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Design and Implementation of Multiple Access techniques Addressing Performance Issues in Data Encoding Techniques for Text Messages

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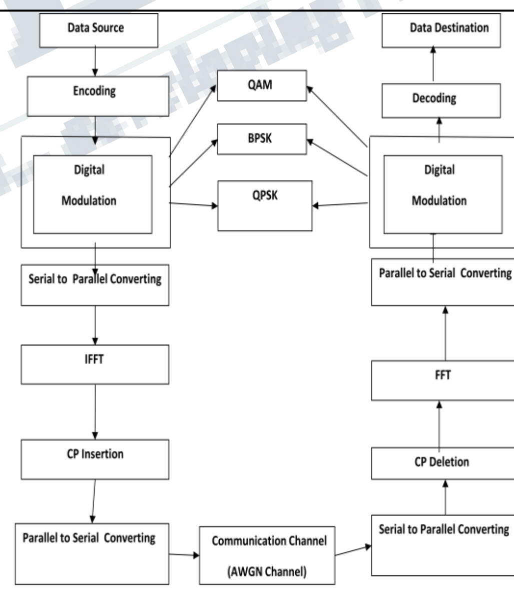
***Abstract*— Orthogonal Frequency Division Multiplexing (OFDM) is a multi-carrier transmission technique in which single data with higher rate is partitioned into multiple lower rate data streams to exhibit the parallelism and orthogonality. Modulation technique is one of the important hand tools in OFDM based wireless communication system. In order to improve the OFDM based wireless communication system, it is better to design an efficient modulation technique for achieving efficient Area, Delay, and Power. Thus different types of modulation techniques such Quadrature Amplitude Modulation (QAM), Quadrature Phase Shift Keying (QPSK) modulation; Binary Phase Shift Keying (BPSK) modulation and M-ary PSK for different bits are proposed in this project. In order to reduce the AWGN noises in OFDM signal, an efficient encoders and decoder such as Hamming encoder and hamming decoder are proposed in this project. Performance measurement of this project is analyzed in terms of Lower power consumption, high speed and less area utilization.**

***Index Terms*—BPSK, FPGA, OFDM, QAM, QPSK, VLSI**

I. INTRODUCTION

Our main purpose is to send text messages from transmitter to receiver block through various modulation techniques like QAM, QPSK and BPSK. By doing this we also analyze the delay and area utilization of each technique.OFDM transmitter and receiver is implemented by verilog HDL coding and hardware implementation is done by using Spartan 3 FPGA.OFDM code block is given below introduced [1]. It provides both edge and texture information of the object.



II. FPGA HARDWARE

A field programmable gate array is an integrated circuit which is designed to be configured by a user. It is specified using hardware descriptive language (HDL). Here we are using the

Spartan 3 family FPGA model XC3S200. We will be using Xilinx 10.4 software which downloads the code to the FPGA kit. We have written separate code for each coding blocks of the OFDM module.

III. MODULATION TECHNIQUES.

We have 3 modulation techniques used here: QAM, QPSK, BPSK.We check which method is efficient.

A. Binary Phase Shift Keying (BPSK)

BPSK (also sometimes called PRK, Phase Reversal Keying, or 2PSK) is the simplest form of phase shift keying (PSK). PSK utilizes a finite number of phases and each assigned a unique pattern of binary digits. Customarily, each phase encodes an equal number of bits. BPSK is a simple but significant carrier modulation scheme. It utilizes 2 phases which are disunited by 180° and so can additionally be termed 2 - PSK. As shown in the constellation diagram binary 1 and binary 0 are represented by different carrier phases each is 180 degree apart. The simplest BPSK scheme uses two phases to represent the two binary digits and is known as binary phase-shift keying. BPSK modulation technique is utilized in most of the adaptive modulation technique adopted in cellular communication.

