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In this paper we present a graphical user interface (GUI) design of the OSI Physical layer in order to calculate the BER (bit error ratio) of three different modulators (QPSK,16QAM And 64QAM) Each modulator will individually work to achieve results in simulation with respect to the (SNR) signal to noise ratio. We will show a clean figures of the process when simulation is running and comparison of the modulators. Previous researches of (BER) have shown that there are different ways to calculate the BER in order to ensure the quality of digital transmission system.

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GJCST-E Classification : H.5.2

AGRAPHICALUSERINTERFACEGUIDESIGNOFTHEPHYSICALLAYERTOINVESTIGATETHREEDIFFERENTMODULATORSEFFECTIVENESSONTHEBITERRORRASIOBERWITHINTHELAYER

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Ahmed Alahdal [α] & Dr. G. N. Shinde [σ]

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I. Introduction

Any study aims to understand the modulation and it is efficiency must take a closer look at the Bit error ratio (BER), According to this simple logic we must know how the BER works.

(BER) is the number of bit errors divided by the total number of transferred bits during a studied time interval. BER is a unit less performance measure, often expressed as a percentage, this could be the definition of the BER but we need more than just a definition we need a simulation Process to study the behavior of the BER with multiple modulator

BER is the percentage of bits with errors divided by the total number of bits that have been transmitted, received or processed over a given time period. The rate is typically expressed as 10 to the negative power. For example, four erroneous bits out of 100,000 bits transmitted would be expressed as 4* 10-5, or the expression 3* 10-6 would indicate that three bits were in error out of 1,000,000 transmitted.BER is the digital equivalent to signal-to-noise ratio in an analog system. Basically the bit error ratio is the sum of the bits that fail to transmit or it is the data which did not transfer during the transmission. Modulators are nothing but a way of transmitting digital data in a form of a binary numbers, Generally, the modulation is the process by which a carrier wave is able to carry the message or digital signal (series of ones and zeroes). The three basic methods to perform the modulation are amplitude, frequency and phase shift keying [3]. Quadrature amplitude modulation (QAM) has been widely used in adaptive modulation because of its efficiency in power and bandwidth [2]. The QAM is one of the adaptive modulation techniques that are commonly used for wireless communications. Different order modulations allow sending more bits per symbol and thus achieving higher throughputs or better spectral efficiencies[1]. In network design it is significant that a network planer needs to optimize the various electrical and optical parameters to enhance the smooth operation of the network. However, the transmission length increases with increase in the bit rate and the parameters have the capability of absenting in the network[8]. Bit error rate BER is a parameter which gives an excellent indication of the performance of a data link such as radio or fiber optic system. As one of the main parameters of interest in any data link is the number of errors that occur, the bit error rate is a key parameter. A knowledge of the BER also enables other features of the link such as the power and bandwidth, etc. Bit error rate is a measurement of success in a digital transaction between receivers and senders, the number of errors which happen when the transmission running is considered as the bit error rate. it provides a way to find out the lost data which may not affect the package but for the sake of better services we try to avoid maximum number errors. The Error Rate Calculation block compares the input data before the signal modulator as it is generated from the signal

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generator to the output of the demodulator on the receiving end. It calculates the error rate as a running statistic, by dividing the total number of unequal pairs of data elements by the total number of input data elements from one source [9].

II. Proposed (GUI) Design of the Physical Layer

The proposed GUI Design of the physical layer represents the process of transmitting data from source to receiver with respect to its original design which can be represented in different style(design).

The figure1 and figure2 provide a view of our GUI design which we are using to investigate the Bit Error Ratio (BER).this design was programmed and coded in the Matlab software, the well known high performance language. As shown the design includes three different types of channels which we will use separately in each simulation process, so we can estimate each channel impact on the different modulators and how the channel is preferred for that specific task. We also aim to know which channel can endure more packet of data transferred and how it is going to be effected in the sense of BER TO SNR.

