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Performance Analysis Of OFDM Signals Using Other Modulation Technique QPSK & BPSK

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ABSTRACT:- There are many multiplexing technique in the communication system.In this paper Orthogonal Frequency Division Multiplexing (OFDM) is used with other multiplexing techniques such as QPSK & BPSK to improve the signal transmission rate. The benefits of OFDM are high spectral efficiency, resiliency of RF interference, and lower multi-path distortion.OFDM is a powerful modulation technique that is capable of high data rate and is able to eliminate ISI.

Keywords:- CDMA,BPSK,QPSK

INTRODUCTION:-

FDMA, TDMA and CDMA are the well known multiplexing techniques used in wireless communication systems. While working with the wireless systems using these techniques various problems encountered are:-

(1) Multi-path fading

(2) Time dispersion which leads to intersymbol interference (ISI)

(3) Lower bit rate capacity

(4) Requirment of larger transmission power for high bit rate

(5) Less spectral efficiency.

Since multiple versions of the signal interfere with each other, it becomes difficult to extract the original information. The use of orthogonal frequency division multiplexing (OFDM) technique provides better solution for the above mentioned problems.

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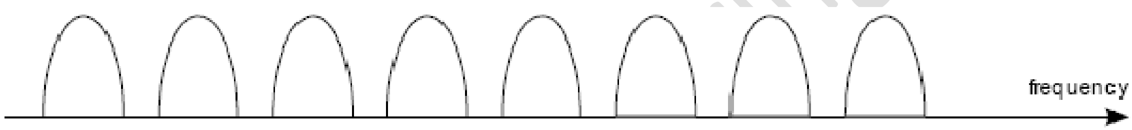
EVOLUTION OF OFDM:-

Frequency Division Multiplexing (FDM):-

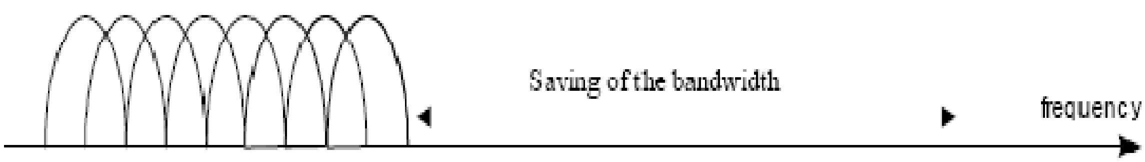
Frequency Division Multiplexing (FDM) has been used for a long time to carry more than one signal over a telephone line. FDM divides the channel bandwidth into subchannels and transmits multiple relatively low rate signals by carrying each signal on a separate carrier frequency. To ensure that the signal of one subchannel did not overlap with the signal from an adjacent one, some guard-band was left between the different subchannels. Obviously, this guard-band led to in efficiencies.

OFDM is a special case of FDM:-

Orthogonal Frequency Division Multiplexing (OFDM) is a special case of FDM. If I have a bandwidth that goes from frequency say a to b, I can subdivide this into a frequency of equal spaces. In frequency space the modulated carriers would look like this.



Bandwidth utilization of FDM



Bandwidth utilization of OFDM

WORKING OF THE OFDM MODEL:

The random data generator generates the data system. This input serial data stream is formatted into the word size required for transmission. For example, 1 bit/word for BPSK & 2 bits/word for QPSK and then shifted into a parallel format. The data is then transmitted in parallel by assigning each data word to one carrier in the transmission. The data to be transmitted on each carrier is then mapped into a Phase Shift Keying (PSK) format.

