Data Transmission Analysis using MW-5000 at 5.8 GHz Frequency

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ABSTRACT

In the recent years, the data communication system become the main type of communication in the world. The FSK modulator or demodulator is one of the part that becomes the most important part and extremely advanced with the involvement of microwave active and passive circuits. This paper presents the data transmission analysis using MW-5000 at 5.8 GHz frequency. This experiment use the microwave communication module MW-5000 that is available in electronic laboratory. From this experiment the duration taken for the transmission of data is depend on the length of sentence and the value of baud rate.

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1. INTRODUCTION

In the recent years, the wireless communication system become the main type of communication in the world [1]. The field of Radio Frequency (RF) design is a growing one as a result of increased demand for wireless products**.** The FSK modulator or demodulator is one of RF system that becomes the most important part and extremely advanced with the involvement of microwave active and passive circuits [1]. WiMAX, which is short for Worldwide Interoperability for Microwave Access, is a novel wireless communication technology. It is an attractive technology due to the high transmitting speed (up to 70Mbps) and long transmitting distance (up to 30 mile). The system bases on IEEE 802.16 standards and uses several bands (2.3-2.7 GHz, 3.4-3.6 GHz and 5.1-5.8GHz) to transmit data. The design of the front-end low noise amplifier (LNA) is one of the challenges in radio frequency (RF) receivers, which needs to provide good input impedance match, enough power gain and low noise figure (NF) within the required band [2], [8]. Many high gain amplifier topologies have been proposed as a way to satisfy the requirement for low power dissipation as well as good performances. The cascode techniques to produces results in a higher bandwidth and gain, due to the increase in the output impedance, as well as better isolation between the input and output ports [3], [7].

2. LITERATURE REVIEW

Basically, microwave transmitters start with a carrier generator and a series of amplifier. It also includes a modulator followed by more stages of power amplification time. The final power amplifier applies the signal to the transmission line and antenna. A transmitter arrangement could have a mixer used to up-convert an initial carrier signal with or without modulation to the final microwave frequency. Microwave receivers, like low frequency are the superheterodyne type. Their front-end are made up of microwave components. Most Basic concept and consideration in design of super high frequency amplifier is presented in this paper. A simple, short-range wireless microwave communication system is the transmission, reception, and processing of information with the use of electronic circuits. Information is defined as knowledge or intelligence communicated or received. Figure 1 shows a simplified short-range microwave communication system of which comprises three primary sections: a source, a destination, and a transmission medium.

Figure 1. Short-Range Microwave Communication System

2.1. Wireless Communication

Wireless communication system is rapidly becoming one of the fastest growing segments of the communication industry. Increasing the data rate, expending the coverage area and accommodating more components on the same chip are the crucial motivations behind the occurring of different generations of wireless communication systems [3]. An WLAN can provide the area of coverage less than 10km which the application is between buildings to building. In Wireless LAN, MAC uses contention access, so the device competes with all other devices on the network for attention on random basis to pass data through. Data sent and requested by devices closer to the network access point (AP) constantly interrupt and even crowd out data sent and received by devices farther away from the AP. Also, the more devices seeking access to the network, the lower the quality of the signal. This means if we access the Internet with a Wireless router hooked up to local cable TV company's broadband service, for instance, and the company also offers VoIP (Voice over Internet Protocol) phone service, the more people who are online, watching TV, and talking on the phone in the access area, the weaker the signal and the slower of the connection speed. VOIP & IPTV are difficult to maintain for large number of users. Encryption is not enabled in wireless LAN. This means the Access Point typically default to an open mode. Wireless LAN networks can be monitored and used to read and copy data (including personal information) transmitted over the network when no encryption is used. The most common wireless encryption standard, Wired Equivalent Privacy or WEP, has been shown to be breakable even when correctly configured. Therefore, no security provided in wireless LAN system. Wireless LAN uses OFDM technique to support internet access data rate up 54Mbps.The required speeds defined in IEEE 802.11a are 6, 12 and 24 Mbps with optional speeds up to 54Mbps [4]