In the main window of our GUI design there are various functions and they are as the following:

Data generator: generates signals as a source of data

Encoded data: encodes the data provided by data generator

Digital modulator: is the process of conveying a message signal

IFFT modulator: Inverse Fast Fourier Transform which supports inputs of the data types double and single.

Channel : is the path which data is transferred through.

FFT Demodulator Fast Fourier Transform which supports the output of the data type double and single.

Digital demodulator: it is the process of conveying signal to a message.

De-interleaving a technique for making forward error correction more robust with respect to burst errors

Decoded data: is to decode the signal that was encoded by the encoder.

We must also consider that There are three channels which we will show in our next figure and they are as the following

Channel types.

AWNG channel

RAYLEIGH channel

RICIAN channel

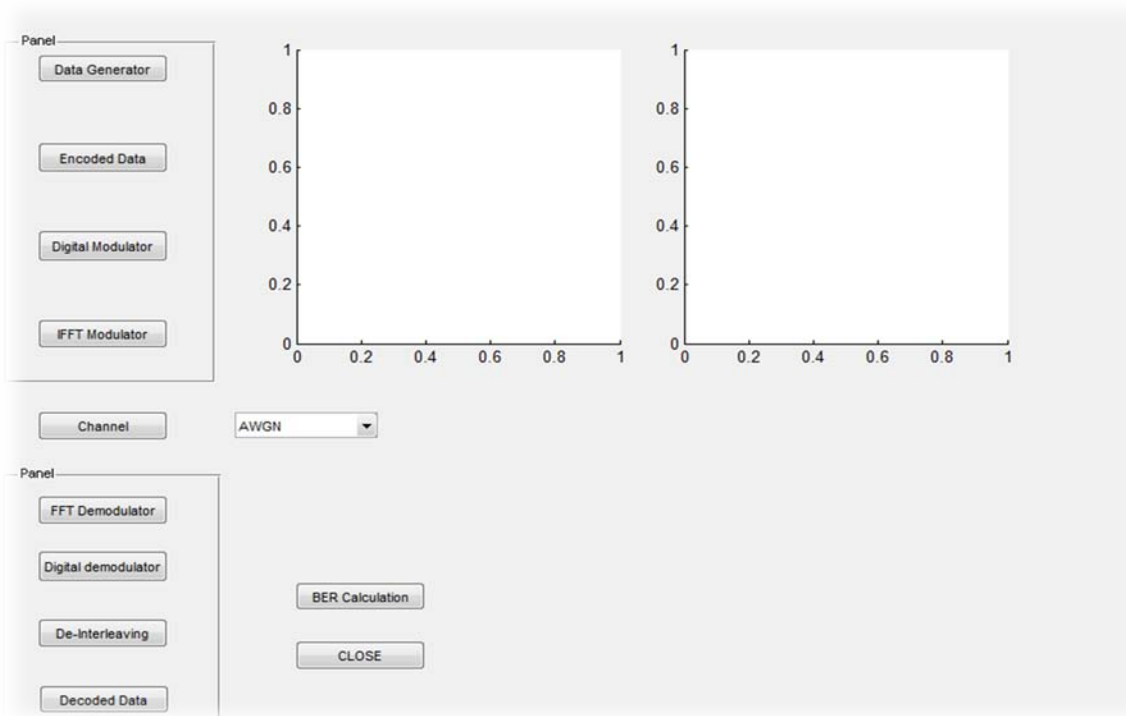

Figure 1 : GUI Design of Physical Layer

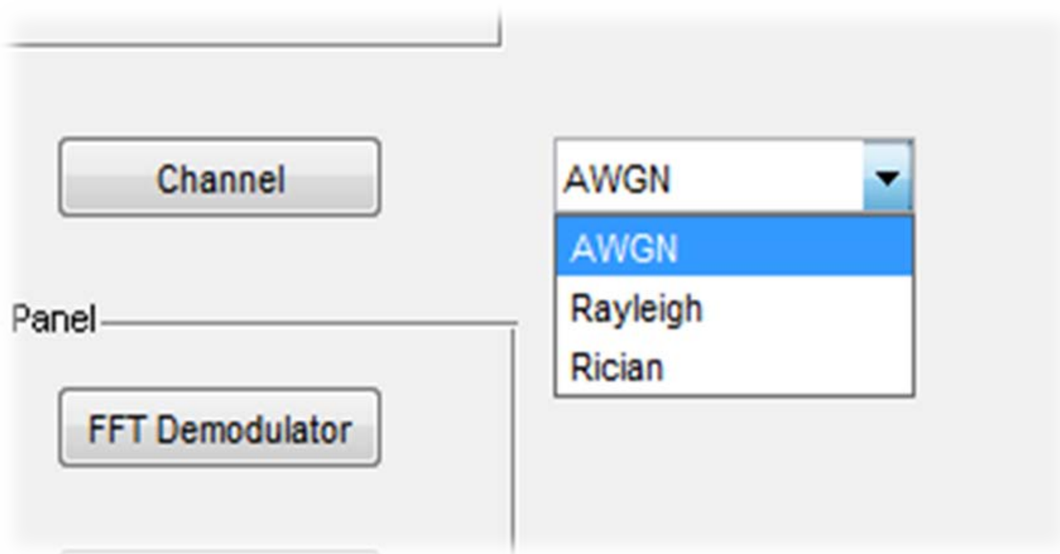

Figure 2 : Channels our Design Provides

III. Experimental Set Up

In this process we will take the Three modulators and examine them one by one as it is designed in our Physical layer design according to such design We will experiment the bit error ratio(BER) of following modulators in three different ways depending on the channel we choose out of the three channel we have(AWNG,RAYLEIGH and RICIAN .

As we all know this is a way to ensure the process and the quality of digital transmition so we will create them and display the results allowing the programer to choose what may suit one work of tramsmition.

Also this process will be in the sence of showing the results of all modulators individually at the same time it will show each channel effectiveness on the modulators.

a) (QPSK) Bit error ratio

The Quadrature Phase Shift Keying (QPSK) is the first modulator we examine in our design, QPSK uses two basic functions a sine and cosine and it is simple to optimize.

In order to modulate the data bits in QPSK it has to be grouped in a symbol each contains two bits and each of the symbol have the possibility of taking one of the following values:00,01,10,or 11 :

