"Performance Enhancement for m-QAM technique using ICI Reduction in OFDM Wi-MAX Technique"

A Dissertation Report

Submitted By

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Under the guidance of

Mr. Ishan Khurana

Department of Electronics and communication Engineering

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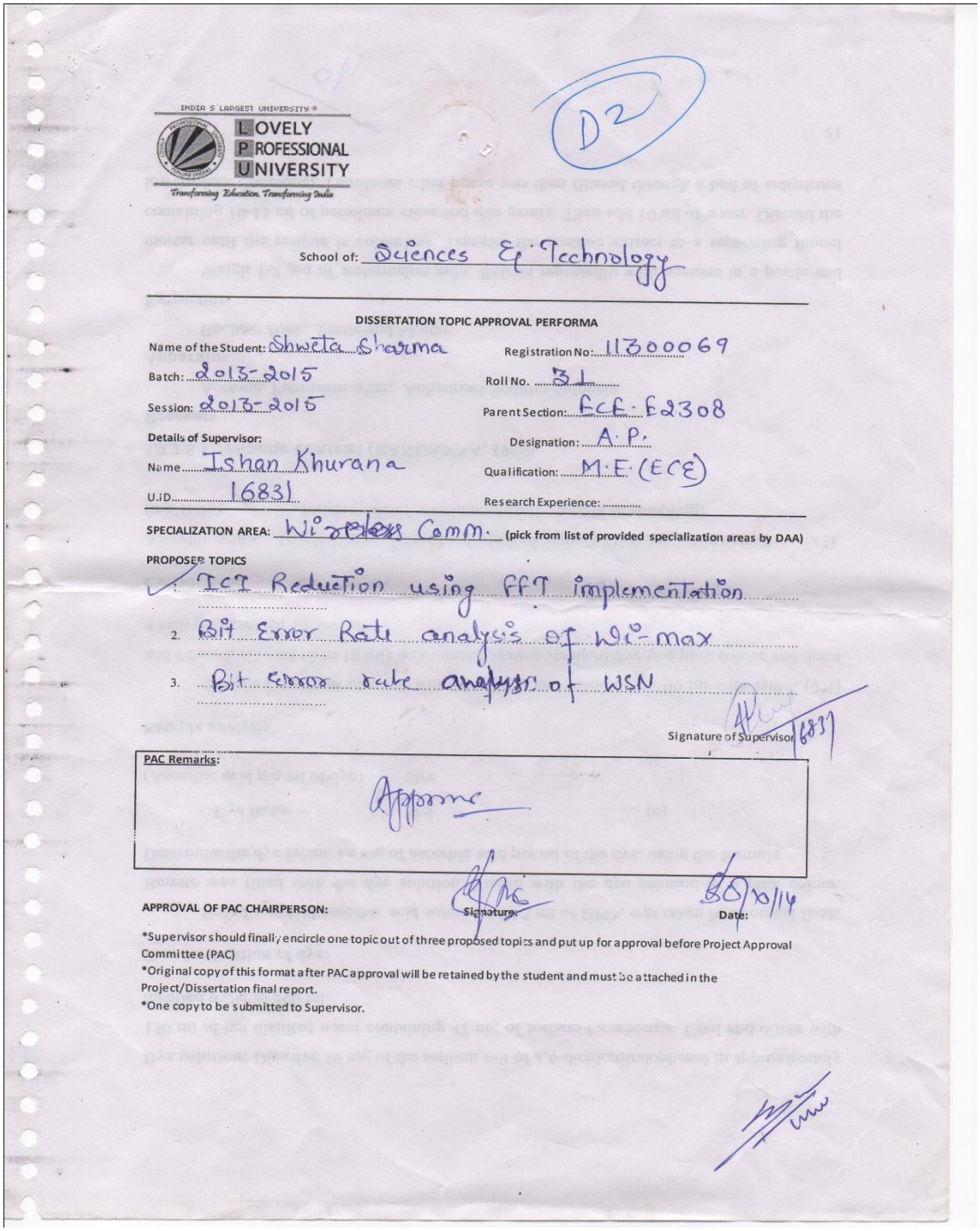
APPROVAL FORM



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This is to certify that **Shweta Sharma** has completed M. Tech (ECE) dissertation report titled "**Performance Enhancement for m-QAM technique using ICI Reduction in OFDM Wi-MAX Technique"** under my guidance and supervision. The contents of this dissertation, in full or in parts, have neither been taken from any other source nor have been submitted to any other Institute or University for award of any degree or diploma and the same is certified.