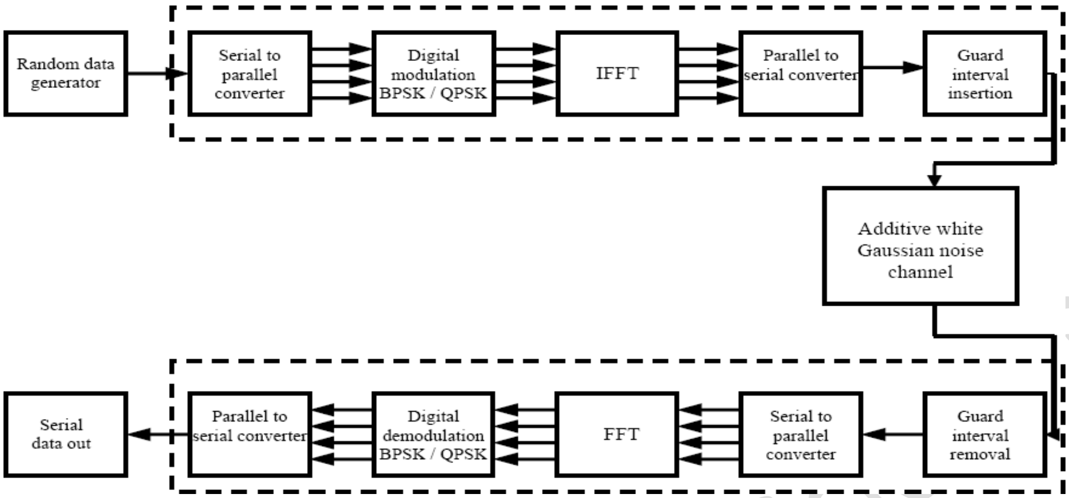


Figure 1: OFDM Model

TDMA (Time Division Multiple Access):_ Time Division Multiple Access (TDMA) improves spectrum capacity by splitting each frequency into time slots. TDMA allows each user to access the entire radio frequency channel for the short period of a call. Other users share this same frequency channel at different time slots. The base station continually switches from user to user on the channel. TDMA is the dominant technology for the second generation mobile cellular networks. TDMA system divide the radio spectrum into time slots, and in each slot only one user is allowed to transmit and receive. It can be seen from Figure 2 that each user occupies a cyclically repeating time slot, so a channel may be thought of as a particular time slot that reoccurs every frame, where N time slots comprise a frame.

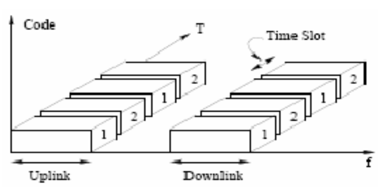


Figure 2 : Time division multiple access (TDMA).

CDMA (Code Division Multiple Access):- CDMA increases spectrum capacity by allowing all users to occupy all channels at the same time. Transmissions are spread over the whole radio band, and each voice or data call are assigned a unique code to differentiate from the other calls carried over the same spectrum. CDMA allows for a "soft hand-off", which means that terminals can communicate with several base stations at the same time. All users in a CDMA system, as seen from figure, use the same carrier frequency and may transmit simultaneously. Each user has its own pseudorandom codeword which is approximately orthogonal to all other code words. The receiver performs a time correlation operation to detect only the specific desired codeword. All other code words appear as noise due to decorrelation. For detection of the message signal, the receiver needs to know the codeword used by the transmitter. Each user operates independently with no knowledge of the other users.

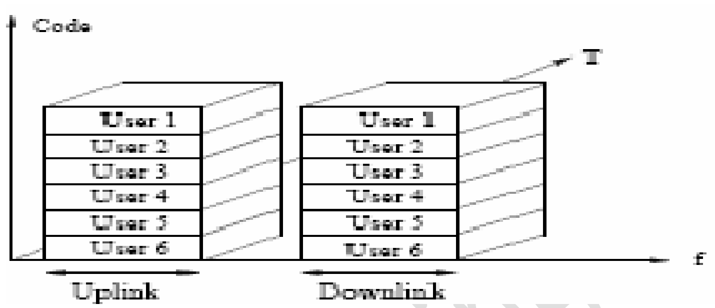


Figure 3 : Code division multiple access (CDMA).

BPSK (Binary Phase Shift Keying):- BPSK is the simplest form of PSK. It uses two phases which are separated by 180° and so can also be termed 2-PSK. It has one fixed phase when the data is at one level and when the data is at another level the phase is different by 180°. It does not particularly matter exactly where the constellation points are positioned, and in this figure they are shown on the real axis, at 0° and 180°. This modulation is the most robust of all the PSK's, since it takes serious distortion to make the demodulator reach an incorrect decision. It is, however, only able to modulate at 1 bit/symbol as seen in the figure and so is unsuitable for high data-rate applications when bandwidth is limited.

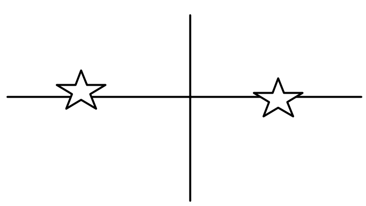


Figure 4 : Constellation diagram for BPSK.