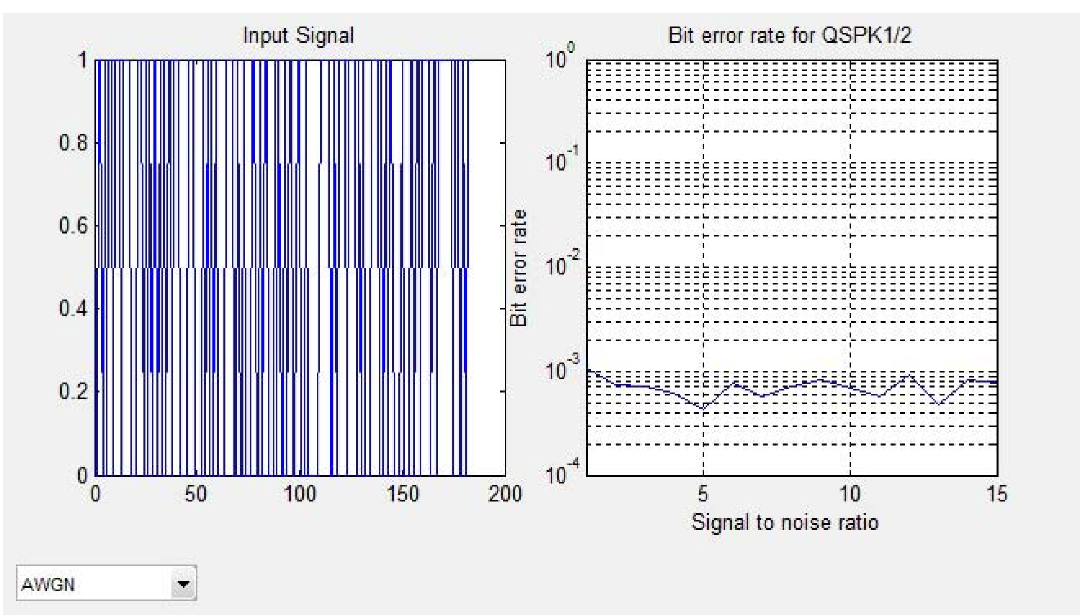

Figure 3 : (BER) of QPSK using (AWGN)channel

As it is shown in figure 3 the input signal was generated and the process of sending and receiving data in one layer(Physical layer) has completed, which allow us to calculate the BER of QPSK using the transmission data.

We can also notice that we have used the (AWGN) as our first channel to use with QPSK modulator.

b) (16-QAM) Bit error ratio

The second modulator we examine is called 16 state Quadrature amplitude modulation 16QAM,like all modulation schemes QAM conveys data by changing some aspect of a carrier signal.

The advantage of using the 16-QAM is that it is a higher form of modulation which makes it able to carry more bits of information by symbol.

In the following figure (figure 4) we will show the bit error ratio(BER) of the 16-QAM with respect to the signal to noise ratio (SNR).

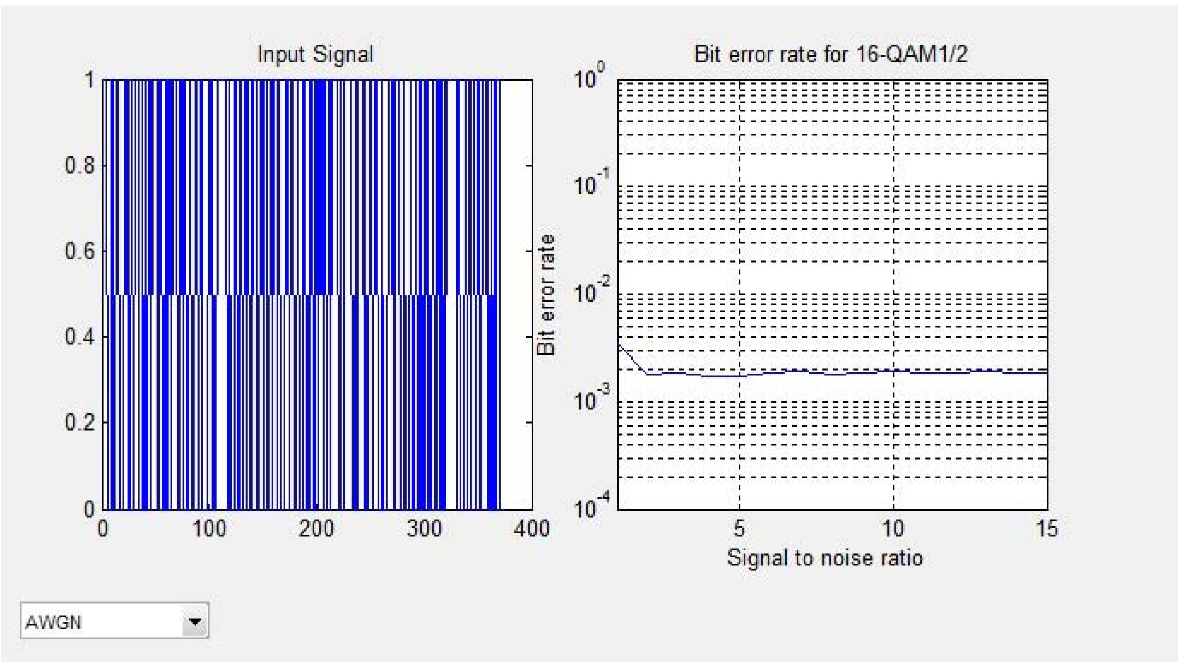

Figure 4 : (BER) of 16-QAM using (AWGN)channel

c) (64-QAM) Bit error ratio

The third modulator we examine is called 64 Quadrature amplitude modulation it is used for digital cable television and cable modem application, the mandated schemes is used for digital cables as standardized by the SCTE,64-QAM can be also used for digital video broadcasting.