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DECLARATION

I hereby declare that the dissertation Report entitled **"Performance Enhancement for m-QAM technique using ICI Reduction in OFDM Wi-MAX Technique"** submitted for the M. Tech (ECE) Degree is entirely my original work and all ideas and references have been duly acknowledged. It does not contain any work for the award of any other degree or diploma.

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ABSTRACT

Orthogonal frequency division multiplexing (OFDM) is one of the main applications which are in use to decrease the Bit Error Rate on Wi-max .In past few years; telecommunication manufacturing has seen fast development in broadband provision requirements with mobility. This played a significant role in the growth of new communication technologies. In current, broadband wireless access has proven them self as leading supplier of high speed broadband services for mobile subscribers. The performance of each pulse shaping function is calculated and associated with each M-QAM technique for 16 and 64 modulations using the parameters such as ICI power and BER (Bit Error Rate). So this thesis is beneficial for study of WIMAX with different inflection methods like BPSK, QPSK, QAM and also study of different efficiency of each variation method. According to the development of multimedia services and the demand of Internet is to increasing attention in high speed communications. Though due to their structural and technological limitation, other wireless alternate has been originated as Wi-MAX notion. Wi-MAX structure is based on IEEE802.16 standard with main advantage over other technologies including easy positioning and low preservation cost, which makes it leading solution for last mile communication providing effectual use of bandwidth in extensive frequency range. All necessary features of Wi-MAX PHY layer has been examined in this thesis to estimate its performance below different combinations of modulations scheme and coding methods with multiple antennas options. OFDM is intelligent to significantly improve the effect of inter-carrier interference (ICI) as well as reduce the out-of-band frequency leak. Now in this thesis, we study numerous pulse shaping functions and examine their efficiency for reducing the ICI in the space-time block coded M-QAM-OFDM system. Our simulation results approve that pulse shaping using a suitable shaping function other than the default quadrilateral one can improve ICI and thus attain better bit error rate (BER) performance. Moreover, it is the most successful one in suppressing ICI.

Keywords: Wi-max, ICI technique, OFDM, AWGN, QPSK, BPSK, M-QAM, BER.

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LIST OF ABBREVATIONS

A:

AWGN	Additive White Gaussian Noise (sound)

B:

BDM	Band Division Multiplexing
BER	Bit Error Rate
BLER	Block Error Rate
BO	Back Off
BS	Base Station

C:

CDF	Cumulative Distribution Function
CDMA	Code Division Multiple Access

M:

MC-SS	Multi Carrier Spread Spectrum
MC-SS MA	Multi Carrier Spread Spectrum Multiple Access
MIMO	Multiple Input Multiple output
MISO	Multiple Input Single Output
MMSE	Minimum Mean Square Error
MRC	Maximal Ratio Combining

O:

OFDM	Orthogonal Frequency Division Multiplexing
OFDM-BDM	Orthogonal Frequency Division Multiplexing - Band Division Multiplexing
OFDMA-CDM	Orthogonal Frequency Division Multiple Access with Code Division Multiplexing

OFDM-TDM	Orthogonal Frequency Division Multiplexing - Time Division Multiplexing
OFDM-TDMA	Orthogonal Frequency Division Multiplexing – Time Division Multiple Access
OFDMA	Orthogonal Frequency Division Multiple Access
OFDMA-TDMA	Orthogonal Frequency Division Multiple Access – Time Division Multiple Access

P:

PAM	Pulse Amplitude modulation
PAPR	Peak to Average Power Ratio
PC	Power Control
PER	Packet Error Rate
PSK	Segment Shift Keying

Q:

QAM	Quadrature Amplitude Modulation
QoS	Quality of Service
QPSK	Quadrature Segment Shift Keying

R:

RF	Radio Wireless Frequency
RMS	Root Mean Square

S:

SCH	Subcarrier hopping
SCH-OFDMA-CDM	Sub-Carrier Hopped Orthogonal Frequency Division Multiple Access with Code Division Multiplexing
SCH-MC-SS	Sub-Carrier Hopped Multi Carrier Spread Spectrum

