Improvement in SNR with 32-QAM and 128 point FFT in OFDM transmission system

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Abstract :- **High rate data transmission and reception can be successfully implemented if the high rate signal to be split into multiple parallel low rate signals and each of them is transmitted on a separate frequency (or sub-carrier). To facilitate separation of the signals at the receiver, the carrier frequencies were spaced sufficiently far apart so that the signal spectra do not overlap. Channel coding plays a very important role in OFDM systems performance. The role of channel coding in conjunction with frequency and time interleaving is to provide a link between bits transmitted on separated carriers of the signal spectrum, in such a way that the information conveyed by faded carriers can be reconstructed in the receiver. Frequency selectivity, currently known to be a disadvantage, is then turned into an advantage that can be called frequency diversity. Using Channel State Information (CSI), channel coding can yield some additional gain. Channel state information is frequency response of the channel or signal to noise ratio in each carrier.**

Some author suggested that for SNR value of 26db BER plot reach to zero for 16-QAM over AWGN channel, while for QPSK scheme value of SNR is around 30db. So 16-QAM is better than QPSK for AWGN channel because it requires less SNR for zero BER.we include that for SNR value of 20db BER plot reach to zero for 32-QAM over AWGN channel, So 32-QAM is better than QPSK , 16 QAM for AWGN channel because it requires less SNR for zero BER. The complete model for this OFDM transceiver with 32-QAM and 128 IFFT/FFT point is designed in the Communication tool box in MATLAB 7.8.0.

I. LITERATURE SURVEY

The transmission of BPSK signals in an OFDM system with 64-point IFFT at transmitter and FFT at receiver. The channel over which transmission will take place is lSI Rayleigh fading channel[1] given by 2 tap channel model with path delay [0, 0.5] Ils. The sampling frequency of OFDM is to be kept at 20MHz.Cyclic prefix for OFDM is calculated for improving bandwidth efficiency of the system. First, the symbol error rate (SER) of un coded OFDM system is plotted as a function of SNR via simulation
in MATLAB and then the result is compared with coded OFDM system's SER plot, where the coding is

provided by convolution encoder accompanied by viterbi decoder at the receiver side.

Orthogonal frequency division multiplexing (OFDM) has become a popular transmission technique for high-data-rate wireless communications in recent years [2]. Orthogonal frequency division multiplexing (OFDM) is one of the efficient techniques which is utilized to combat inter symbol interference, making the transmission over wireless channel less prone to frequency selective fading and thus improving the quality and reliability of wireless communication channel.[3] [4] OFDM achieves it by dividing the frequency selective fading channel into multiple parallel flat fading subchannels. Thus, it not only improves the robustness of the channel but it also provides spectral efficiency by sending the data through multiple sub carriers which are overlapping, as opposed to the guard band used by FDM between consecutive channels [5] [6]. It is noteworthy that there is no interference among overlapping sub channels as they are orthogonal to each other. The symbol error rate performance at receiver can be improved by utilizing a channel coding scheme called convolution coding which provides robustness against channel impairments such as noise, interference and fading. At the receiver, viterbi decoding can be used to decode data in such a way as to minimize the probability of error by performing maximum likelihood decoding.

II. THE BLOCK DIAGRAM OF AN OFDM SYSTEM:

In figure, OFDM transmission scheme using FFT (Fast Fourier Transform) is presented:

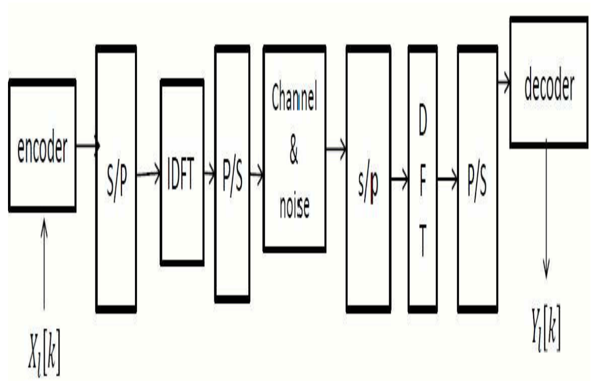

Figure-1 OFDM Processing Block Diagram

The input data sequence is baseband modulated, using a digital modulation scheme. Various modulation schemes could be employed such as BPSK, QPSK (also with their differential form) and QAM with several different signal constellations. There are also forms of OFDM where a distinct modulation on each subchannel is performed (e.g. transmitting more bits using an adequate modulation method on the carriers that are more „confident", like in ADSL systems). The modulation is performed on each parallel sub stream, that is on the symbols belonging to adjacent DFT frames. The data symbols are parallelized in N different substreams. Each substream will modulate a separate carrier through the IFFT modulation block, which is in fact the key element of an OFDM scheme, as we will see later. A cyclic prefix is inserted in order to eliminate the inter-symbol and inter-block interference (IBI). This cyclic prefix of length L is a circular extension of the IFFT-modulated symbol, obtained by copying the last L samples of the symbol in front of it. The data are back-serial converted, forming an OFDM symbol that will modulate a high-frequency carrier before its transmission through the channel. The radio channel is generally referred as a linear time-variant system. To the receiver, the inverse operations are performed: the data are down-converted to the baseband and the cyclic prefix is removed. The coherent FFT demodulator will ideally retrieve the exact form of transmitted symbols. The data are serial converted and the appropriated demodulation scheme will be used to estimate the transmitted symbols. In this section, the key points of OFDM are presented: the principles of a multicarrier (parallel) transmission, the usage of FFT and the

III. PROCESSING BLOCK OF OFDM TRANSCEIVER:

The OFDM transceiver includes the following block for the transmission of message signal:

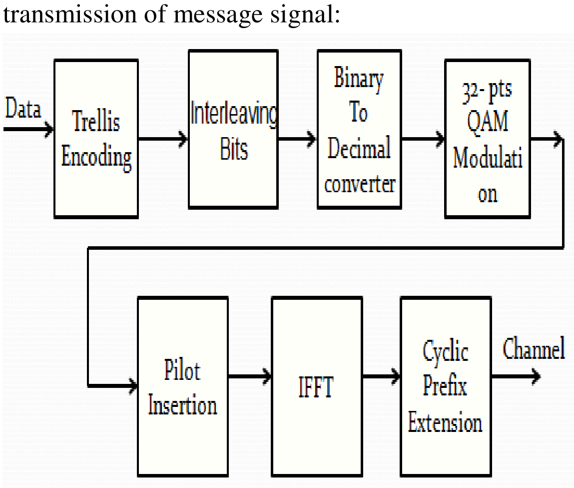

Fig- 2 OFDM transmitter system

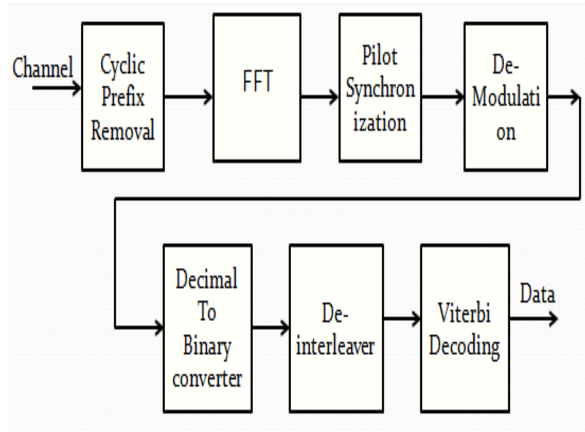

Fig-3 The OFDM receiver systems

The main objective is to design an OFDM Transmitter and Receiver system [2] with less BER. For this purpose the modulation technique and FFT/IFFT are the main building blocks of OFDM. In our approach 32-QAM and 128 point IFFT/FFT are used.

IV. AT TRANSMITTER END

Generate the Data "D".
While D!=Null
{
Encode the generated data.
Insert the interleaving Bits into Data.
32- QAM Mapping of data.
Insert the Pilot Carrier
Conversion into 128 IFFT Domain
Append Cyclic Prefix.
}
Transmit the generated data through AWGN channel

V. AT RECEIVER END

Receive the Data Bits "T".
While T!=Null
{
Remove Cyclic Prefix
Conversion into 128 FFT Domain
Synchronize the Pilot Carrier.
32 QAM De-Modulation of received data.
De-interleaving Bits from Data.
Decode the generated data.
}
Calculate the Bit Error Rate for the received Data.

VI. RESULTS & CONCLUSION

The complete model for this OFDM transceiver with 32-QAM and 128 IFFT/FFT point is designed in the Communication tool box in MATLAB 7.8.0We randomly generate the data using "randint" function provided in MATLAB for the random generation of data. Encoding of data is carried out by "Trellis Encoding". Insert the Interleaving Bits by using "matintrlv" function.QAM modulation is done of 32 QAM.After the cyclic prefix inserted data, we designed a channel for transmission, channel is prepared using "AWGN" function. At the receiver side for the decoding purpose "Viterbi Detector " is used. Bit Error Rate is calculated using the formula:

BER = Error Bits / Length of Data

PREVIOUS RESULT

It concluded that for SNR value of 26db BER plot reach to zero for 16-QAM over AWGN channel, while for QPSK scheme value of SNR is around 30db. So 16-QAM is better than QPSK for AWGN channel because it requires less SNR for zero BER.

