OFDM: Orthogonal Frequency Division Multiplexing

Sandeep Kumar Dwivedi
K.I.T. Kanpur

Vaibhav Purwar
K.I.T. Kanpur

Sanjiv Mishra
K.I.T. Kanpur

***Abstract*-—**in wireless communication system, with the increase of data rate the distortion of the received signal caused by multipath fading channel become a major problem. OFDM (orthogonal frequency division multiple access) technique is a solution of this problem in wireless communication. OFDM provides much more bandwidth efficiency as compared to conventional multicarrier modulation schemes. Simulation results are based on MATLAB completely.

Index Terms- OFDM Interference management..

1. INTRODUCTION

OFDM is a digital modulation schame in which a wideband signal is split in to a number of narrowband signals.Because the symbol duration of a narrowband signal will be larger than that of a wideband signal, the amount of time dispersion caused by multipah delay spread is reduced.OFDM is a multicarrier modulation scheme in which multiple user symbols are transmitted in parallel using different orthogonal subvarriers. The conventional multicarrier modulation techniques suffer from bandwidth inefficiency due to use of guard interval or spacing between adjacent channels.Our aim is here to achieve high data rate by using limited avalaible frequency bandwidth efficiency [1] [2].

2. REASONS OF ISI IN WIRELESS COMMUNICATION

In wireless communication ISI (Inter Symbol Interference) is the major problem,ISI is caused by high data rate transmission using conventional transmission schemes. Multipath propagation and bandlimited channels are the two factors causing ISI [3].

1. Multipath propagation-when the signal reaches the receiver end propagating through different paths, this is called Multipath Propagation. The time taken by the signal to reach the receiver end from transmitter end is directly proportional to the distance between the transmitter and receiver .Due to different path lengths for multipath propagation the delay time of received signal at the receiver end varies.

2. Band limited Channel-Band limited channel is a channel whose frequency response is zero above and below a certain cut-off frequency. When the signal is passed through such a channel the frequency components above the cut-off frequencies are completely removed therefore the removal of higher frequency components due to band limited channel making the time domain pulse spread. The distortion due to pulse spreading is referred as ISI.

3. COMPARISON OF OFDM

1. OFDM vs. CDMA

Table 1.Comparison of CDMA and OFDM [1]

PARAMETERS	OFDM	CDMA
Near Far Effect	**Insensitive**	**Sensitive**
Synchronization	**Yes**	**No**
Crosscell Interference	**Sensitive**	**Mitigated**
Intercell Interference	**NO**	**Sensitive**
Treatment for ISI	**Cyclic Prefix**	**Rake Receiver**
To achieve high data rate	**Hogh order Modulation**	**Difficult**

2. OFDM vs. IDMA

Table 2 Comparison of OFDM and IDMA [1]

PARAMETERS	IDMA	OFDM
Near Far Effect	MUG	Insensitive
Synchronization	NO	NO
Crosscell Interference	Mitigated	Sensitive
Intercell Interference	Suppressed by MUD	NO

4. OFDM PRINCIPLE

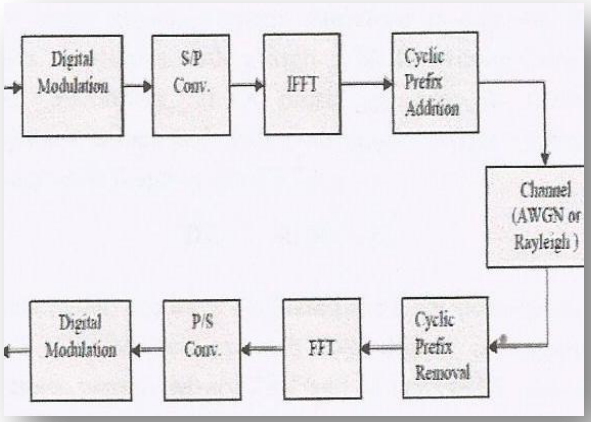

Figure 1 Working Principle of OFDM System

As shown in above figure, First the transmitted data is digitally Modulated using modulation schemes. Mostly QAM and PSK digital modulation schemes are used to modulate the transmitted signal. The output of the modulator is converted in to parallel signal. By this techniques signal is transmitted through subcarriers which are orthogonal to each other Due to orthogonality property, sub channels are not overlapped to each other, and ICI (Inter channel Interference) problem is reduced. The output of the serial to parrel converter is then applied to IFFT (Inverse Fast Fourier Transform) .By using IFFT the spectral representation of the data is transferred in to time domain, which is much more computationally efficient. The Cyclic prefix scheme is used at the output of the IFFT [3].

