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Studying The Quality of Transmitted Signal Via a Wireless and Wired Lines

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Abstract: A communication system refers to the process of exchanging information between two or more parties. Wired communication systems use physical cables or wires to transmit signals, while wireless communication systems transmit signals through the air without the use of physical cables. Both wired and wireless communication systems have their advantages and disadvantages, and the choice of system depends on the specific requirements of the application. In this research, a full compression between wired and wireless signals are discussed.

Keywords: :(optical, wire, wireless, control, system, communication).

Introduction

A communication system conveys information from its source to a destination some distance away. There are so many different applications of communication systems that we cannot attempt to cover type. Nor can we discuss in detail all the individual parts that make up a specific system.

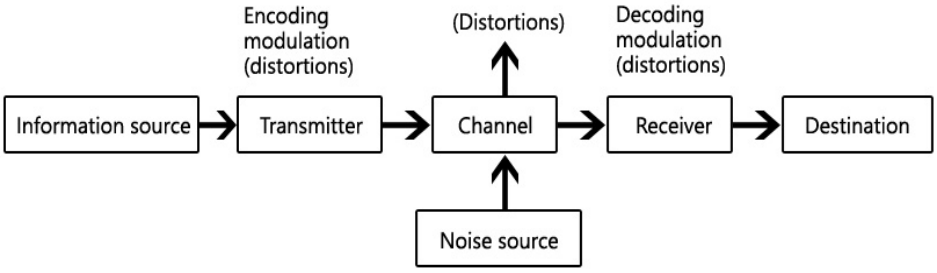

Figure 1: Functional block diagram of a communication system

The Transmitter. The transmitter converts the electrical signal into a form that is suitable for transmission through the physical channel or transmission medium.

The Channel. The communications channel is the physical medium that is used to send the signal from the transmitter to the receiver. In wireless transmission, the channel is usually the atmosphere (free space).

The Receiver. The function of the receiver is to recover the message signal contained in the received signal.

Optical communication system

optic communication is such as any communication system with one different where, this kind uses light pulses to transfer information from one point to another through communication channel.

In this kind of communication system, the transmission could be by two different ways, either using optical Fiber by means of wired communication medium as shown in figure.2 or letting the signal propagating in atmosphere direct to destination by means of wireless communication medium as figure.3.

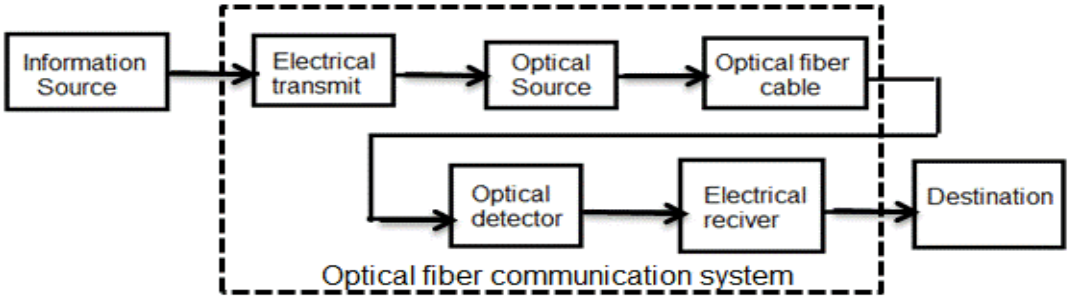

Figure2: Optical Fiber communication system

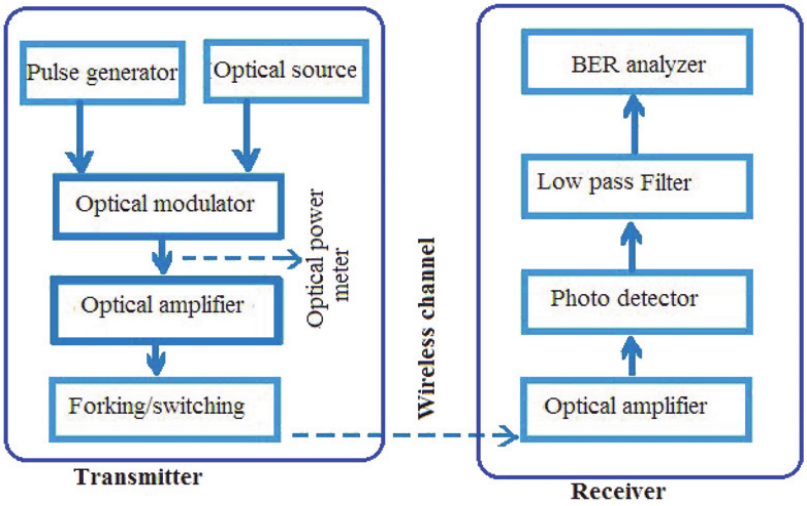

Figure 3: Optical wireless communication system.

