Subject Activity Report on

"Discuss OFDM PAPR reduction technique"

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Discuss OFDM PAPR reduction technique :-

INTRODUCTION

Since the very genesis of man, communication has been one of the main aspects in human life .Previously various methods like sign languages were implemented for this purpose. As various civilizations started coming into existence, many innovative ideas came to the minds of the people – special birds and human messengers were employed to meet these challenges. As ages rolled by, post system developed and transportation vehicles like trains and ships were used to maintain link between people miles apart. But by the turn of the nineteenth century, a great leap in communication system was observed when wireless communication was introduced. After the advent of wireless communication huge change has been observed in the lifestyle of people. Wireless communication which was initially implemented analog domain for transfer has is now-a-days mostly done in digital domain. Instead of a single carrier in the system multiple sub-carriers are implemented to make the process easier.

ELECTRONIC COMMUNICATION SYSTEM

Electronics communication system has revolutionized the face of the world. Communication with someone a mere century back was only possible by physical mode. But now that can be done just by clicking a switch on the telephone pad or by just a click of the mouse. Even live television report, live games telecast could not be possible without wireless communication. A simple communication system consists of a transmitter end which send the data and a receiver end at which the data is received. Usually there received data is not the same as the data sent. Because of the noise present in the medium the signal gets affected and distortion is observed in the signal. Various modulation techniques are under taken in order to ensure that the signal sent is safely available at the receiver end