In practice, a BPSK signal is generated by applying the waveform, cos ($m_o t$) as a carrier, to a balanced modulator and applying the baseband signal b(t) as the modulating waveform. In this sense BPSK can be thought of as an AM signal.

Vol 11, Issue 5, MAY /2020
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If *fc* is the frequency of the sinusoidal and T is the bit interval then the spectrum of the resulting. BPSK signal is shown in the figure 4.1

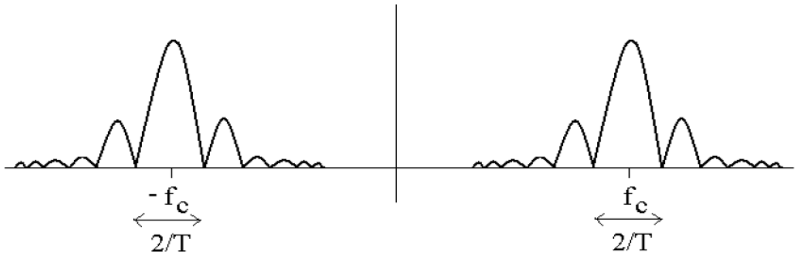

Figure 4.1: Amplitude spectrum of BPSK.

QPSK (Phase shift keying):- QPSK modulated carrier undergoes four distinct changes in phase that are represented as symbols and can take on the values of π/4, 3π/4, 5π/4, iand 7π/4. Each symbol

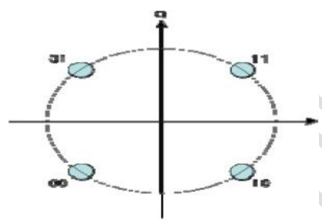

Figure 5: Constellation diagram for QPSK with Gray coding. Each adjacent symbol only differs by one bit.

represents two binary bits of data. The constellation diagram of a QPSK modulated carrier is shown in Figure 5 s(t) = xcos(mt) + ysin(mt)

QPSK Modulation :- Figure 5.1 represents the process of a QPSK modulator. First the input binary bit stream is split into two bit streams which are the even and odd bit streams (quadrature and in-phase streams) by the serial to parallel converter. Then , send alternating bits to I, Q channels: even bits to Q channel, odd bits to I channel.

Second, using the method of NRZ, the even and odd bits are converted from a unipolar sequence to a bipolar sequence (0 to -1). Next , multiply Q channel with a sine of fc and multiply I channel with a sine but shifted by 90 degree which is –cosine. Notice that the 90 degrees block in the figure transmits the upper sine sequence to the lower -cosine sequence. Finally, combining or adding the upper (I) and lower (Q) parts and passing through a harmonic or channel filter will get the QPSK modulated output.

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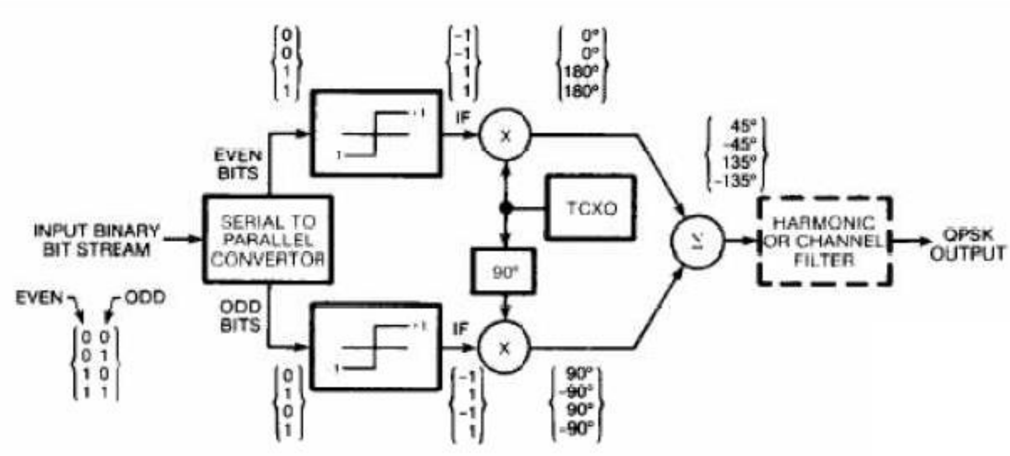