B. Quadrature Phase Shift Keying (QPSK)

QPSK is an expanded version from binary PSK where in a symbol consists of two bits and two orthonormal basis functions are used. A group of two bits is often called a 'dibit'. So, four dibits are possible. QPSK is bandwidth efficient as each signal point represents two bits. For example, instead of a phase shift of 180 degree, as allowed in BPSK, a common encoding technique, known as QPSK uses phase shifts of multiples of 90 degrees i.e. pi by 2. QPSK can encode two bits per symbol with 4 possible phases as shown in the diagram with gray coding to minimize the bit error rate (BER), sometimes misperceived as twice the Bit error rate (BER) of BPSK. Based on the analysis it shows that by maintaining the same bandwidth (BW) of the signal, QPSK can be utilized either to double the data rate compared with a BPSK system or to sustain the data-rate of BPSK but halving the bandwidth needed. In this latter case, the bit error rate of QPSK is precisely identically tantamount to the BER of BPSK and deciding differently is a prevalent perplexity when considering or describing QPSK.

C. Quadrature amplitude modulation

Quadrature amplitude modulation (QAM) is both an analog and a digital modulation scheme. It conveys two analog message signals, or two digital bit streams, by changing (*modulating*) the amplitudes of two carrier waves, using the amplitude-shift keying (ASK) digital modulation scheme or amplitude modulation (AM) analog modulation scheme. The two carrier waves of the same frequency, usually sinusoids, are out of phase with each other by 90° and are thus called quadrature carriers or quadrature components — hence the name of the scheme. The modulated waves are summed, and the final waveform is a combination of both phase (PSK) and amplitude-shift keying (ASK), or, in the analog case, of phase modulation (PM) and amplitude modulation. In the digital QAM case, a finite number of at least two phases and at least two amplitudes are used. PSK modulators are often designed using the QAM principle, but are not considered as QAM since the amplitude of the modulated carrier signal is constant. QAM is used extensively as a modulation scheme for digital telecommunication systems. Arbitrarily high spectral efficiencies can be achieved with QAM by setting a suitable constellation size, limited only by the noise level and linearity of the communications channel.

IV. SIMULATION SOFTWARE

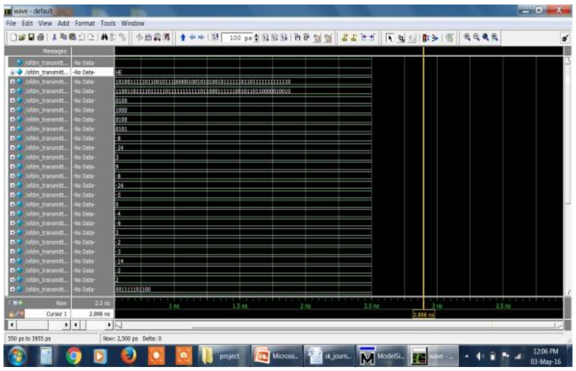
Here we are using Modelsim XE III 6.3C software to show the simulation outputs of the transmitted text bit. We have written separate coding for each coding block. The text bit is in ASCII code and we have to convert it into binary bits. We are using text bits "HE" for which the binary bits is "0100100001000101".Below are the steps to run the simulation:

- Open the simulation software.
- File>new>project>Enter project name>copy the address of the code files>ok.
- Add existing files>select all files>open.
- Compile all the codings.
- Then click simulate>select te transmitter coding>open.
- Right click the transmitter>add to wave.
- Assign the reset value to 0>runthe simulation.
- Again assign the value of reset to 1>simulate.
- Now the output of transmitter is given as the binary value of "HE">we can also see the ASCII value by changing the binary to ASCII.
- Now Real and Imaginary values in transmiiter are given.
- These binary values need to be given while doing the receiver simulation.
- We have predefined these values in the receiver programming instead of manually programming while simulation.
- Then we repeat the steps for receiver.
- In receiver we assign two values: enable and reset.
- Then we get the text bit in ASCII format.

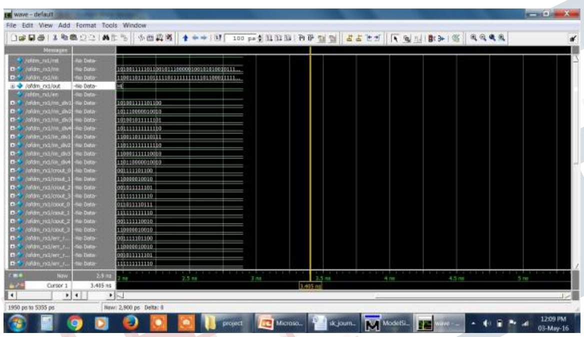
- We also get the hamming code values.