But above of all that we are more concern about the bit error ratio of the 64-QAM ,as it is known the 64-QAM can take up to 8 channels some classified it as a better modulator.

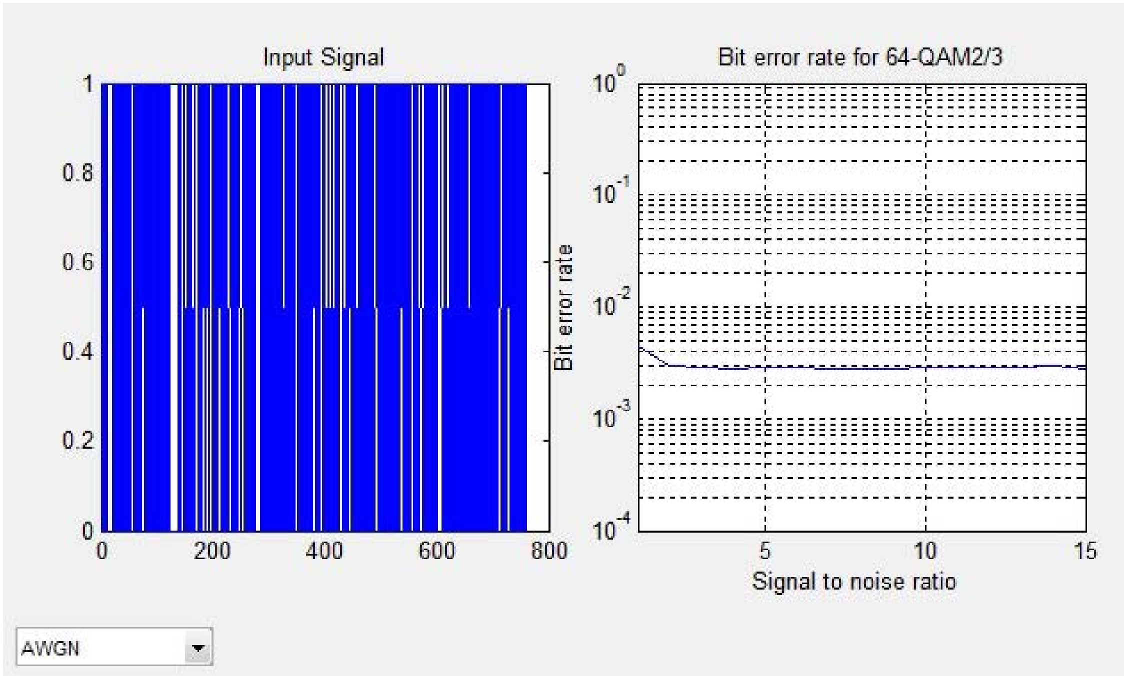

Figure 5 : (BER) of 64-QAM using (AWGN)channel

However, it must also be noted that when using a modulation technique such as 64-QAM, better signal-to-noise ratios (SNRs) are needed to overcome any interference and maintain a certain bit error ratio (BER).

A simple Table to brief the results

Modulator	Bit Error Ratio	Signal to noise ratio
QPSK	10^{-3}	10^{-4}
16 QAM	10^{-2}.6	10^{-4}
64 QAM	10^{-2}.5	10^{-4}

IV. Result and Discussion

a. QPSK shows less error rate in different channels, it is considered as less noise and interface.

Here we show the three channels and their impact on the QPSK modulator.

