RECEPTION OF AUDIO AND VIDEO SIGNAL USING SQUARE WAVE FREQUENCY MODULATION

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Dedicated especially to my Father, Mother, my brothers, my beloved mate and my truly friends.

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ABSTRACT

This project is referred to design a system that will receive audio and video signal using square wave frequency modulation. It is invented to receive the signal from source using optical fibre system. Optical fibre, where it is a communication through glass or plastic fibres has several advantages over conventional metallic transmission medium. Optical fibre has greater information capacity due to the inherently wider bandwidths available with optical frequencies. Besides, the optical fibre mediums are immune to the crosstalk. This is because glass and plastic fibre are non-conductors of electrical current. Another advantage of this medium is the immunity to static interference. The non-conductor materials again distinguish the static noise that due to electromagnetic interference (EMI).

ABSTRAK

Projek ini merujuk kepada pembinaan sebuah system penerima bagi isyarat video dan audio yang menggunakan modulasi frekuensi segi empat (SWFM). Ia berupaya untuk menerima isyarat dari penghantar dengan menggunakan system fiber optik. Fiber optik merupakan sistem komunikasi yang menggunakan medium plastic fiber atau gelas kaca mempunyai banyak kelebihan berbanding sistem penghantaran biasa yang menggunakan medium berlogam. Fiber optik yang mempunyai kapasiti informasi yang lebih tinggi berpunca daripada panjang gelombang yang lebih luas. Selain itu medium fiber optik juga kalis gangguan isyarat yang wujud kerana gabungan tidak sengaja terjadi. Ini kerana kaca dan plastik fiber adalah penebat kepada arus elektrik. Kelebihan lain bagi medium ini adalah kebal kepada gangguan tidak berubah. Bahan penebat kepada arus elektrik ini sekali lagi tidak mengalami gangguan tidak berubah yang berpunca daripada gangguan elektromagnetik (EMI).

TABLE OF CONTENT

LIST OF TABLE

LIST OF FIGURE

LIST OF ABBREVIATION

AC	-	Alternating Current
AM	-	Amplitude Modulation
EMI	-	Electromagnetic Interference
FDM	-	Frequency Division Multiplexing
FM	-	Frequency Modulation
IC	-	Integrated Circuit
MUX	-	Multiplexer
PAL	-	Phase Alternating Line
PM	-	Phase Modulation
SECAM	-	Sequential Colour with Memory
SWFM	-	Square Wave Frequency Modulation
TDM	-	Time Division Multiplexing
WDM	-	Wavelength Division Multiplexing
BPF	-	Band Pass Filter
LPF	-	Low Pass Filter
APD	-	Avalanche Photodiode
PLL	-	Phase Locked Loop
VCO	-	Voltage Controlled Oscillator
FO	-	Fibre Optic

CHAPTER I

INTRODUCTION

This chapter is about the project introduction, project objective, problems statement, scope of work and short methodology.

1.1 Application Background

The importance of communication systems can hardly be overestimated. Communication systems, such as TV, radio, fixed and mobile telephony, and the Internet, are essential in modern society. Efficient, rapid transmission of information reduces the need for energy-demanding transportation of paper and people, and can therefore reduce the negative impact on our common environment. Moreover, it is difficult to imagine a democratic society without efficient communication systems.

In the communication systems, there are transmitter and receiver. However, this research will only cover the receiver path where we will see the application of photo detector in optical receiver.

Figure 1.1 shows a schematic of an optical receiver. The receiver serves two functions: It must sense or detect the light coupled out of the fiber-optic cable and convert the light into an electrical signal, and it must demodulate this light to determine the identity of the binary data that it represents. The receiver performs the OE transducer function.