Figure 5.1: QPSK Modulator

For a binary sequence m(t) = 0 0 0 1 1 0 1 1, if the sinusoid s(t) is of amplitude of A, then the resulting QPSK signal will be as shown in the figure 3.12. Phase of the sinusoid is shifted by 90°, 180°, 270°, 360° for data 00, 01, 10, 11 respectively

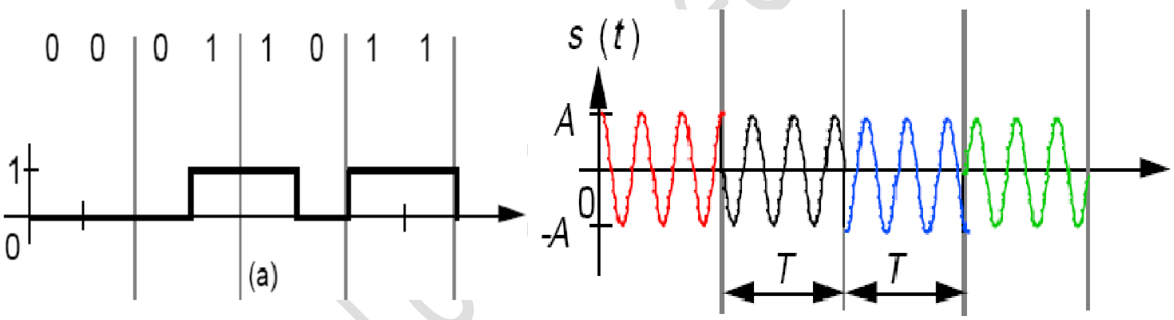
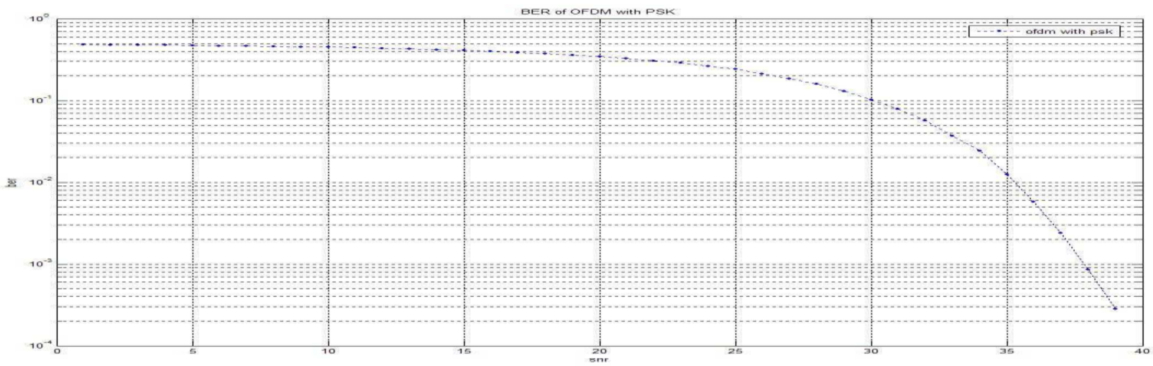


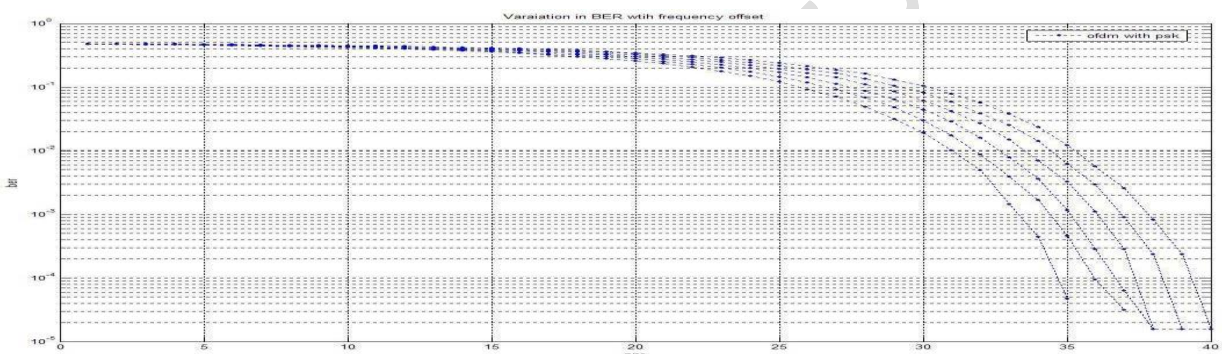
Figure 5.2 QPSK modulation: (a) binary sequence and (b) QPSK signal.