WiMAX offers significant improvements over Wireless LAN, and among the more important is the specification making 802.16a a system that uses a scheduling MAC (Media Access Control). The subscriber station only has to compete once (for initial entry into the network). After that, it is allocated a time slot by the base station. The time slot can enlarge and constrict, but it remains assigned to the subscriber station meaning that other subscribers are not supposed to use it but take their turn. Unlike 802.11a, Even since its invention by Edwin Armstrong in 1917 [6], the superheterodyne architecture has dominated the design of practical radio. This architecture uses two frequency conversion steps: first the received frequency is converted to an intermediate frequency, and after some amplification and filtering, the IF is converted to baseband. Note that the final down-conversion is performed twice to produce I (in-phase) and Q (quadrature) output. This is necessary because the down-conversion operation cannot tell the difference between frequency above and below the carries, so they end up on top of each other when the carrier is converted to zero frequency. This information about the side band can be preserved by doing two frequency conversions using different phases of the carries this scheduling algorithm is stable under overload and over-subscription. It is also much more bandwidth efficient. The scheduling algorithm also allows the base station to control Quality of Service by balancing the assignments among the needs of the subscriber stations.

The difference is distance and area of coverage. WiMAX provides up to 30km (18.641 miles) in every direction for fixed stations and 3 to 10 miles for mobile stations. It allows the connectivity between users without direct line of sight. WiMAX will provide fixed, nomadic, portable and, eventually, mobile wireless broadband connectivity [5]. Wireless can be used for a number of applications including last mile broadband access, hotspot and cellular backhaul for carrier infrastructure, and high speed enterprise connectivity. WiMAX support the frequency range 2-11 GHz, of which most parts are already unlicensed internationally and only very few still require domestic licenses. The 802.16a specification improves upon many of limitation of 802.11a standard by providing increased bandwidth and stronger encryption. WiMAX specified the theoretical data rate up to 70Mbps. However, in the real world test, the maximum data rate is between 50kbps and 2Mbps. It can be achieved by providing OFDM technique as well as wireless LAN modulation technique [5].

2.2. RF Transmitter Architecture

A microwave transmitter starts with a carrier a generator and a series of amplifiers. It also includes a modulator followed by more stages of power amplification. The final power amplifier applies the signal to the transmission line and antenna. A transmitter arrangement could have a mixer used to-convert an initial carrier signal with or without modulation to be final frequency. Figure 2 shown the block diagram of transmitter for microwave communication system.

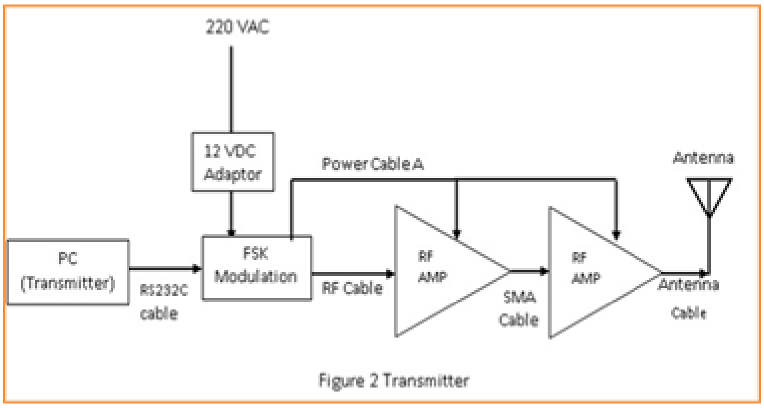

Figure 2. Transmitter

2.3. RF Receiver Architecture

It is the receiver that ultimately determines the performance of the wireless link. Given a particular transmitter power, which is limited by the regulations, the range of the link will depend on the sensitivity of the receiver, which is not legally constrained. Of course, not all application require optimization of range, as some are meant to operate at short distances of several meters or even centimeters. In these cases simplicity, size and cost are the primary considerations [4].The purpose of a radio frequency (RF) receiver is to process incoming energy into useful information, adding a minimum distortion. How well receiver performs its purpose is a function of the system design, its internal circuitry, and its working environment. The acceptable amount and type of introduced distortion vary with the application.

