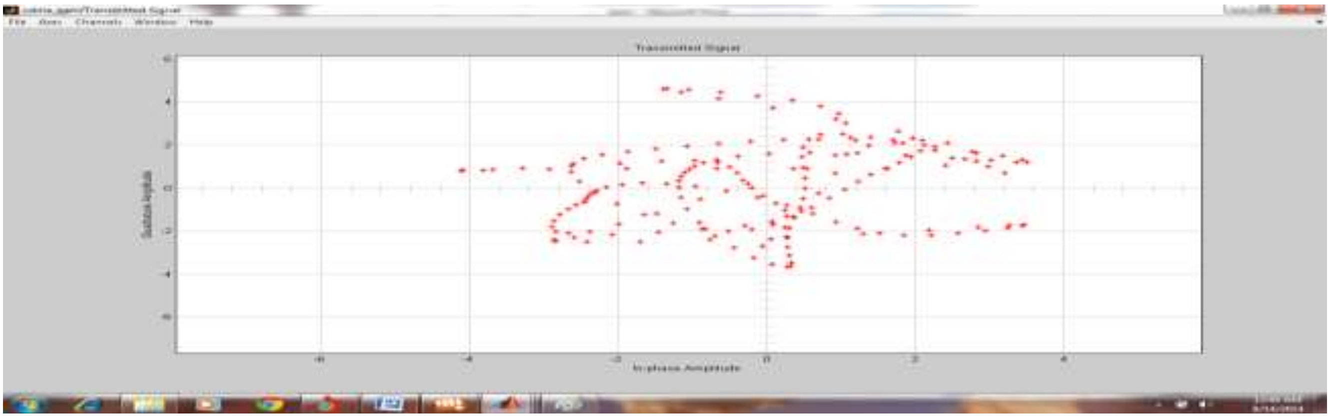

Fig-2: Scatter Plot Of Transmitted Signal.

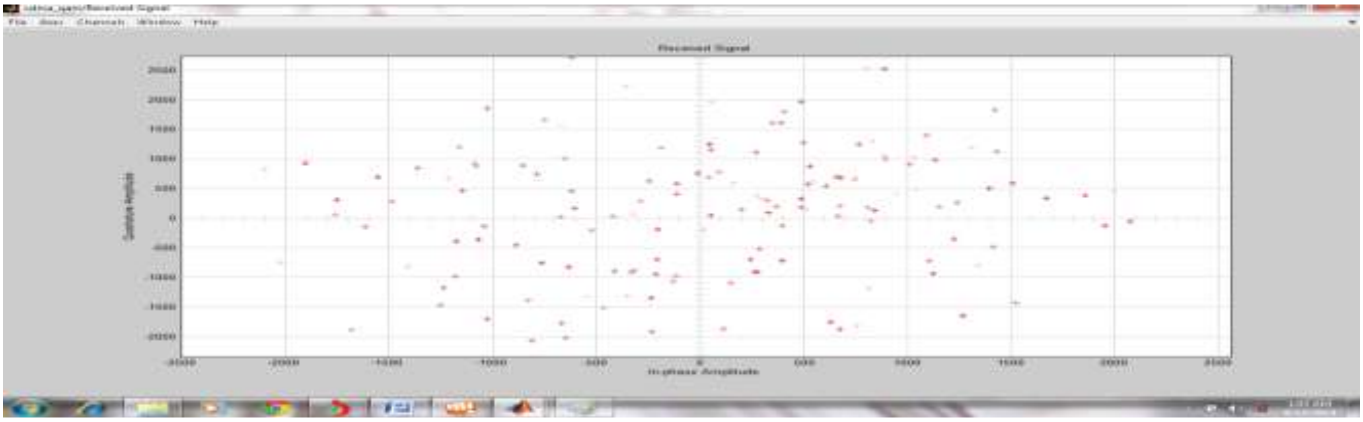

Fig-3: Scatter plot of Received signal.

CONCLUSION

The higher data rate can be achieved in mobile communication by using a higher order modulation technique with the cost of Inter-Symbol Interference. The Equalizer can be used to overcome the disadvantage of Inter-symbol Interference but the hardware implementation of Transmitter and Receiver with equalizer will become so complicated. The present work shows the reduction of ISI with optimized Transmitter and Receiver When the system is subjected to a Awgn and Rayleigh Channel.

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