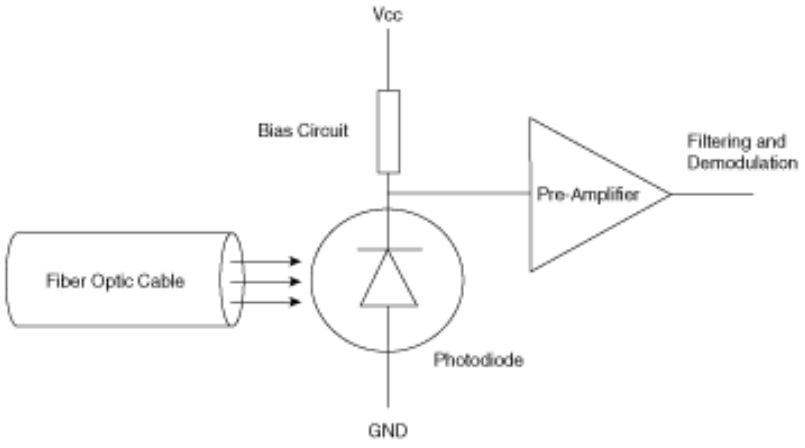

Figure 1.1 Schematic of an Optical Receiver

The receiver schematic in Figure 1.1 shows a photodiode, bias resistor circuit, and a low-noise pre-amp. The output of the pre-amp is an electrical waveform version of the original information from the source.

To the right of this pre-amp are an additional amplification, filters, and equalizers. All of these components can be on a single integrated circuit, a hybrid, or discretely mounted on a printed circuit board.

There are two types of photodiode structures: positive intrinsic negative (PIN) and the avalanche photodiode (APD). In most premise applications, the PIN is the preferred element in the receiver. This is mainly due to fact that it can be operated from a standard power supply, typically between 5 and 15V.

APD devices have much better sensitivity. In fact, APD devices have 5 to 10 dB more sensitivity. They also have twice the bandwidth. However, they cannot be used on a 5V printed circuit board. They also require a stable power supply, which increases their cost. APD devices are usually found in long-haul communication links and can increasingly be found in metro-regional networks (because APDs have decreased in cost).

The demodulation performance of the receiver is characterized by the BER that it delivers to the user. The sensitivity curve indicates the minimum optical power that the receiver can detect compared to the data rate, to achieve a particular BER.

The sensitivity curve varies from receiver to receiver. The sensitivity curve considers within it the SNR parameter that generally drives all communications-link performance. The sensitivity depends on the type of photodiode used and the wavelength of operation. Figure 1.2 shows sensitivity curve examples.