The signal is transferred from an electrical signal into an optical form by using one kind of light either in both wire or wireless. As the signal transferred into optic and transmitted through one types of communication medium then the light detector plays great role, where the light detector is the device that converts the light into electrical signal or regenerate the optical signal back to its original signal (massage signal).

COMMUNCATION MEDIUM

The communication medium could be one of two ways whether wired which presented by optical fiber or wireless which represented in atmosphere.

Optical Wireless Communication

Wireless technologies are one of the great success stories in the history of technology, realizing the dream of humans to communicate from anywhere at any time. While voice communication was the primary service some ten years ago, wireless data and mobile Internet have become pervasive much more rapidly than anyone could have imagined and augmented voice communication experience with much richer multimedia content. Today, the term “wireless” is widely used as a synonym of radio frequency (RF) technologies as a result of the worldwide domination of RF devices and systems in the market. The RF band lies between 30 kilo Hertz (kHz) and 300 Giga Hertz (GHz) of the electromagnetic spectrum and its use is strictly regulated by the local and international authorities. In most cases, sub-bands are exclusively licensed to operators, e.g., cellular phone operators, television broadcasters, point-to-point microwave links etc. With the ever-growing demand for data heavy wireless applications and services, the demand for the RF spectrum is outstripping the supply, thus leading to the spectrum congestion. In the light of the spectrum bottleneck at both the network access and backhaul levels, the time has come to seriously consider the upper parts of the electromagnetic spectrum for wireless communications. By doing so, we move into the optical band which includes infrared (IR), visible (VL) and ultraviolet (UV) sub-bands, see Fig. 4.

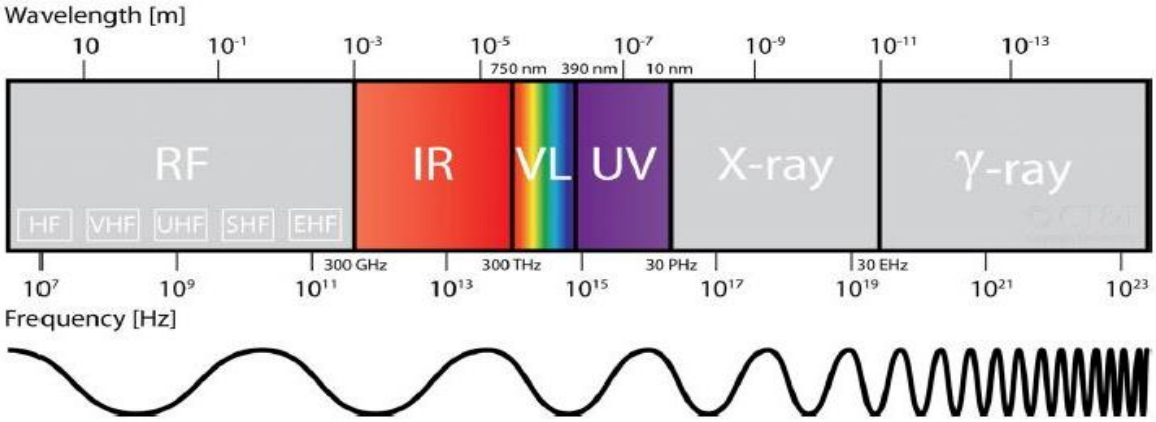

Figure 4: Electromagnetic Spectrum

Transmitter and receiver circuits

To study the wireless and wires signals, a transmitter and receiver circuits are applied. The transmitter circuit consists of four stages as shown on figure 5.

