ANALYSIS OF DIFFERENT MODULATION TECHNIQUE AT AWGN CHANNEL WITH THE HELP OF MATLAB

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Abstract - : ***This Frequency Hopping Spread Spectrum transceiver is designed to provide the secure communication domain. FHSS is a radio transmission process where user information is sent on a radio channel that regularly changes frequency according to a predetermined code with the help of different modulation techniques. This system is very popular because it is a secure communication model which utilizes the Pseudo Random Noise (PN) Sequence as a carrier signal. And the communication channel used as Additive white Gaussian noise (AWGN) Channel is preferred in this work. And at receiver side the data recovered as well as the Bit Error Rate is estimated at the receiver. The overall design is modeled and simulated using MATLAB-Simulink. This paper focuses on error performance of BPSK, QPSK, DPSK at AWGN channel on the method of modulation and demodulation technique. AWGN channel has been reported here. To find out the best BER performance between BPSK QPSK and DPSK. we use SIMULINK software.***

Key Words: *BPSK, QPSK, DPSK, AWGN.*

2. INTRODUCTION:

In initial application of spread spectrum technique was in development in military guidance and communication system by the end of World War II, spectrum spreading for jamming resistance was already familiar concept to radar engineers. [7]. In Wireless communication technology has taken on a prominent position in indoor environment applications recently and become important with advent of personal communication system,(pcs) which usually co-exist in the 2.4GHZ ISM band .Therefore, the interference rejection property has become very important in developing a reliable wireless transmission system for indoor application. Wireless communication technologies for un-licensed band applications are the situations where it is necessary to sacrifice the efficient utilization at ion of these two resources in order to meet certain 0 and design object i.e. ability to reject the interference whether among the various signal .This requirement is catered to by a class of signaling techniques known collectively as spread spectrum modulation.in digital transmission, BER is the percentage of bits with errors divided by total number of bits that have been transmitted ,received or processed over a given time period.

3. DESCRIPTION OF BLOCK DIAGRAM:

In this technique of spread spectrum there is a transmission bandwidth employed is much greater than minimum bandwidth required to transmit the information the system is defined to be spread spectrum system.[3].Now consider spread spectrum technique in which the carrier hopes randomly from one frequency to another frequency is called Frequency Hop spread spectrum. A common modulation format for FH system is that of M-ary frequency shift keying, since frequency hopping does not cover entire spread spectrum. Instantaneously, we are led to consider the rate at which the hop occurs.[10].

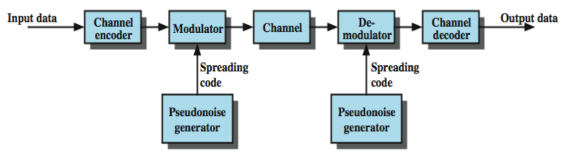


Fig-1: Block diagram of spread spectrum

3.1 PN SEQUENCE GENERATON

The block of PN sequence generator generates a sequence of pseudorandom binary numbers using a linear-feedback shift register (LFSR). The LFSR is implemented using a simple shift register generator (SSRG, or Fibonacci) configuration. A pseudo noise sequence can be used in a pseudorandom scrambler and descrambler. It can also be used in a direct-sequence spread-spectrum system.

3.2 CHANNEL ENCODER

A major feature of digital transmission is the myriad techniques use d to protect data or speech through coding adds additional bits to the original payload to provide a means of protecting original information.

3.3 CHANNEL DECODER

Decoding is the opposite process the conversion of an. encoded format back into the original sequence of characters. And the data receives by the desired receiver.

3.4 MODULATOR

In electronics and communication , modulation is the process of varying one or more properties of a periodic waveform, called the carrier signal, with a modulating signal that typically contains information to be transmitted and this operation is performed by modulator.

3.5 DEMODULATOR

A demodulator is an electronic circuit (or computer program in a software-defined radio) that is used to recover the information content from the modulated carrier wave.