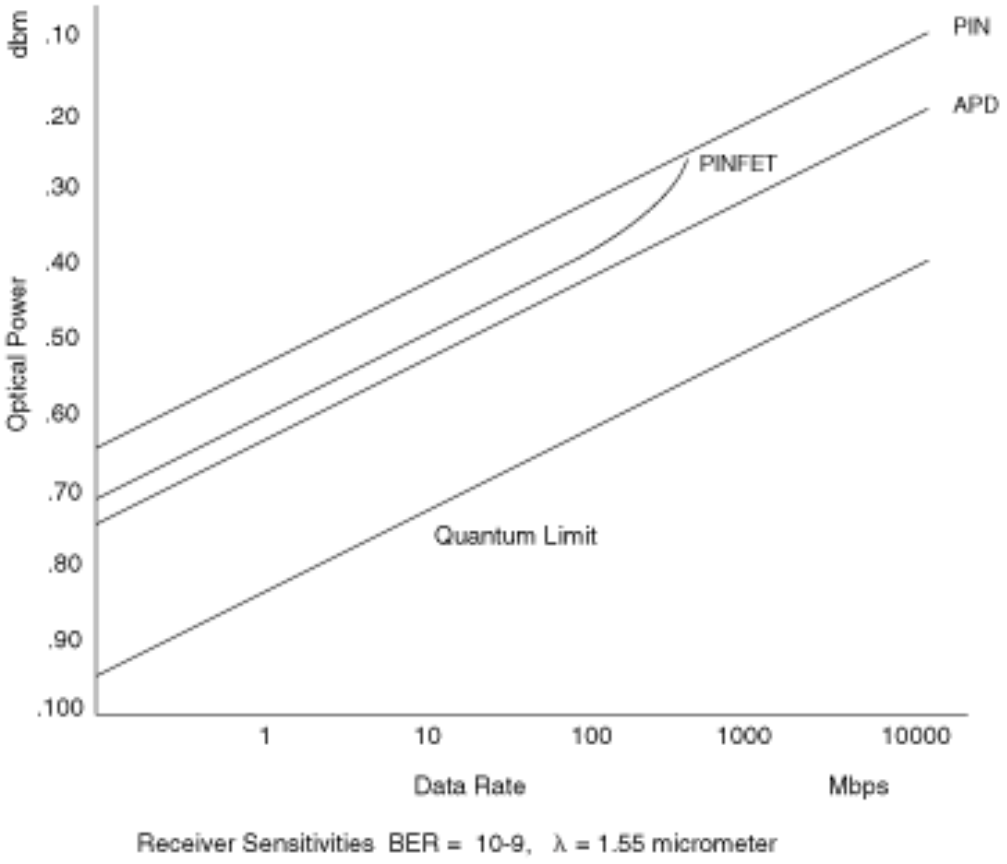

Figure 1.2 Receiver Sensitivity Curves

The quantum limit curve serves as a baseline reference. In a sense it represents optimum performance on the part of the photodiode in the receiver—that is, performance in which there is 100 percent efficiency in converting light from the fiber-optic cable into an electric current for demodulation. All other sensitivity curves are compared to the quantum limit

1.2 Project Objectives

The purpose of this project is to design a system for optical fibre reception of audio and video signal. It will be focusing on demodulation and separation of audio and video signal by using square wave frequency modulation.

The design of an optical receiver depends on the modulation format used by the transmitter. Since most light wave systems employ the binary intensity modulation, we will be focused on optical fibre receivers. We decided to implement and build a receiver for the reception of audio and video signal by using optical fibre as the transmission medium.

The main objectives that should be achieved at the end of this project are:

(a) To design system for optical fibre reception of audio and video signal.
(b) To modulate square wave frequency modulation (SWFM).
(c) To study performance of square wave frequency modulation (SWFM) technique for optical fibre transmission.

1.3 Problem Statement

Transmission audio and video signal using copper cable has many disadvantages. There is undesired phase shift which can distort chrome information in long transmission lines. Possibility of ground loops and reflections can be result from improper termination of coaxial distribution systems.

Besides that, signal quality degradation is usually caused by inferior electromagnetic interference (EMI) of metal wire cable lines. EMI is electromagnetic energy that causes undesirable responses, degradation, or completes system failure.

1.4 Scope of Work

There are several areas that being identified or considered in order to maintain the progress due to the objective of this project:

(a) Studied on the square wave frequency modulation or digital communication systems and its operation.

This method is focusing on studying the basic digital systems that use the application of fibre optic cable itself.

(b) Analyzed digital modulation and demodulation techniques (SWFM)

It is the important part in this project since it is one of the main objectives in this project.

(c) Application of Square to sine oscillator.

The digital application for this device, which that applied the process of generating the sine wave within the demodulation process.

(d) Filter application to normalised the signal

To differentiate the wave that transmitted to the receiver, this part will separate the signal to pull out the audio and video signal. The application of low pass filter and band pass filter take in charge in this process.

(e) Simulation the circuit by using the MULTISIM software

To sure the operational of the circuit, the simulation of the designed circuit is made before fabricating. From here we will troubleshoot any part of the circuit that seems to be affected of unwanted results.

(f) Design using PROTEUS 7 professional for PCB design

This software is used to convert the schematic design to PCB layout before the etching process.

1.5 Methodology

There are several phases involved in order to achieve the objective of this project and achieved the optimum results:

(a) Project Planning
(b) Literature Review
(c) Hardware Construction
(d) Finishing

The detail explanations of these phases continue on chapter 3.

CHAPTER II

LITERATURE REVIEW

This chapter will review research that has been done about the project, including theory and circuits related to the project.