As we can see in figure 7,8 and 9 the AWGN in figure 7 has shown less error rate if compared to the other channels.

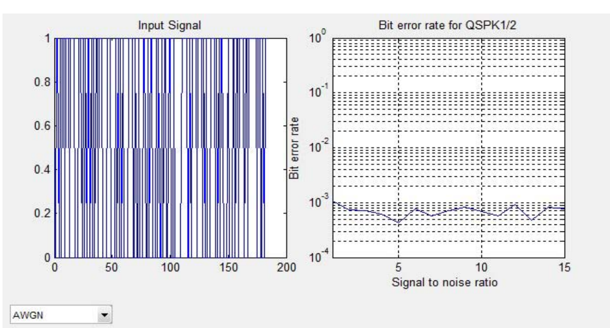

Figure 7 : QPSK using AWGN channel

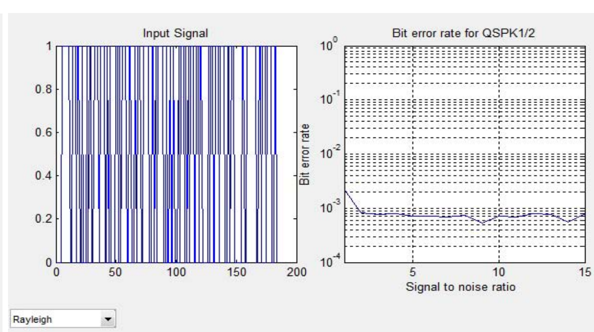

Figure 8 : QPSK using RAYLEIGH channel

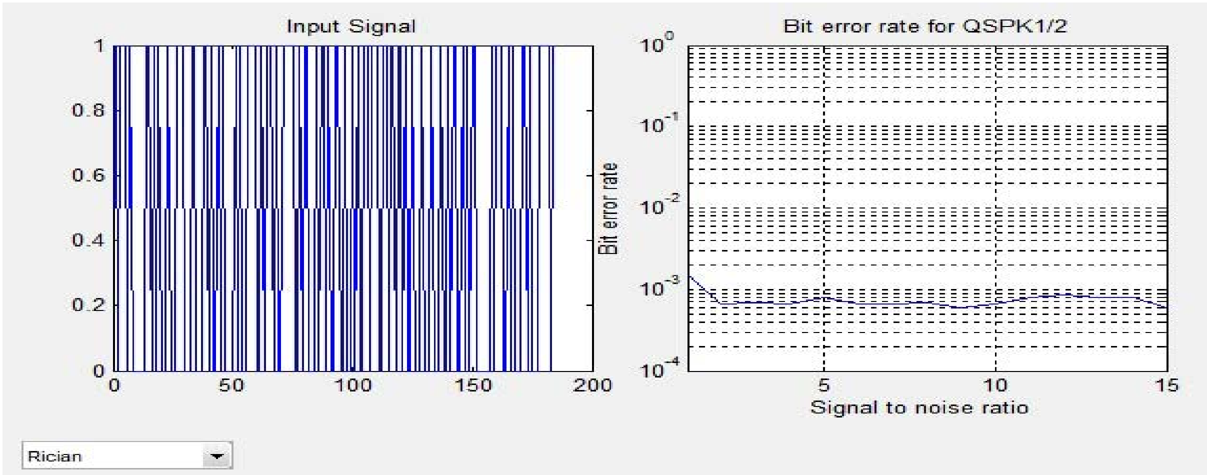

Figure 9 : QPSK using RICIAN channel

b. Here we show 16-QAM Bit error ratio with three different channel, as we can see there is a slight different among the three output which does not necessary effect in the transmission of data.

As a result of this simulation process we can see clearly that all channels can be used according to our need where our process should not be effected.