3.4 CHANNEL

A channel is used to convey an information signal for example bit stream, from one sender to several senders to one to several receivers. A channel has certain capacity for transmitting information often measured by its bandwidth in HZ or its data rate in bits per second. If the noise is introduced primarily by electronic components and the amplifiers at the receiver, it may be characterized as a thermal noise. This type of noise statistically as a Gaussian noise process. Hence the resulting mathematical model for the channel is usually called additive white Gaussian channel. [5]

4 SIMULATION DIAGRAM:

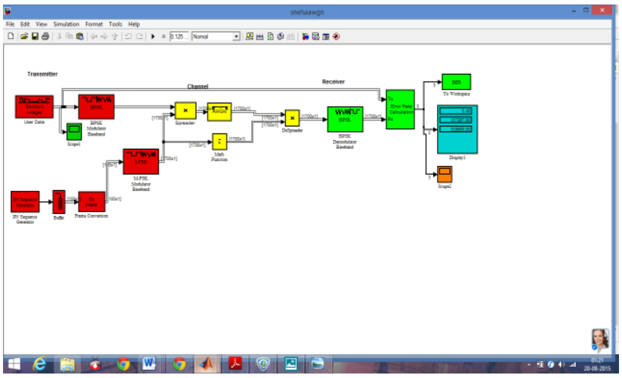


Fig-2: simulation of BPSK

4.1 DESCRIPTION OF SIMULATION DIAGRAM:

4.1.1 PN SEQUENCE:

The PN Sequence Generator block generates a sequence of pseudorandom binary numbers using a linear-feedback shift register (LFSR). The LFSR is implemented using a simple shift register generator (SSRG, or Fibonacci) configuration. A pseudo noise sequence can be used in a pseudorandom scrambler and descrambler. It can also be used in a direct-sequence spread-spectrum system.

The PN Sequence Generator block uses a shift register to generate sequences, as shown below .Yields an output with a slower frame rate than the input, as illustrated below:

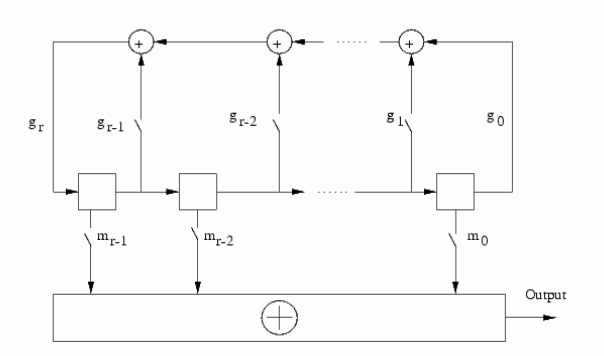


Fig-3: generation of PN sequence

All r registers in the generator update their values at each time step according to the value of the incoming arrow to the shift register. The adders perform addition modulo 2. The shift register is described by the **Generator Polynomial** parameter, which is a primitive binary polynomial in z, $g_r z^r + g_{r-1} z^{r-1} + g_{r-2} z^{r-2} + ... + g_0$. The coefficient g_k is 1 if there is a connection from the kth register, as labelled in the preceding diagram, to the adder. The leading term g_r and the constant term g_0 of the **Generator Polynomial** parameter must be 1 because the polynomial must be primitive.

4.1.2 BUFFER

The Buffer block redistributes the input samples to a new frame size. Buffering, to a larger frame size scalar input Buffering to a smaller frame size yields an output with a faster frame rate than the input, as illustrated below for scalar output. This block supports triggered subsystems when the block's input and output rates are the same. Sample-based full-dimension matrix inputs are not accepted.

4.1.3 SAMPLE BASED OPERATION

Buffering to a smaller frame size yields an output with a faster frame rate than the input, as illustrated below for scalar output. The block coordinates the output frame size and frame rate of non-overlapping buffers such that the sample period of the signal is the same at both the input and output: $T_{so} = T_{si}$.

4.1.4 FRAME SIZE:

The Frame Conversion block passes the input through to the output and sets the output sampling mode to the value of the **Sampling mode of output signal** parameter, which can be either Frame-based or Sample-based

4.1.5 MFSK MODULATOR BASEBAND

The M-FSK Modulator Baseband block modulates using the M-ary frequency shift keying method. The output is a baseband representation of the modulated signal. The **M-ary number** parameter, M, is the number of frequencies in the modulated signal. The **Frequency separation** parameter is the distance, in Hz, between successive frequencies of the modulated signal. The sampling frequency must be greater than M multiplied by the **Frequency separation** or the output signal will be aliased. :

4.1.6 RANDOM INTEGER GENERATOR

The Random Integer Generator block generates uniformly distributed random integers in the range [0, M-1], where M is the M-ary number defined in the dialog box. The M-ary number can be either a scalar or a vector. If it is a scalar, then all output random variables are independent and identically distributed (i.i.d.). If the M-ary number is a vector, then its length must equal the length of the Initial seed; in this case each output has its own output range.

If the Initial seed parameter is a constant, then the resulting noise is repeatable.