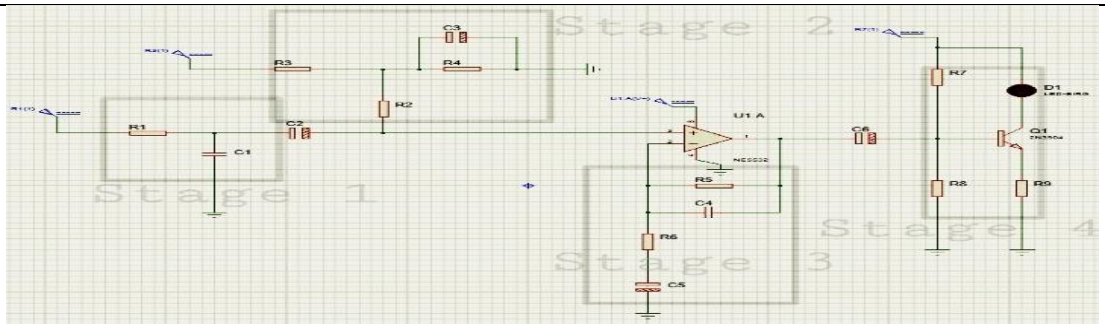

Figure 5: transmitter stages

The first stage in transmitter is low pass filter to pass frequencies blew 80KHz. Second stage (signal supply voltage) is alternative way to compensate the reverse bias for the op-Amp. Third stage is active band bass filter to pass frequencies between nearly 10Hz and16 KHz and amplify signal in this range. Where the R5 and R6 controlling the gain of op-amp and these resistors with C4 and C5 are controlled the frequencies cut off. Fourth stage is the last stage which are used to amplify the current which feeds LED, the current should deliver to LED.

The receiver circuit consists of two stages as in figure 5.

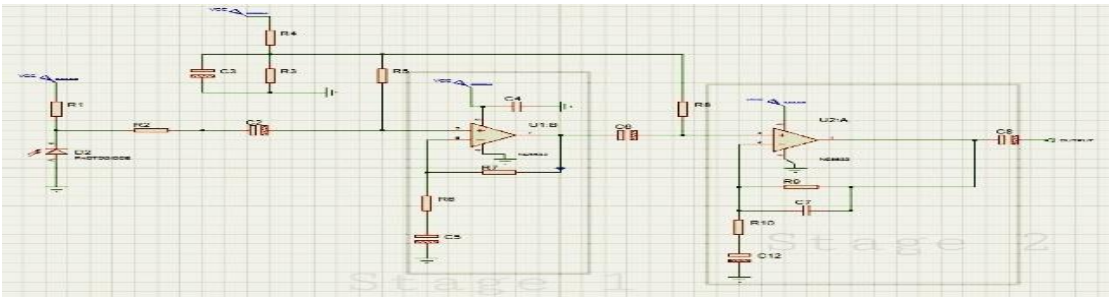

Figure 6: receiver stages.

The received signal is weak so, it needs to be amplified. The first stage would amplify the signal ten times where, R7 and R6 to control the gain of op-amp so, R7 should be ten times of R6. Second stage is band pass filter is used to pass frequencies in range 1.5 Hz to 16KHz. Where R9 and R10 controlling the gain of op-amp and these resistors with C7and C12 are controlled the frequencies cut off.

RESULTS

A sine wave with 1 KHz frequency and 50mVp-p is supposed as an input to check the implemented practical transmitter and receiver in lab and we get these results:

At transmitter:

The output at stage **1** (low pass filter):

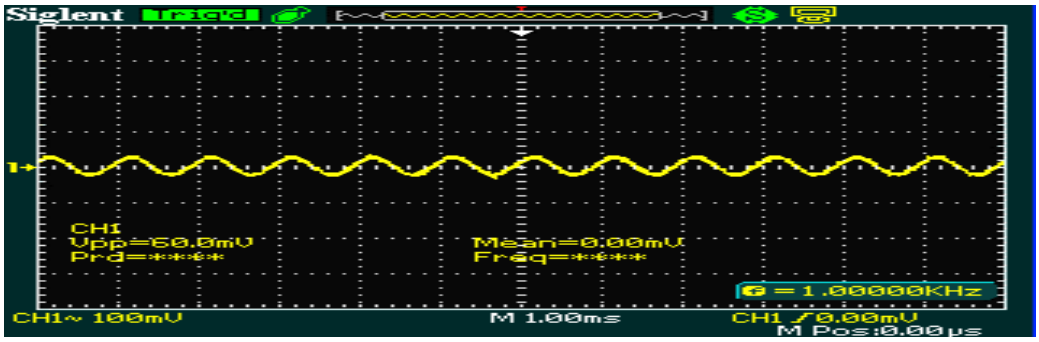

Figure 7: Reading at stage 1

$Amplitude\ in\ figure\ 7 = 60\ mV$

The output at stage **3**(amplifier):