SDNR	Signal to Distortion plus Noise (sound) Ratio
SE	Spectral Efficiency
SIC	Successive Interference Cancelation
SIMO	Single Input Multiple Output
SINR	Signal to Interference plus Noise (sound) Ratio
SISO	Single Input Single Output
SNR	Signal to Noise (sound) Ratio
T:	
TDD	Time Division Duplex
TDEG	Total Degradation
TDM	Time Division Multiplexing
TS	Training Classification
TWTA	Traveling Wave Tube Amplifier
V:	
VHDSL	Very High speed Digital Subscriber Line
VGI	Variable Guard Interval
VSB	Variable Sub Carrier Bandwidth
W:	
Wi-MAX	Worldwide Interoperability for Microwave Access
WLAN	Wireless Local Zone Network
WMAN	Wireless Metropolitan Zone Network
WPAN	Wireless Personal Area Network

CHAPTER 1

INTRODUCTION

1.1 WI-MAX Introduction

Obviously, this takes precedence over all others. The better must win, or would it? Wouldn't cost effectiveness matter? But first let's concentrate purely on technology. BWA can logically be a mix of WI-MAX and long term eVolution abbreviated as LTE. Long term eVolution have been available in a market since 2009 whereas on the other hand WI-MAX since 2006.These two technologies are comes under pre fourth generation of communication method as technology or marketing material. International mobile telecommunication requirements are not fulfilled by these two fourth generation technologies. International mobile telecommunication advanced latest version of these technologies comes under development and named as 'LTE advanced' and 'Wireless metropolitan zone network advanced'.

Wireless statistics transmission at very high statistics rate needs type of accessible electro-magnetic being used necessary for forever increasing demands and approaches. The key purposes are spectrum efficiency that is bit/second/hertz, robustness besides broad-casting in multipath, range, power consumption and main thing is complexity in implementation. Such

Objectives are incompatible frequently in a proper manner and to give probable tradeoff which is best in nature, approaches and implementations are essential. The internet environment develops the greatest necessity of wireless communication technology. Wireless technologies are divided at high speed statistics rate in a proper respected manner. Hence to encourage high speed statistics rate with sufficient amount of robustness destroys the selection procedure of various modulation patterns in communication method [1].

OFDM is most widely used performance now days and is a perfect appearance in the field of wireless communication networks. OFDM gives conditions for wireless network subscribers as an inflection process technology for better communication and offer high statistics rate communication. It a multi-carrier modulation performance which gives waveforms as a output and these waveforms are orthogonal with each other in nature. Here orthogonal word stands for

90 degree with every other. In this performance there are large numbers of subcarriers which are orthogonal and overlapped and parallel transmission of these subcarriers occurs.

Division of obtainable transmission bandwidth is done through the subcarriers. According to this performance presence of relatively sub-channel (frequency)s in a f-dominion is necessary through which transmission rate will be increased. One other factor known as fast fourier transform comes in scenario which needs a quite large digits of modulators, use of filters on receiver portion and demodulators also on receiver side. OFDM consider as an authorized standard in various applications of wire-line and wireless method.

1.2 Past of Mobile Wireless Communication Method

In 1920 the mobile email approaches in wireless communication method had started for the rapid and continuous deployment and growth of various new technologies. That time period referred as era of pre-cellular. Mobile duplex communication method had determined in 1969 at 460MHZ f-band. New method of telephone method was appeared as improved mobile telephone method has big zone of coverage. The method does not have a very large amount of subscribers/users. It becomes possible to use dissimilar frequency networks in dissimilar cellular zones. Due to that fact, the measurement of distance between these cellular zones is high which decreases the probability of occurrence of interference [3]. Generate new advancement in such cellular zone through a fresh concept known as cellular era. In roaming zone required services were not accessed by service giver, this is main problem for any operator. The solution of this problem is only to use analog mobile communication network method. By using analog method, method capacity will be raised for a large number of customers. This will be gives little better communication in roaming zone even outside service region.

To get accurate signals of communication or for a proper communication digital communication comes under communication category and starts digital transmission of voice signals. The explanation of dissimilar digital patterns is categorized in second generation of wireless communication whereas analog generation referred for first generation. In first generation we have voice channel (frequency) is used frequency modulation patterns and frequency shift keying modulation pattern for communication in dissimilar fields. On the other hand, digital method generation that’s second generation only use digital channel (frequency)s for both voice

as well as video transmission. Second generation communication method is more efficient and reliable method which give better communication as compared to first generation method [3]. Second generation element is like global method for mobile (GSM). There are three important parameters of accessing these are categorized as frequency division, time division and code division multiple access. These parameters produce an opportunity for the customer of sharing of individual channel (frequency) among multiple subscribers.

Frequency division multiple access diminishes the bandwidth of the network. Time division multiple accesses allow the dissimilar users share the same communication channel (frequency) within dissimilar time slot. Code division multiple access distributes communication channel (frequency) into various coded channels (frequency) .