All modern digital radios have two sections. One section is analog part and another section is digital part. Among their other services, radio must provide frequency conversion between antenna and the digital circuitry. In wireless MAN, the signal at the antenna which operates in the GHz is converted to the IF by tuning the local oscillator. A wireless MAN superheterodyne receiver might look like a block diagram shown in Figure 3.

The RF signal to lower IF signal to the desired level, the cascaded IF amplifier is used so that I and Q demodulator (in Indoor unit) can detect and down convert the IF signal to the I and Q signal [4]. Finally, the signals are further processed by OFDM baseband in order to get actual baseband data.

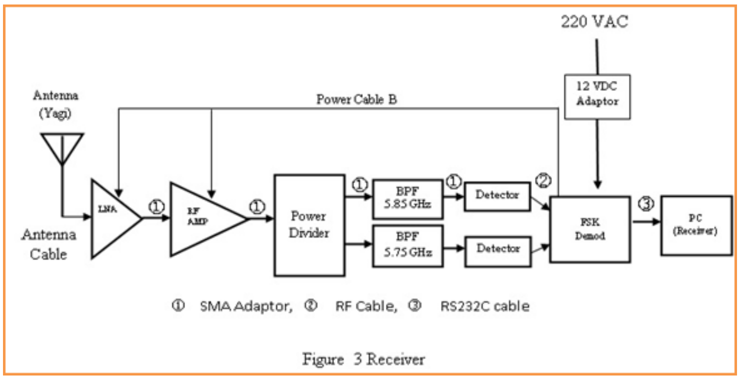

Figure 3. Receiver

3. MEASUREMENT RESULTS

Measurement set up for measuring data transmission analysis shown in Figure 4.

Table 1 shows that, using different length of sentence at the same baud rate for each test, the duration taken to reach the receiver is almost same. When using the same length of sentence but different the baud rate as shown in Table 2 the duration taken to reach the receiver is different. For example 4800 baud rate send in 1.14 sec, while 9600 baud rate send in 0.60 sec.While the Table 3 shows that, the duration will become shorter, when use same size of sentence but different the baud rate.

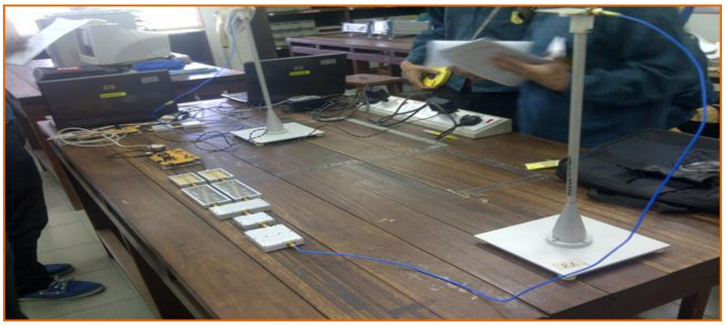

Figure 4. Measuring Setup for Data Transmission

Table 1. Fix Baud Rate 4800

No	Text Send	Baud Rate	Duration Taken to reach the receiver (Sec)
1	"The flower is very beautiful and feel comfortable to see"	4800	1.02
2	"The flower is very beautiful and feel comfortable to see and touch it"	4800	1.09
3	"The flower is very beautiful and feel very very comfortable to see touch it"	4800	1.19

Table 2. Fix Text sender

No	Text Send	Baud Rate	Duration Taken to reach the receiver (Sec)
1	"Ahmad adalah kawan di Universiti Pendidikan Sultan Idris"	4800	1.14
2		9600	0.60
3		14400	0.27

Table 3. Fix text sender at 12KB

No	Text Send	Baud Rate	Duration Taken to reach the receiver (Sec)
1	12 KB	4800	27,58
2		9600	14.39
3		14400	9.56

4. CONCLUSION

From this experiment, the distance is 1 Meter between sender and receiver antenna and 12 volt adopter is connected correctly. The different text sent with same baud rate can be sent with duration taken to reach the receiver is almost same. When, the value of baud rates is different the duration taken to reach the receiver is different. For example 4800 baud rate send in 1.14 sec while 9600 baud rate send in 0.06 sec. Generally, from this experiment can concluded that the duration taken for transmission of data is depend on the length of sentence and the amount of baud rate setting.

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