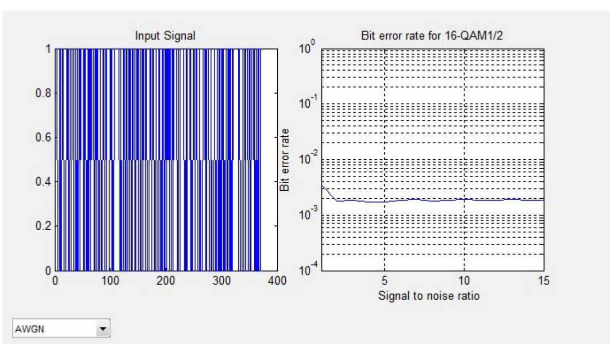

Figure 9 : 16-QAM using AWGN channel

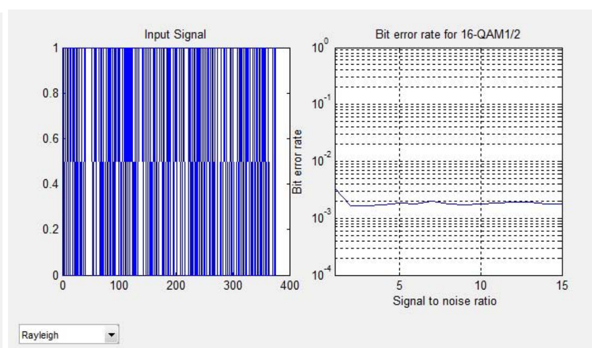

Figure 10 : 16-QAM using Rayleigh channel

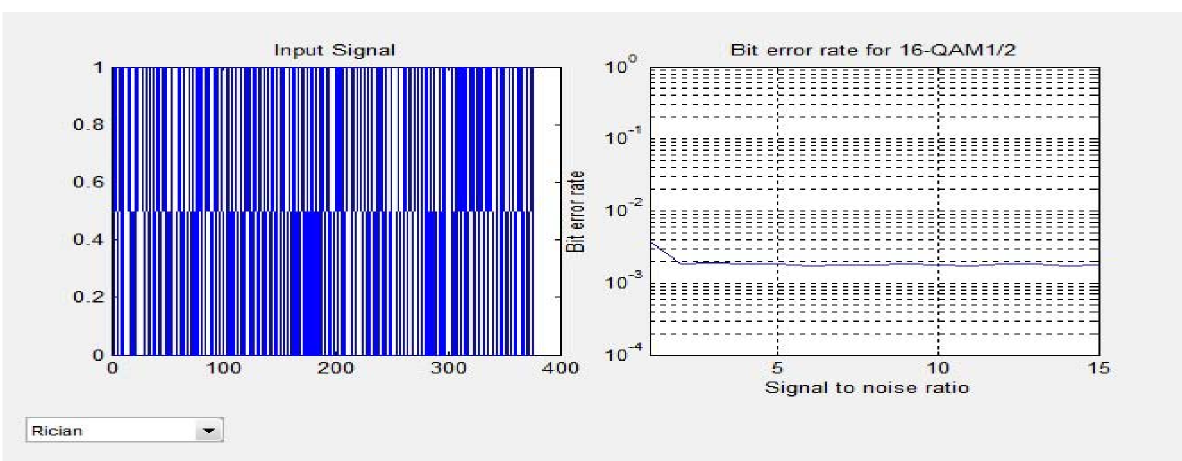

Figure 11 : 16-QAM using Rician channel

c. 64-QAM

The 64-QAM has the ability to take up to 8channels but it gives less bandwidth comparing with the 16-QAM,but in the other hand the quality of picture for example in the 64-QAM is better than the 16-QAM.

In the following figures we can notice that no differences in any of the BER using the three channel which indicates the possibility of using any of them.