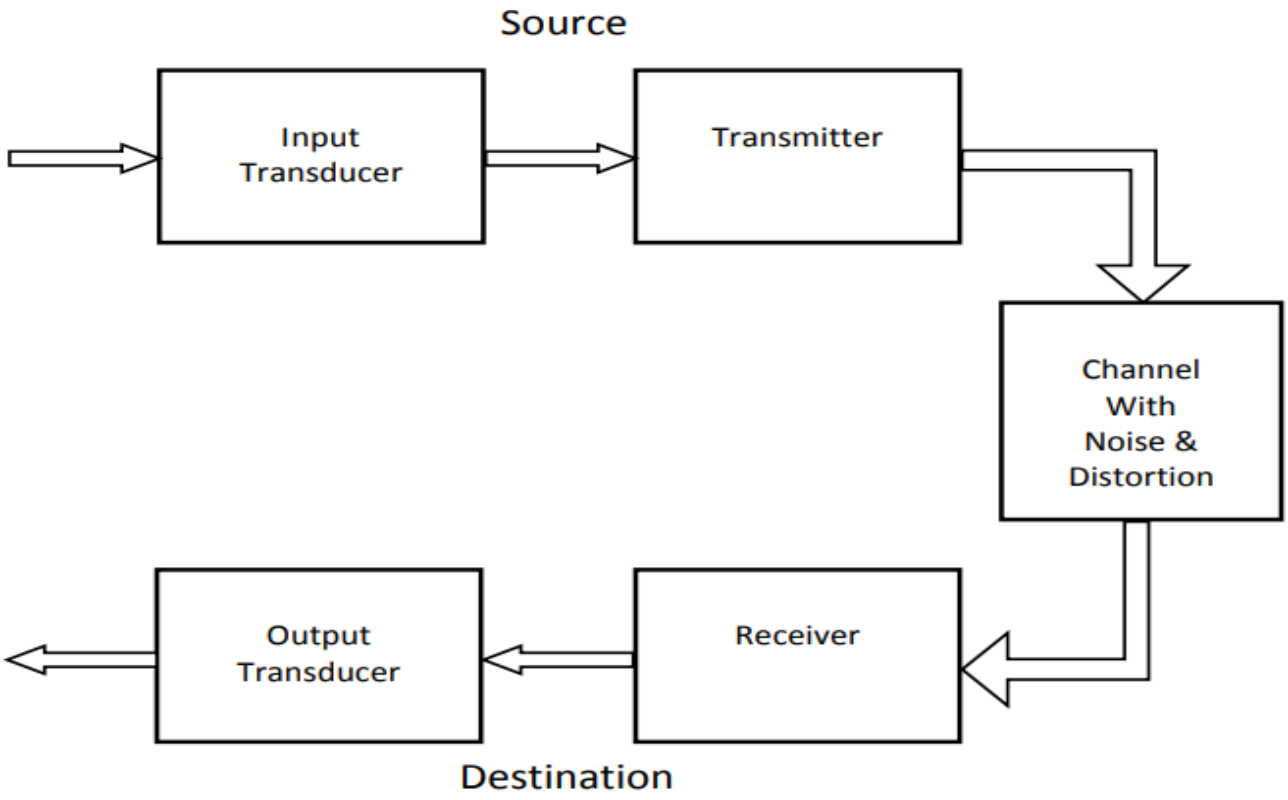

Fig 1.1 A block diagram representation of electronic communication system

CONVOLUTION

Convolution is the process by which the output of a system can be determined. One of the signals is time reversed, shifted, multiplied with another signal and finally integrated to generate the output signal in this process. Mathematically, it is represented as

$$w(t) = v(t) \otimes h(t) = \int_{-\infty}^{+\infty} v(\tau)h(t-\tau)d\tau$$

Linear time invariant systems obey the above rules.

MULTIPATH CHANNELS

The transmitted signal faces various obstacles and surfaces of reflection, as a result of which the received signals from the same source reach at different times. This gives rise to the formation of „echoes" which affect the other incoming signals. Dielectric constants, permeability, conductivity and thickness are the main factors affecting the system. Multipath channel propagation is devised in such a manner that there will be a minimized effect of the echoes in the system in an indoor environment. Measures are needed to be taken in order to minimize echo in order to avoid ISI.

Cyclic Prefix

The Cyclic Prefix or Guard Interval is a periodic extension of the last part of an OFDM symbol that is added to the front of the symbol in the transmitter, and is removed at the receiver before demodulation [1]. The cyclic prefix has to two important benefits

– The cyclic prefix acts as a guard interval. It eliminates the inter – symbol interference from the previous symbol. It acts as a repetition of the end of the symbol thus allowing the linear convolution of a frequency – selective multipath channel to be modeled as circular 19 convolution which in turn maybe transformed to the frequency domain using a discrete fourier transform. This approach allows for simple frequency – domain processing such as channel estimation and equalization.

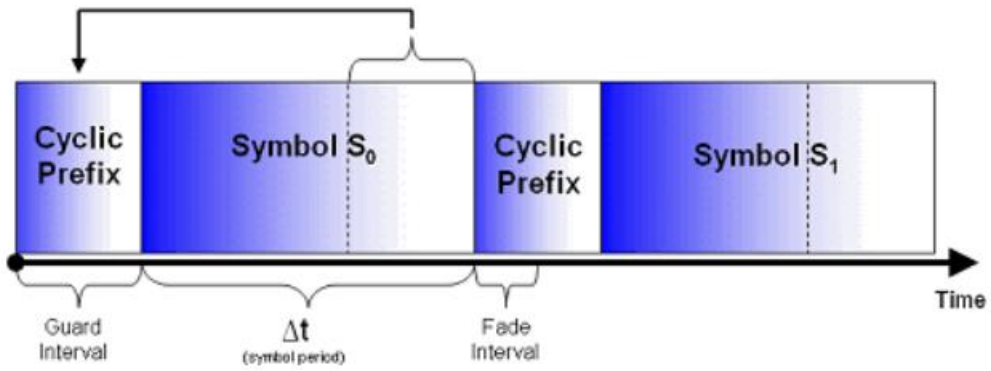

Fig. 3.2 Cyclic Prefix

Inverse Discrete Fourier Transform By working with OFDM in frequency domain the modulated QPSK data symbols are fed onto the orthogonal sub-carriers. But transfer of signal over a channel is only possible in its time-domain. For which we implement IDFT which converts the OFDM signal in from frequency domain to time domain. IDFT being a linear transformation can be easily applied to the system and DFT can be applied at the receiver end to regain the original data in frequency domain at the receiver end. Since the basis of Fourier transform is orthogonal in nature we can implement to get the time domain equivalent of the OFDM signal from its frequency components. Usually, in practice instead of DFT and IDFT we implement Fast Fourier Transformation for an N-input signal system because of the lower hardware complexity of the system