4.1.6 BPSK MODULATOR BASEBAND

The BPSK Modulator Baseband block modulates using the binary phase shift keying method. The output is a baseband representation of the modulated signal. For both integer and bit inputs, this block can accept the data types int8, uint8, int16, uint16, int32, uint32, Boolean, single, and double. input must be a discrete-time binary-valued signal. If the input bit is 0 or 1, respectively, then the modulated symbol is exp(jθ) or -exp(jθ) respectively, where θ is the Phase offset parameter.

4.1.6 AWGN CHANNEL

The AWGN Channel block adds white Gaussian noise to a real or complex input signal. When the input signal is real, this block adds real Gaussian noise and produces a real output signal. When the input signal is complex, this block adds complex Gaussian noise and produces a complex output signal. This block inherits its sample time from the input signal. This block uses the Signal Processing Block set™ Random Source block to generate the noise. Random numbers are generated using the Ziggurat method, which is the same method used by the MATLAB random function. The Initial seed parameter in this block initializes the noise generator. Initial seed can be either a scalar or a vector whose length matches the number of channels in the input signal. For details on Initial seed, see the Random Source block reference page in the Signal Processing Block set documentation set. The signal inputs can only be of type single or double. The port data types are inherited from the signals that drive the block.

4.1.7 MATH FUNCTION

The Math Function block performs numerous common mathematical functions.

4.1.8 BPSK MODULATOR

When used with default parameter values, the Product block outputs the result of multiplying its two inputs, which can be two scalars, a scalar and a no scalar, or two non-scalars that have the same dimensions. The default parameter values that specify this behavior are:
Multiplication: Element-wise (.*), Number of Inputs: 2
Setting non-default values for either of these parameters can change a Product block to be functionally equivalent to a Divide block or a Product of Elements block. See the documentation of those two blocks for more information. If all you need is to multiply two inputs to create an output, you can use the Product block with default parameter values. If you need additional capabilities, see Product Block Capabilities.

4.1.9 BER WORKSPACE

The BER Workspace block inputs a signal and writes the signal data to the MATLAB workspace. The block writes the data to an array or structure that has the name specified by the block's Variable name parameter. The Save format parameter determines the output format.

4.1.10 DISPLAY

The Display block shows the value of its input on its icon. We control the display format using the format parameter :If the signal input to a Display block has an enumerated data type (see Using Enumerated Data):The block displays enumerated values, not the values' underlying integers. Setting the Format to any of the Stored Integer settings causes an error. The amount of data displayed and the time steps at which the data is displayed are determined by the decimation block parameter and the Sample time property: The decimation parameter enables you to display data at every nth sample, where n is the decimation factor. The default decimation, 1, displays data at every time step.

4.2 SIMULATION DIAGRAM QPSK:

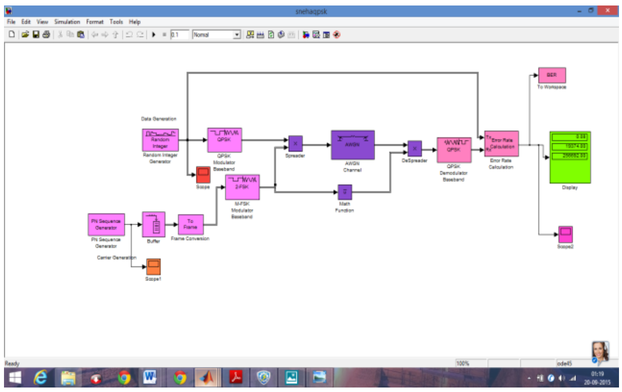


Fig- 4 simulation of qpsk

4.2.1 RANDOM INTEGER GENERATOR

The Random Integer Generator block generates uniformly distributed random integers in the range [0, M-1], where M is the M-ary number defined in the dialog box. The M-ary number can be either a scalar or a vector. If it is a scalar, then all output random variables are independent and identically distributed (i.i.d.). If the M-ary number is a vector, then its length must equal the length of the Initial seed; in this case each output has its own output range. If the Initial seed parameter is a constant, then the resulting noise is repeatable.

4.2.2 QPSK MODULATOR BASEBAND

The QPSK Modulator Baseband block modulates using the quaternary phase shift keying method. The output is a baseband representation of modulated signal. Quadrature Phase Shift Keying (QPSK) is a form of Phase Shift Keying in which two bits are modulated at once, selecting one of four possible carrier phase shifts (0, 90, 180, or 270 degrees).QPSK allows the signal to carry twice as much information ordinary PSK using the same bandwidth. QPSK is used for satellite transmission of MPEG2 video, cable modems videoconferencing, cellular phone systems, and other forms of digital communication over an RF carrier [2].