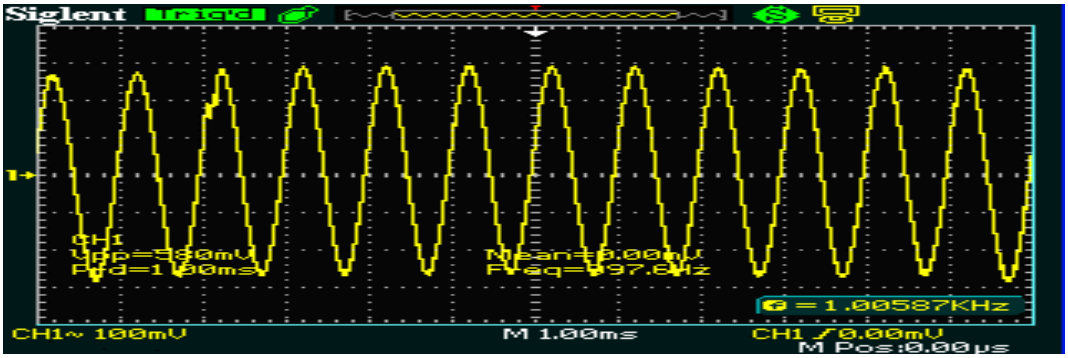

Figure 8: Reading at stage 3

$Amplitude\ \ in\ figure\ 8 = 580\ mV$

The output at stage 4(LED):

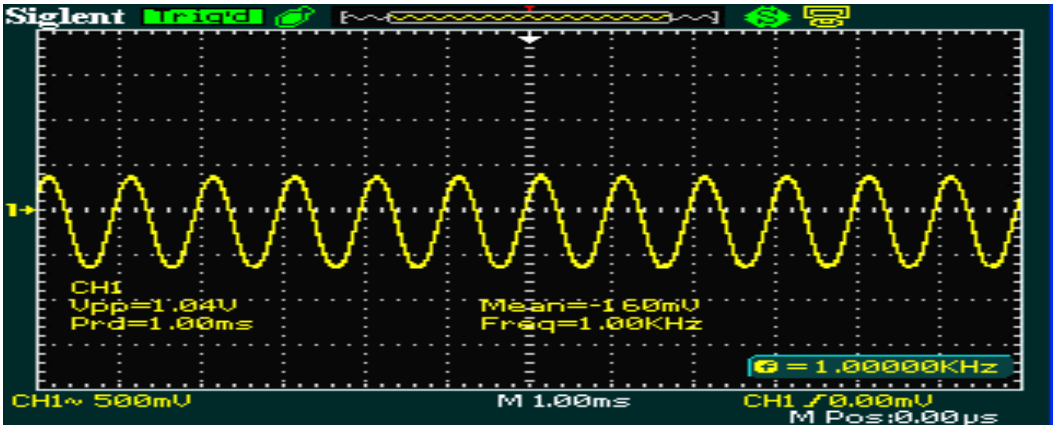

Figure 9: Reading at stage 4

$Amplitude\ \ in\ figure\ 9 = 1.04V$

At receiver:

The output before stage 1(amplifier):