OUR RESULT

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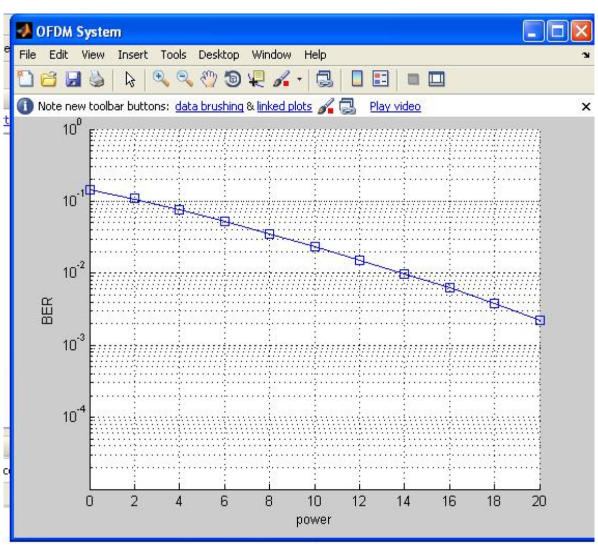

Fig-4 BER VS SNR Performance Of OFDM in Pervious

APPROACH USING BPSK MODULATION

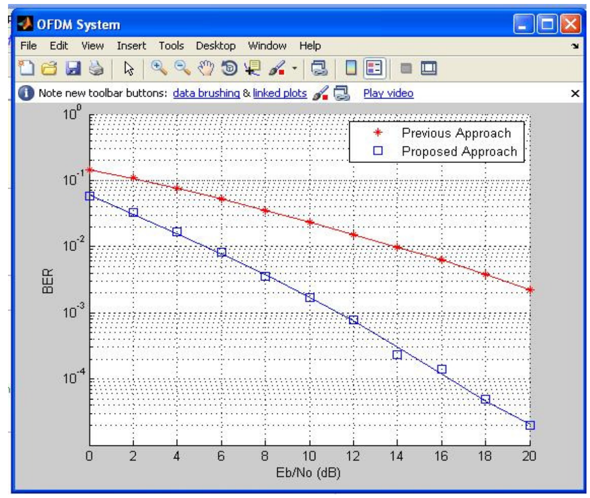

Fig-5 BER VS SNR Graph For Proposed And Previous Approach (Using 128 Point FFT And 32 QAM Modulation)

VII CONCLUSION

OFDM is an efficient technique in mitigating the effect of ISI. The performance of QAM signal in an OFOM systemic compared to the one with an added feature of convolution encoding. It is quite evident from the results that there is significant improvement in performance if convolution coding is used before transmission. In addition to this, value of cyclic prefix is kept equal to the multipath, thus lower value of CP helped to improve the bandwidth efficiency of the OOFM system. In this work, it can be concluded that QAM waveform is successfully generated by using MATLAB. The basic principles of digital modulation techniques are studied through MATLAB coding. QAM demonstrates better performance than BPSK. These two phases are 0 and π. The phase of carrier is changed according to input data signal. It has the minimum error possibility with the same Eb/No. Next, QPSK does not suffer from BER degradation while the bandwidth efficiency increases. In a QPSK system, data bits are divided into groups of two bits called dibits (00,01,10,11). Unlike BPSK, the output signal for QPSK has a constant envelope than BPSK. The performance between BPSK and QAM is analyzed. QAM is better in terms of data rate and bandwidth. QAM transmits data twice as fast as BPSK. QAM has high data rate which is 2 bits per bit interval. QPSK does not suffer from BER degradation while the bandwidth efficiency is increased. Only two different phases are used to represents two different binary values whereby each element only represents one bit in BPSK meanwhile four different phases are used to represent two binary values in QPSK whereby each signal element represents in two bits. For the same bit error rate the bandwidth required by QPSK is reduced half than BPSK. Applications for QAM in digital communications include CDMA system, Iridium Satellite Communication System, Digital Video Broadcasting Satellite. QPSK is also used for satellite transmission of MPEG-2 videos. It also used in cable modems, video conferencing and in cellular phone systems and other forms of digital communications over an RF carrier

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