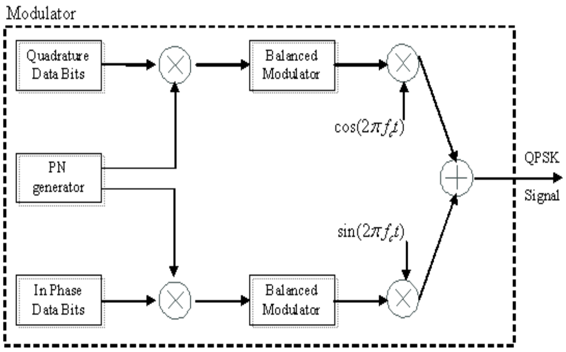
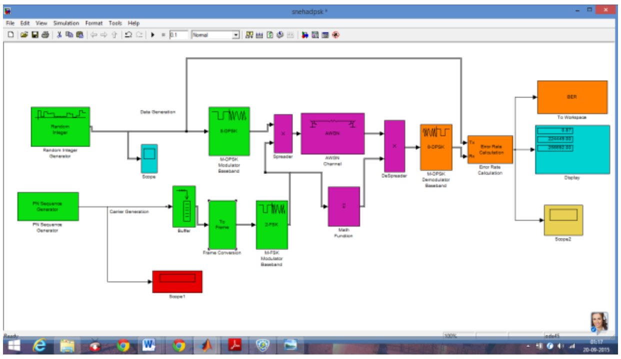


Fig-5 QPSK modulator

4.2.3 QPSK DEMODULARED BASEBAND-

The QPSK Demodulator Baseband block demodulates a signal that was modulated using the quaternary phase shift keying method. The input is a baseband representation of the modulated signal. The input must be a discrete-time complex signal. The input can be either frame based or sample based.



4.3 SIMULATION DIAGRAM OF DPSK:

Fig -6 simulation of DPSK

4.3.1 DPSK MODULATION OR DEMODULATION:

DPSK stands for Differential Phase Shift Keying. It is the version of BPSK. In **DPSK**, there is no absolute carrier phase reference, instead transmitted signal itself used as phase reference In DPSK demodulation, phase of the received bit is compared with phase of the previous bit. DPSK may be viewed as the non-coherent version of PSK. It eliminates the need for a coherent Reference signal at the receiver by combining two basic operations at the transmitter.

5 RESULT AND ANALYSIS

TABLE NO 1-BER of QPSK, DPSK, and BPSK at 3000 H

TX	RX	BER	FREQ. (HZ)	TECH
637500	315163	0.49	3000	BPSK
511692	38605	0.08	3000	QPSK
511692	447466	0.87	3000	DPSK

TX	RX	BER	**FREQ** (HZ)
1700	494	**0.29**	1.46
1700	605	0.36	2.92
1700	676	0.4	5.89
5100	2272	0.45	23.43
10200	4747	0.47	46.87
20400	9679	0.47	93.75
40800	19416	0.48	187.5
79900	38749	0.48	375
159800	78236	0.49	750
319600	157297	0.49	1500
637500	312163	0.49	3000

AT PARTICULAR FREQUENCY WE CONCLUDE THAT BER OF QPSK IS MINIMUM SO THAT QPSK IS MUCH BETTER THAN BPSK AND DPSK:

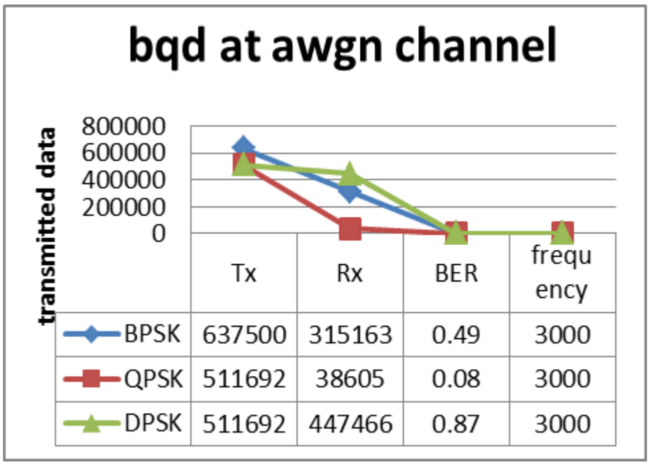


Fig -7 BPSK,QPSK and DPSK at AWGN channel

5.1 BPSK AT DIFFERENT FRQUENCIES:

5.1a WAVEFORM AT DIFF FREQUENCIES:

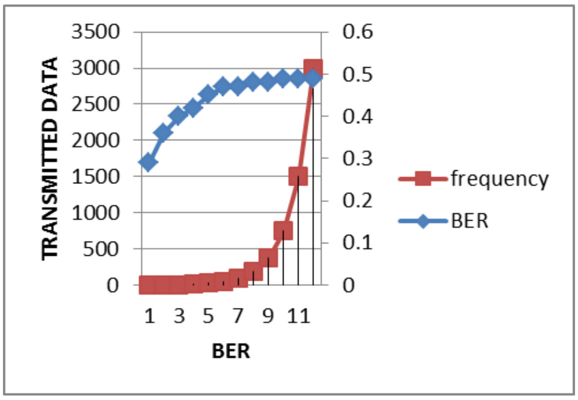


Fig-8 waveform of BPSK at AWGN

5.2 DPSK AT DIFFERENT FRQUENCIES:

Table no 3 : diff freq of dpsk

TX	RX	BER	FREQ(HZ)
64592	56480	0.87	375
129192	112968	0.87	750
256692	22449	0.87	1500
511692	447466	0.87	3000
1021692	893622	0.87	6000

5.2.a WAVEFORM AT DIFF FREQUENCIES:

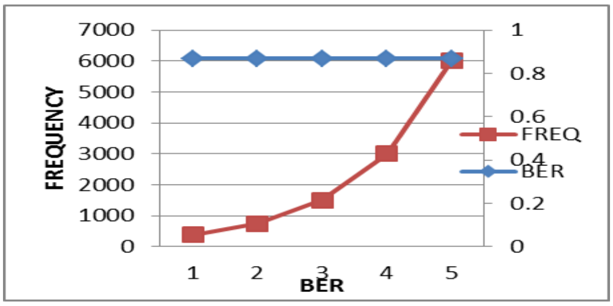


Fig-9: waveform of DPSK at AWGN

5.3 QPSK AT DIFF FREQUENCIES:

Table no 4: diff freq of qpsk

TX	RX	BER	FREQ (HZ)
64592	4918	0.08	375
129192	9734	0.08	750
156692	19374	0.08	1500
511692	38605	0.08	3000

5.3 a WAVEFORM AT DIFF FREQUENCIES:

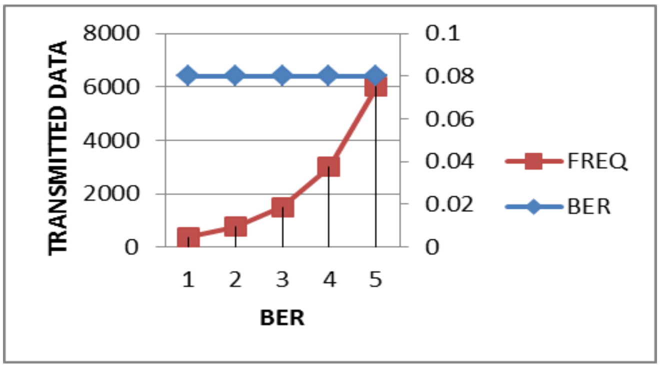


Fig -10 waveform of QPSK at AWGN

6. CONCLUSIONS:

QPSK is much better than BPSK & DPSK at AWGN channel In AWGN, BER will increase on increasing input signal power with the help of Simulink models of BPSK & QPSK, the graph between SNR and BER is obtained. Additive white Gaussian noise (AWGN) channels with 100 random input powers are used in simulation. AWGN Channel block adds white Gaussian noise to a real or complex input signal. This block inherits its sample time from the input signal. This block supports multichannel input and output signal as well as frame based processing. AWGN channel has lower BER than Raleigh and Rician fading channel.

SUGGESTIONS FOR FUTURE WORK: Based on gathered observations while completing this project; to picks were identifying which would benefit for further investigation.

1. The spreading technique is analyzed for its processing gain, because it characterized this technique.
2. Using different-different length of the Spreading code it can once more analyzed.
3. For short range communication i.e. Blue tooth (2.4 ISM band) unlicensed band applications it should also be analyzed.
4. This technique is also analyzed for multipath propagations using both cons erring fading phenomena and without considering fading phenomena, no of path will also very as pre requirements.
5. This technique is also be used for coding and spreading of the CDMA, to show its practical approaches.

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