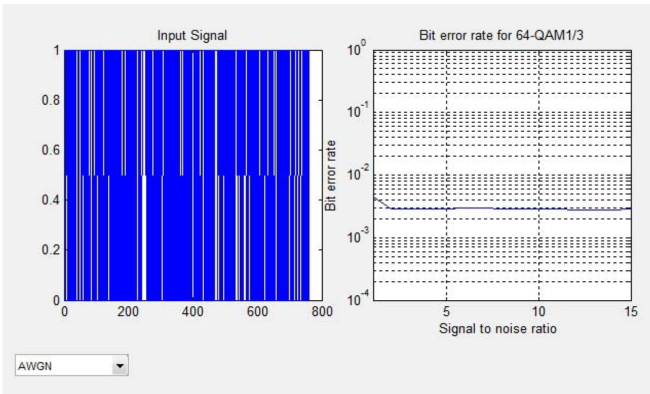

Figure 12 : QPSK using AWGN channel

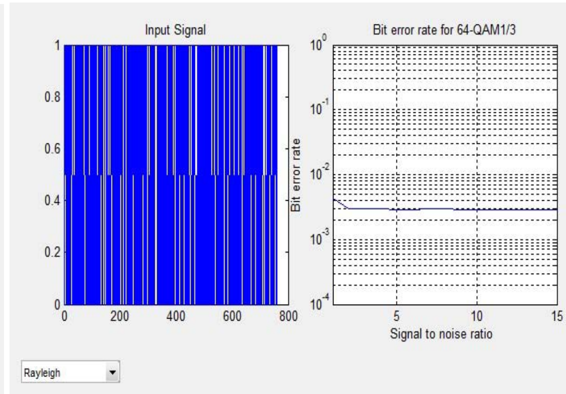

Figure 12 : QPSK using RAYLEIGH channel

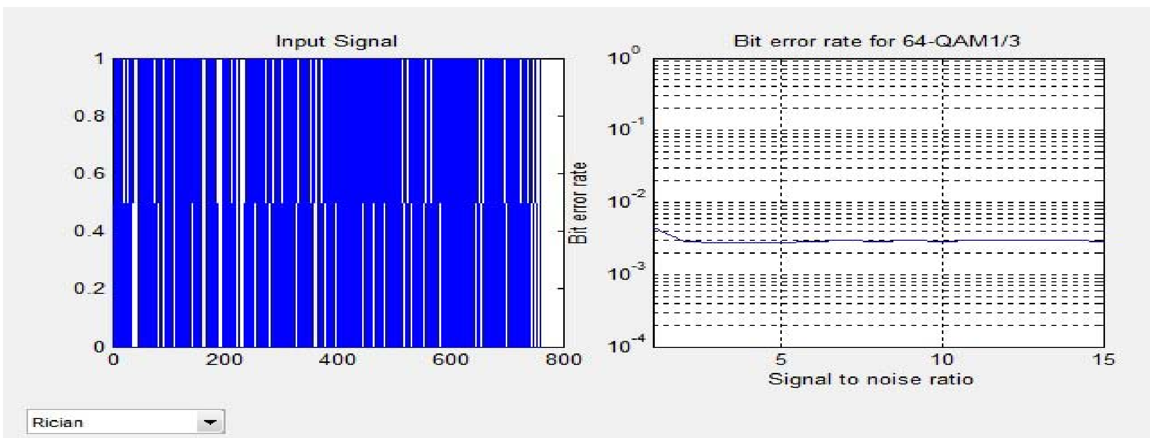

Figure 12 : QPSK using RICIAN channel

V. Conclusions

In this paper we have presented a new graphical user interface design(GUI) of the ieee 802.11 Physical layer, this design illustrate the Bit error ratio of three different modulators to show each impact on the digital data transmission with the measurement of the SNR signal to noise ratio.

We have used the Matlab tool GUI to build the physical layer and simulate the three modulators.

The 16-QAM has shown quite bit different from the 64-QAM in the sense of BER to SNR where QPSK has shown better quality and improvement in the number of the bit error ratio.

We have also discussed and shown the results of the 16-QAM,64-QAM and QPSK using three different channels AWNG,RAYLEIGH and RICIAN each one operated separately in order to see how the channel will effect on the BER of the modulator used in the transmitter.

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