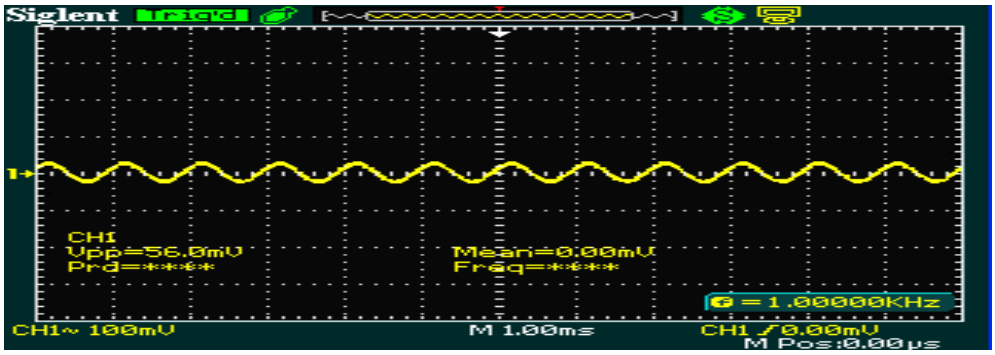

Figure 10: Reading before stage 1

$$Amplitude\ in\ figure\ 10 = 56\ mV$$

The output at stage 1(amplifier):

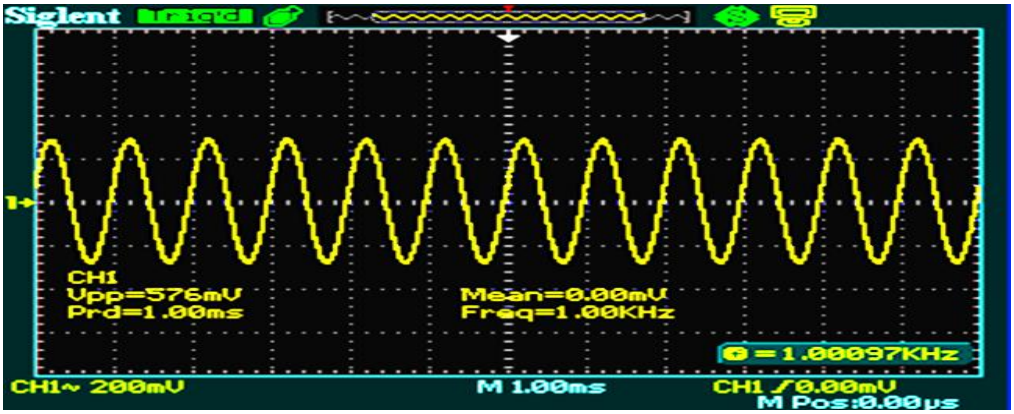

Figure 11: Reading at stage 1

$$Amplitude\ in\ figure\ 11 = 576\ mV$$

The output at stage 2(active band pass filter):

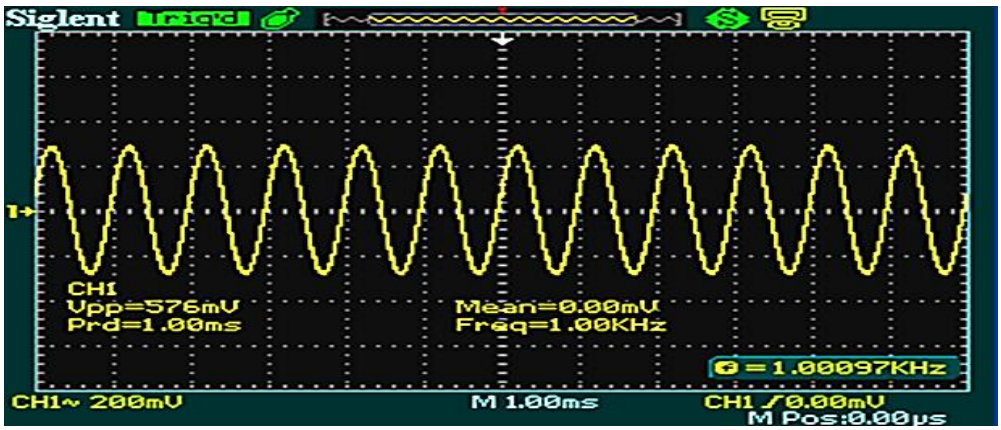

Figure 12: Reading at stage 2

$$Amplitude\ in\ figure\ 12 = 576\ mV$$

Using the whole circuit (transmitter and receiver) in wired (optical fiber) case at different lengths using the same check signal above we get the results below:

After distance 0.5 m:

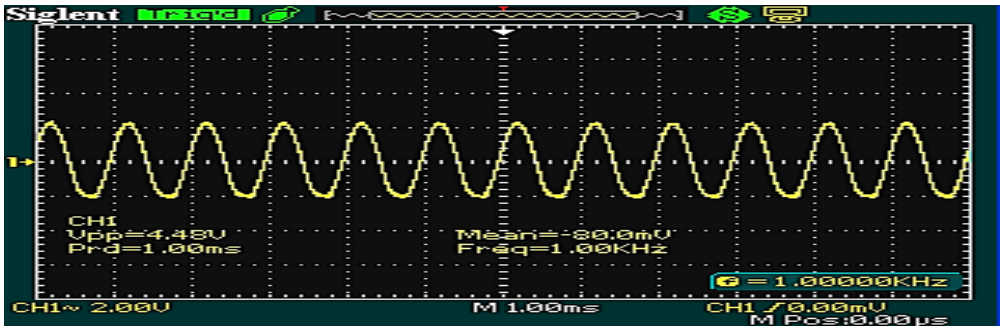

Figure 13: Output receiver after 0.5 m from transmitter by optical Fiber

$$Amplitude\ in\ figure\ 13 = 4.48V$$

After distance 1 m:

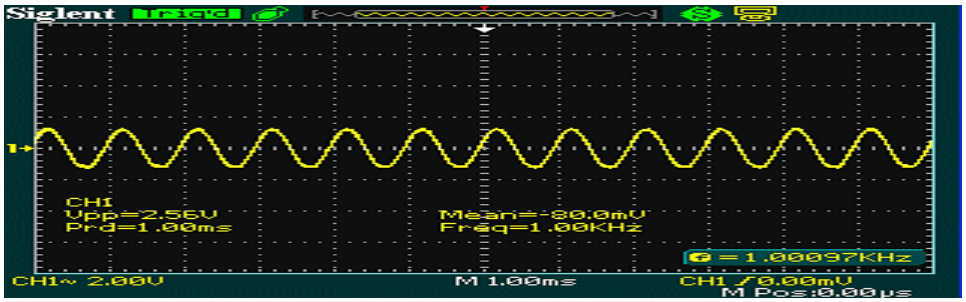

Figure 14: Output receiver after 1 m from transmitter by optical fiber

$$Amplitude\ in\ figure\ 14 = 2.56V$$

After distance 3 m:

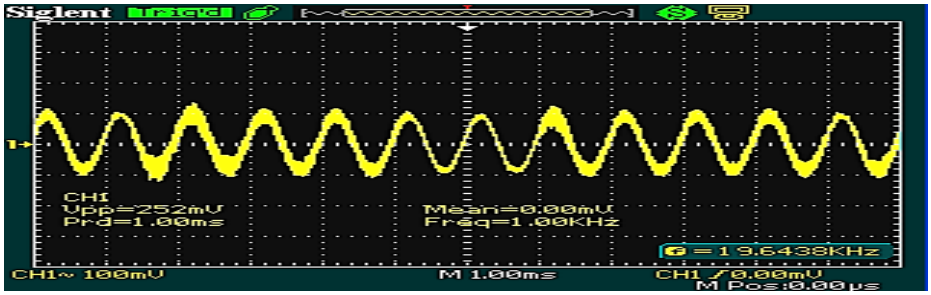

Figure 15: Output receiver after 3 m from transmitter by optical fiber

$$Amplitude\ in\ figure\ 15 = 252\ mV$$

After distance 0.1m:

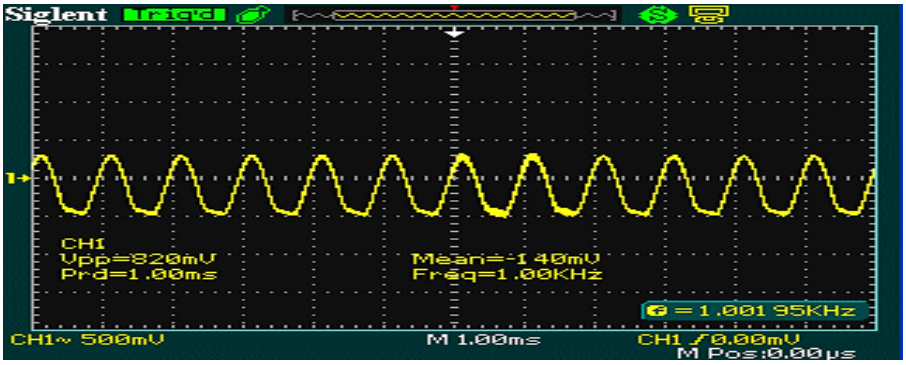

Figure 16: Output receiver after 0.1 m from transmitter by wireless

$$Amplitude\ in\ figure\ 16 = 820\ mV$$

Then using wireless channel (free space) and changing LED and photodiode types at different lengths and we get these results below:
After distance 0.1m:

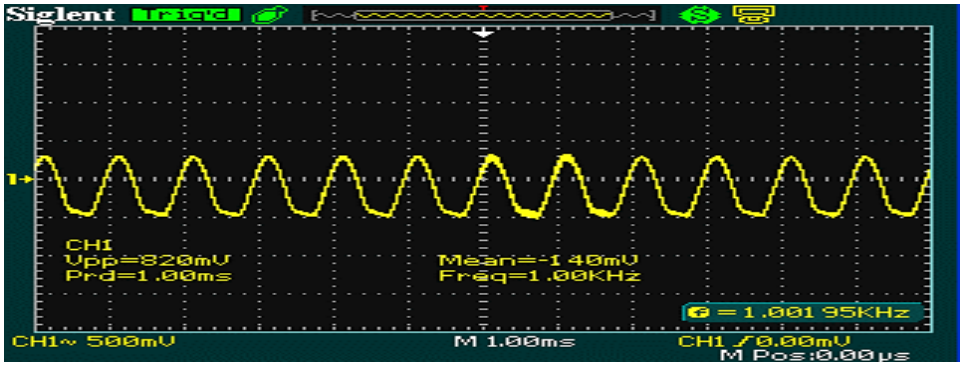

Figure 17: Output receiver after 0.1 m from transmitter by wireless

$$Amplitude\ in\ figure\ 17 = 820\ mV$$

After distance 0.5m:

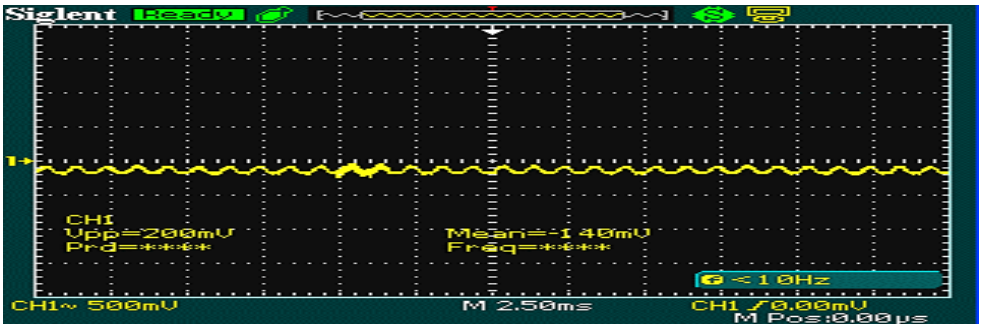

Figure 18: output receiver after 0.5 m from transmitter by wireless

$$Amplitude\ in\ figure\ 18 = 200\ mV$$

After distance 1m:

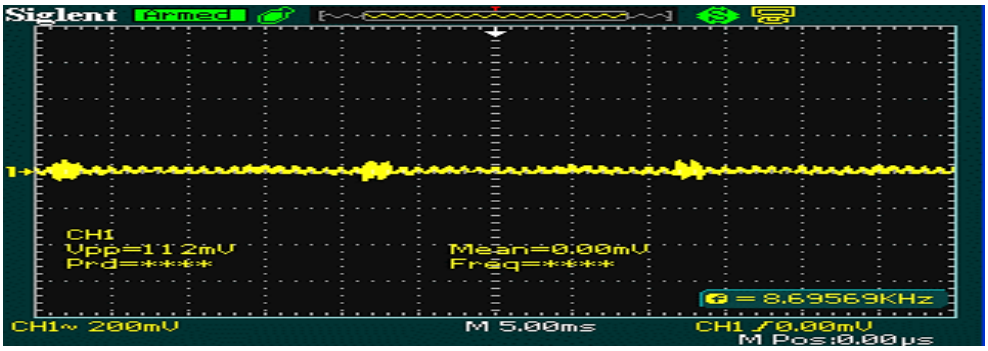

Figure 19: Output receiver after 1 m from transmitter by wireless

$$Amplitude\ in\ figure\ 19 = 112\ mV$$

Also, we sent voice signal on both medium and get these results:

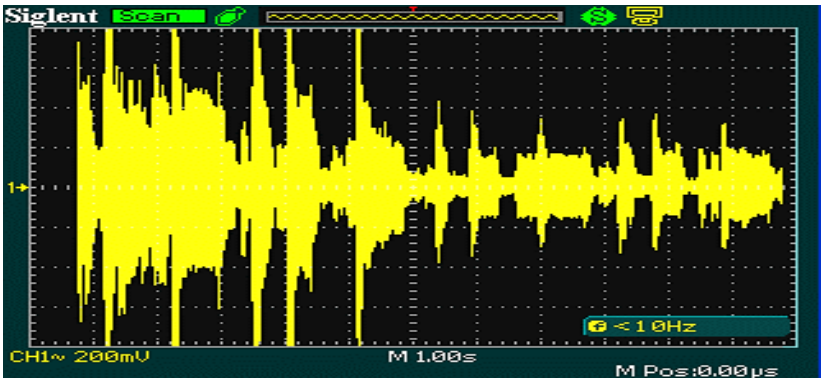

Figure 20: Input voice signal

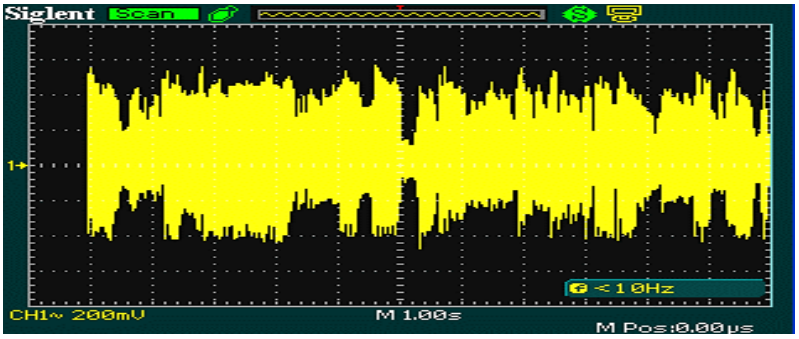

Figure 21: Output voice signal at 1m by optical Fiber

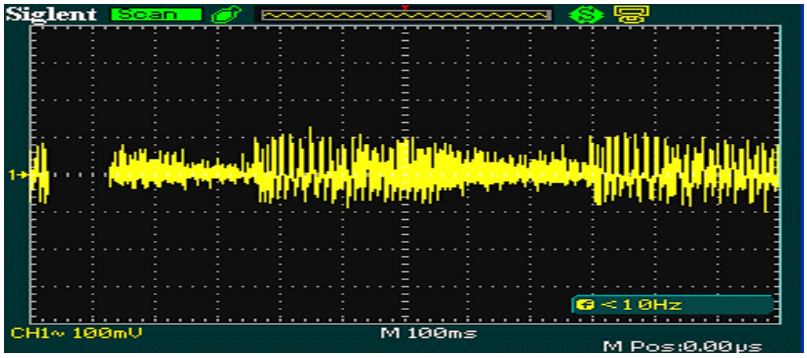

Figure 22: Output voice signal after 1m wireless

Conclusion

The transmitter and receiver electronic circuits have been built successfully and the main purpose of this project has satisfied effectively. Through also thru test and observes the circuits, they give robust results.

Signal degradation in optical Fiber depends on various parameters such as Fiber type, length of Fiber and wavelength. by using optical Fiber more efficient than wireless channel because it's noise less channel.

Many useful notes and deductions are concluded from this work, and could be summarized as follows:

1) The distance of optical fiber has a great effect on degrading the signal as noted from results.
2) From results, there is notable different in received signal when changing communication medium.
3) We have a prospect for practical use if the transmission distance is within about 3 meters for wired and 1.5 meters for wireless.
4) From the wired results we noted a bit of attenuation, and we discovered that is the results of the side cutter that we used. The side cutter that we used meant to be a cupper cable which is use not suitable for optical cables.

In final, this kind of simple circuits could be used in (Indoor application) due to its efficiency and low cost.

References

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