V. SIMULATION ANALYSIS

After using the simulation software we get the simulation outputs given below:



Transmitter Output



Receiver Output

In the transmitter side we give the text bit predefined in the coding itself. The transmitter outputs are RIN and IIN for which binary bits are of real and imaginary values.

In receiver simulation we have enable and reset as inputs along with RIN, IIN values of the transmitter. After receiver simulation we get the text bit along with the hamming code values for the corrected bits.

VI.HARDWARE ANALYSIS

After the simulation tool we have designed hardware for displaying the text bit. The given text will be in ASCII.But the fpga kit can only accept the binary values. So here also we convert the text bit into binary form and use the same coding used for the simulation.

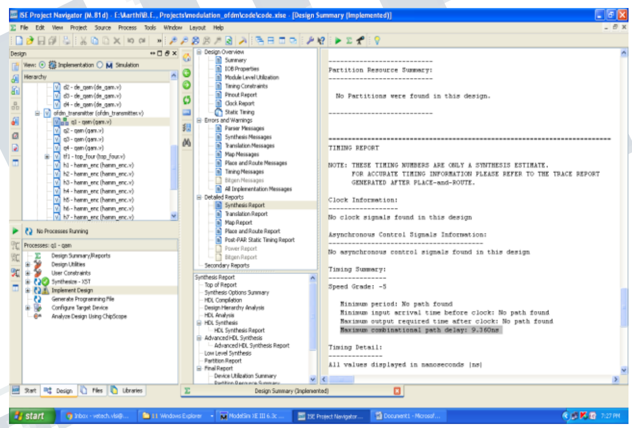
We are using Xilinx 10.4 software for programming our FPGA kit. We have to assign some values for the FPGA connectors used in the process. After assigning the values we have to download the program from the computer to the FPGA kit.

The binary values of the text bit will be displayed in the LED bulbs provided in the kit.

VII OUTPUT

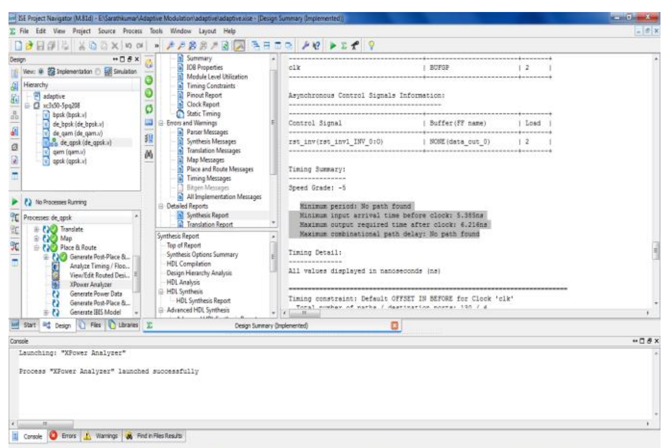
After the hardware outputs we compare the values of the modulation techniques we used. We compare parameters such as delay time, area and power of the modulation techniques.

Below given the comparison:

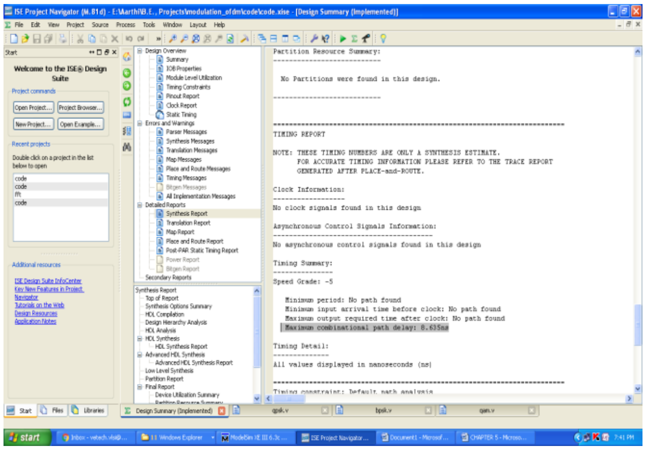


QAM

The delay time is 9.36ns.



QPSK



BPSK

VIII.CONCLUSION

On comparing three modulation techniques we found that QAM is more efficient because it can be used for high speed data communication. Its delay speed is 9.36ns; power consumption is 0.242W and thermal temperature of 34^0C. We have also performed the simulation analysis by transmitting the text bit without any errors as the error were corrected by the hamming encoders we used.

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