5. CYCLIC PREFIX

Cyclic prefix is a process of addition of a guard period to the start of each symbol. This guard period is a cyclic copy that extends the length of the symbol waveform. The addition of cyclic prefix to each symbol solves both ICI and ISI problems. From figure 1,

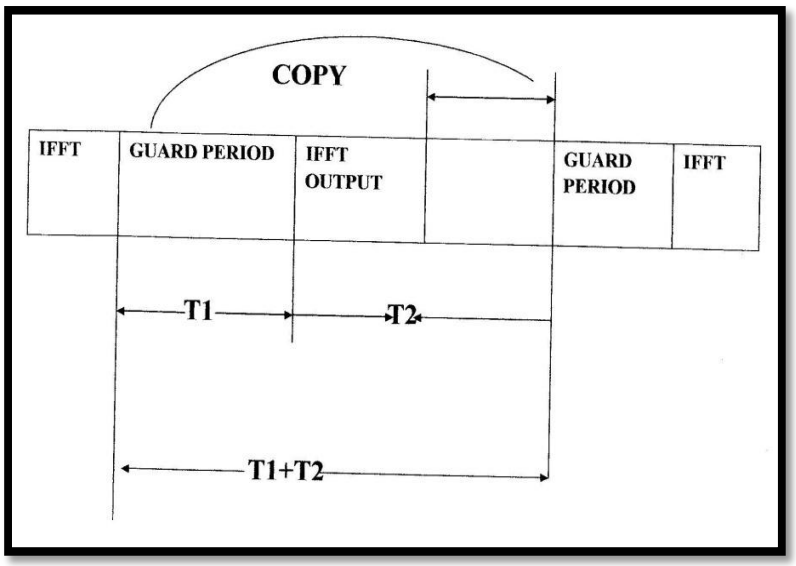

Figure 2 Concept of cyclic prefix

After that, the digital data is transmitted over the channel. At the Receiver side the reverse process is adopted as shown in the figure.2 we can see that the guard period is T1.When the guard period is not added the symbol period of IFFT output is T2 only. But when Guard period is added at the output of IFFT, then the symbol period is T1+T2. Therefore, the symbol period of transmitted data is increased, and ISI is reduced [4] [5].

6. SIMULATION RESULTS

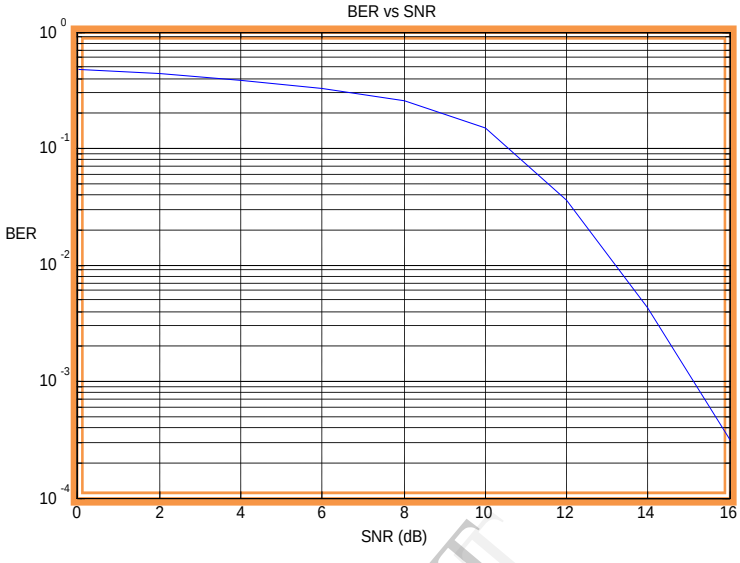

Figure 3 BER Performance of OFDM system

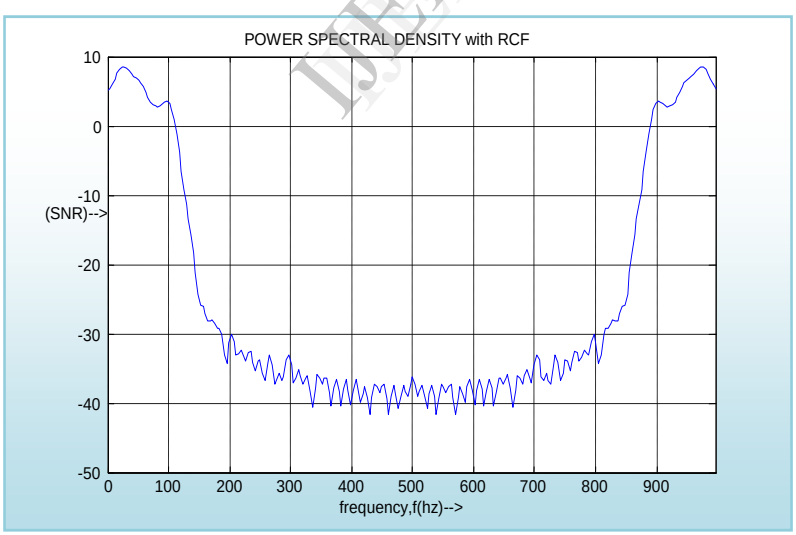

Figure 4 PSD with RCF

7. CONCLUSION

In this paper we explained the problem of ISI and ICI in wireless communication and also discuss the Solution for it and this is OFDM system with Cyclic Prefix scheme. Now if we use Raised cosine filter with BPSK technique, the BER can be reduced and ISI is reduced.

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