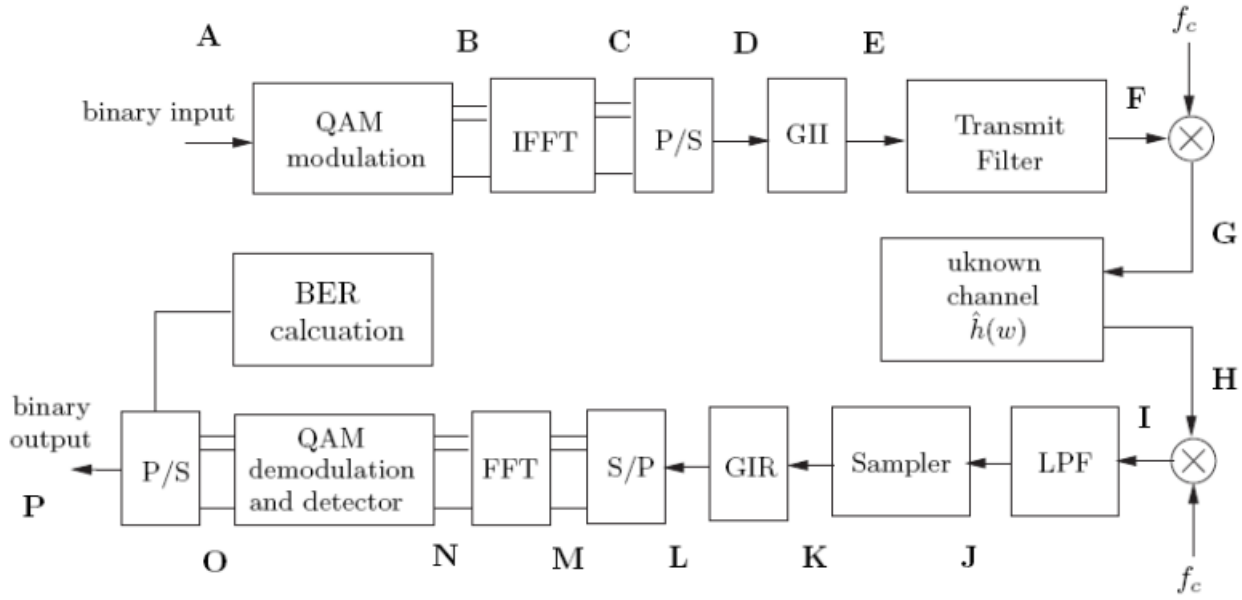

Fig. 3.3 OFDM Block Diagram

Modulation Modulation is the technique by which the signal wave is transformed in order to send it over the communication channel in order to minimize the effect of noise. This is done in order to ensure that the received data can be demodulated to give back the original data. In an OFDM system, the high data rate information is divided into small packets of data which are placed orthogonal to each other. This is achieved by modulating the data by a desirable modulation technique (QPSK). After this, IFFT is performed on the modulated signal which is further processed by passing through a parallel – to – serial converter. In order to avoid ISI we provide a cyclic prefix to the signal.

Communication Channel This is the channel through which the data is transferred. Presence of noise in this medium affects the signal and causes distortion in its data content. 21 3.4.3 Demodulation Demodulation is the technique by which the original data (or a part of it) is recovered from the modulated signal which is received at the receiver end. In this case, the received data is first made to pass through a low pass filter and the cyclic prefix is removed. FFT of the signal is done after it is made to pass through a serial – to – parallel converter. A demodulator is used, to get back the original signal. The bit error rate and the signal – to – noise ratio is calculated by taking into consideration the un – modulated signal data and the data at the receiving end.

ADVANTAGES & DISADVANTAGES OF AN OFDM SYSTEM

Advantages Due to increase in symbol duration, there is a reduction in delay spread. Addition of guard band almost removes the ISI and ICI in the system.

Conversion of the channel into many narrowly spaced orthogonal sub – carriers render it immune to frequency selective fading.

As it is evident from the spectral pattern of an OFDM system, orthogonally placing the sub – carriers lead to high spectral efficiency.

Can be efficiently implemented using IFFT. Disadvantages These systems are highly sensitive to Doppler shifts which affect the carrier frequency offsets, resulting in ICI.

Presence of a large number of sub – carriers with varying amplitude results in a high Peak – to – Average Power Ratio (PAPR) of the system, which in turn hampers the efficiency of the RF amplifier.

Conclusion:-

In partial transmit sequence, the input data vector is first divided into m disjoint blocks then each block is multiplied by some random vectors. This is done to reduce the PAPR. This random vector is generated by phase factor optimizer. So that value will be considered that can lead to reduction in PAPR.