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"Implementation of a Digital Communication System Using VHDL"

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Abstract

Main aim of our paperwork is to study, we are proposing an idea to simulate basic modulation methods (ASK, PSK, FSK) on a single FPGA chip with the help of VHDL. The code will be generated with the help of Xilinx.

***Keywords*—ASK, PSK, FSK, VHDL**

I. INTRODUCTION

In this study, basic modulation methods are coded with the help of AMI (alternate Mark Inversion) code. All the methods are having their own importance in different area of communication system. The application of the whole system is that it is utilized in computer networking equipment such as modems (1940), local area networks (LAN) adapters (1964), repeaters, hubs, microwave links, wireless network
access points (1997), etc. Amplitude shift keying (ASK) is data transfer technique with different amplitude of carrier frequency. Although it is sensitive to propagation channel variation, ASK modulation has been widely used in low-power wireless transceiver for system simplicity.

II. BLOCK DIAGRAM

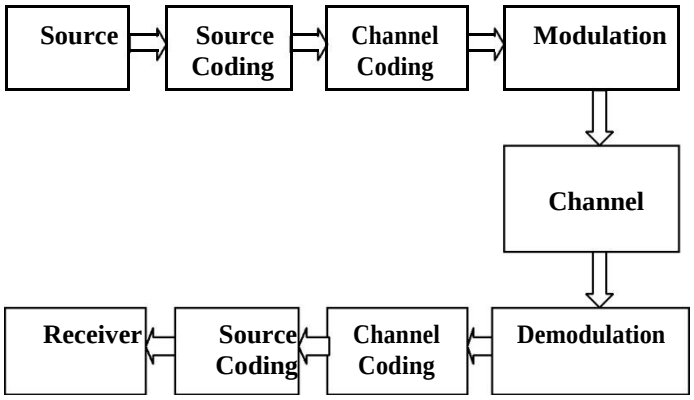

Figure1. Block Diagram of Communication System

Here is the block diagram of digital communication system, which consists of source, source coding, channel coding, process of modulation, channel, process of demodulation, channel coding, source coding block and a receiver unit.

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III. WORKING

The basic building block diagram of a communication system is shown above. Source provides the information to be transmitted. Source Coding is the process of compressing the data efficiently. Source coding is thereby used to send only that portion of a frame which is being changed and not the useless information. Channel coding involves the addition of redundant bits to a message signal or in other words it is use for correction of errors in the message signal if any. Hamming code it the best example of Channel Coding. Modulation is the process of varying properties of a periodic waveform, called the carrier signal, with a modulating signal which typically contains information or message to be transmitted. Mainly the three parameters phase, frequency and amplitude are the three parameters modified in the process of modulation. It is the process of conveying a message signal, for example a digital bit stream or an analog audio signal, inside another signal that can be physically transmitted. Channel is a physical transmission medium such as wire or to a logical connection over a multiplexed medium such as a radio channel. It is used to convey an information signal, for example a digital bit stream from sender (or transmitter) to receiver. A channel has a certain capacity for transmitting information, often measured by its bandwidth in Hz or its data rate in bits per second. Demodulation is the act of extracting the original information- bearing signal from a modulated carrier wave. The device mainly used is a demodulator for performing the action. It is used to recover the information content from the modulated carrier wave. Modem is the device where both the process modulation and demodulation of the information is simultaneously occurring. Demodulator is the device used in this process of demodulation. Receiver is a physical device which receives the signal or collects the information or message signal which was transmitted by transmitter or source.

IV. METHEDOLOGY

Phase-shift keying (PSK) is a digital modulation scheme that conveys data by changing, or modulating, the phase of a reference signal (the carrier wave). Wireless LAN uses a variety of different PSKs depending on the data-rate required.

By using different techniques of modulation (BPSK, DPSK), it is also useful in Bluetooth and satellite applications.

Frequency-shift keying (FSK) is frequency modulation scheme in which digital information is transmitted through discrete frequency changes of a carrier wave. The simplest FSK is binary FSK (BFSK). BFSK uses a pair of discrete frequencies to transmit binary (0s and 1s) information. With this scheme, the "1" is called the mark frequency and the "0" is called the space frequency.

In all of the above methods, each of these phases, frequencies or amplitudes are assigned a unique pattern of binary bits. Usually, each phase, frequency or amplitude encodes an equal number of bits.

VHDL (VHSIC hardware description language) is a hardware description language used in electronic design automation to describe digital and mixed-signal systems such as field-programmable gate arrays and integrated circuits.

With the help of VHDL we program a design on a FPGA chip of different modulation methods.

V. SOURCE CODING TECHNIQUE

The Coding technique we are using to design this system is Alternate Mark Inversion (AMI). The code AMI (Alternate Mark Inversion-Inversion alternating marks) is a source for binary transmissions. It can be defined as a bipolar code with return to zero with some particularities which are described below. In this code, when assigning a positive impulse to the first "1", the next "1" is assigned a negative pulse, and so on. Therefore, allocated alternately positive and negative impulses to the "1" logic. Moreover, because of the return to zero type, during the second half of the bit interval of zero voltage is used to represent "1". It is a ternary line coding for transport of digitized data. AMI example: here is the relationship demonstrated between input data, the clock and the encoded signal. The encoded bit sequence is “1000010000000011010”. It is believed that the previous '1 'has been encoded as a negative pulse Ternary want in this case to say that in this code three signal values are used (- , 0and +) to the two possible values of the bit to be coded. A 'logical' 0 is used as a physical 0 coded, and a 1 is varied by a + and a - (a "Mark") is encrypted. This will prevent a direct current component is created.

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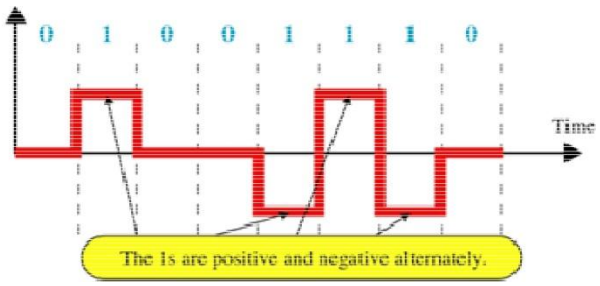

Figure2 AMI Coding Waveform

VI. Expected Result

By developing algorithm for the whole communication system and implementing it on a FPGA chip system will perform the operation as expected.

VII. Conclusion

By preparing this study paper we studied the applications of all the modulation methods in different field of communication system and many others. So we concluded all the brief information regarding different modulation methods and AMI coding technique and its usage.

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