Simulation results:

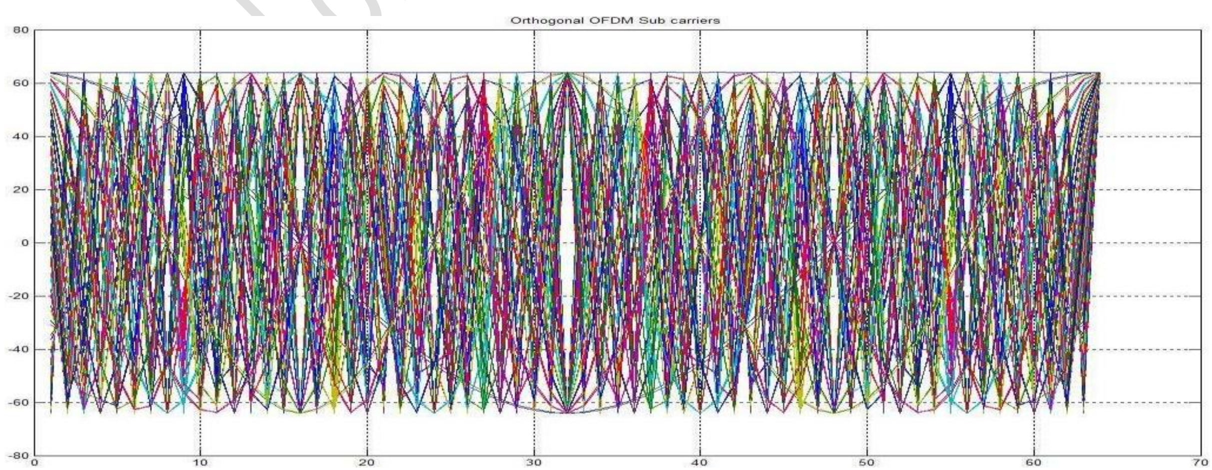
- Bit error rate (BER) in OFDM using PSK as an Input Signal.



- Effect of change in frequency offset in BER in OFDM.



- Orthogonal subcarriers in an OFDM signal. N=64



CONCLUSION

Using MATLAB software, the performance of OFDM system was tested for two digital modulation techniques namely BPSK and QPSK. From the simulation results, it is observed that

1. The BPSK allows the BER to be improved in a noisy channel at the cost of maximum data transmission capacity.
2. QPSK allows higher transmission capacity, but at the cost of slight increase in the probability of error. This is because of the fact that QPSK uses two bits per symbol. Hence QPSK is easily affected by the noise. Therefore OFDM with QPSK requires larger transmit power.
3. From the results, use of OFDM with QPSK is beneficial for short distance transmission link.
4. For long distance transmission link OFDM with BPSK will be preferable.

REFERENCES

[1] W. Y. Zou, and Wu, "COFDM: An overview," IEEE Trans. Broadcasting,vol. 41, pp. 1– 8, Mar. 1995.

[2] J. A. C. Bingham, "Multicarrier modulation for data transmission: An idea whose time has come," IEEE Commun. Mag, vol. 28, pp. 5–14,May 1990.

[3] L. Wei and Schlegel, "Synchronization requirements for multi-user OFDM on satellite mobile and two-path Rayleigh fading channels," IEEE Trans. Commun, vol. 43, pp. 887–895, Feb./Mar./Apr. 1995.

[4] M. Moeneclaey, "Synchronizability of OFDM signals," in Proc. Globecom'95, Singapore, vol. 3, Nov. 1995, pp. 2054–2058.

[5] T. Pollet and Bladel, "BER sensitivity of OFDM systems to carrier frequency offset and Wiener phase noise," IEEE Trans. Commun, vol. 43, pp. 191–193, Feb./Mar./Apr. 1995.

[6] W. D. Warner and Leung, "OFDM/FM frame synchronization for mobile radio data communication," IEEE Trans. Veh. Technol, vol. 42,pp. 302–313, Aug. 1993.

Journal of Engineering Sciences