1.3 Telecommunication Generations

There are following few generations of telecommunication method

- 1G (first generation)
- 2G (second generation)
- 2.5G (Two and half generation)
- 3G (third generation)
- 4G (fourth generation)

First generation is generally a mixture of voice and control channel (frequency)s. Voice channel (frequency)s are analog whereas control channel (frequency)s are digital in nature. Frequency and frequency shift keying modulation are two modulation patterns which are used by voice channel (frequency)s and control channel (frequency)s respectively. First generation give wireless communication over medium but with some disadvantages such as low speed statistics rate, signal interception etc. To resolve these deficiencies a new wireless communication generation has been developed named as second generation. This generation of wireless communication includes high speed statistics rate, roaming free facilities etc…In this generation subscribers are not applicable to access internet during the call, this is the main cons of second generation. This generation of communication includes global method for mobile which can be accessed by multiple users during the time period of such generation [4]. The disadvantage of

this generation had been removed in next generation of communication named as third generation.

There is an improvement of second generation with high speed statistics rate known as two and half generation (2.6G). This includes improved version of second generation parameters on the basis of packet wireless switching. Advanced version of this generation is called as third generation which gives better communication performance as compared to other generations at high speed statistics rate. Parameters of such generation are universal mobile

Telecommunication method and wide code division multiple access. But new generation of communication network is fourth generation this generation takes baby segments for development and be a part of various subscribers daily routine.

1.4 Motivation

OFDM gives high level effectiveness and flexibility to give secure and better communication. Sharing of the channel (frequency)s is compulsory among all subscribers to achieve high Volume flexibility and also for allotment of bandwidth for multiple users. This allotment will not generate any impact on performance of communication method. Many approaches used for wireless method working including multipath fading, bit rate capacity is low, spectral efficiency is less and time dispersion parameter permits inter-symbol interference among all subcarriers. One more type of interference is inter-carrier interference caused by OFDM compassion [7]. This type of interference generates a great impact on performance of method performance. Many systems are used to remove inter-carrier interference such as self-cancellation. Likelihood estimation, pulse determining etc…In this self-cancellation method of interference removal has been used. This interference removal performance mapped input statistics upon a group of subcarriers. Due to this communication system will become good and interference free.1.6 WI-MAX

WI-MAX is an abbreviated form of worldwide interoperability for microwave access. It is fourth generation of wireless communication which permits high selection of communication over channel (frequency) or medium. WI-MAX uses point to multipoint topology for communication purpose. In point to multipoint topology services will be reached to all customers during communication having one server and multiple subscribers. WI-MAX

standard is named as IEEE 802.16 standard also called wireless broadband access. Hence customers are able to access WI-MAX services anywhere anytime in the world and enjoy all the internet services provided by the fourth generation communication system WI-MAX. [10].

1.5 WI-MAX Working

WI-MAX working can be explained by using some terms such as broadband, dialup, and Wi-Fi access. Summarize these terms as follows-

- **Broadband access**- Broadband access uses manacle modem whenever customers are available at home whereas when customers are available at office then they were able to access internet via T1 or T3 line.
- **Wi-Fi access**–In Wi-Fi access we have to need a router to access the internet services whereas when the users are travel either on the road side or anywhere then they will find Wi-fi hotspot to access internet.
- **Dial-up access**–It gives the probability of broadband access occurrence in that case when users think that broadband access is expensive. Main problem with broadband connection is its unavailability to all the zones.

1.6. WI-MAX Wireless Network

The working of WI-MAX is almost similar to Wi-Fi working with high speed and large number of users. WI-MAX generates a great environment for urban and rural zones users for internet accessing. WI-MAX working can be classified into following parts which may contains receiver and receiver. Receiver transmits the signal and receivers receive the signals at high speed in communication method. There is a figure representation of WI-MAX tower or receiver.

- **WI-MAX transmitter:** WI-MAX transmitter covers large coverage zone up to 3000square miles. It has a same concept of working as a cell-phone receiver. It gives facilities to subscribers.
- **WI-MAX receiver:** WI-MAX receiver works in a way that the Wi-Fi access in the laptop or any other internet access device. WI-MAX receiver is directly connected to the internet access medium and through line of sight connection it is further connected to another WI-MAX receiver. This WI-MAX receiver makes a backhaul connection to the home local

zone network and permits WI-MAX to cover remote rural zones [11]. WI-MAX may offer two forms of wireless services which are non line of sight service and line of sight service.

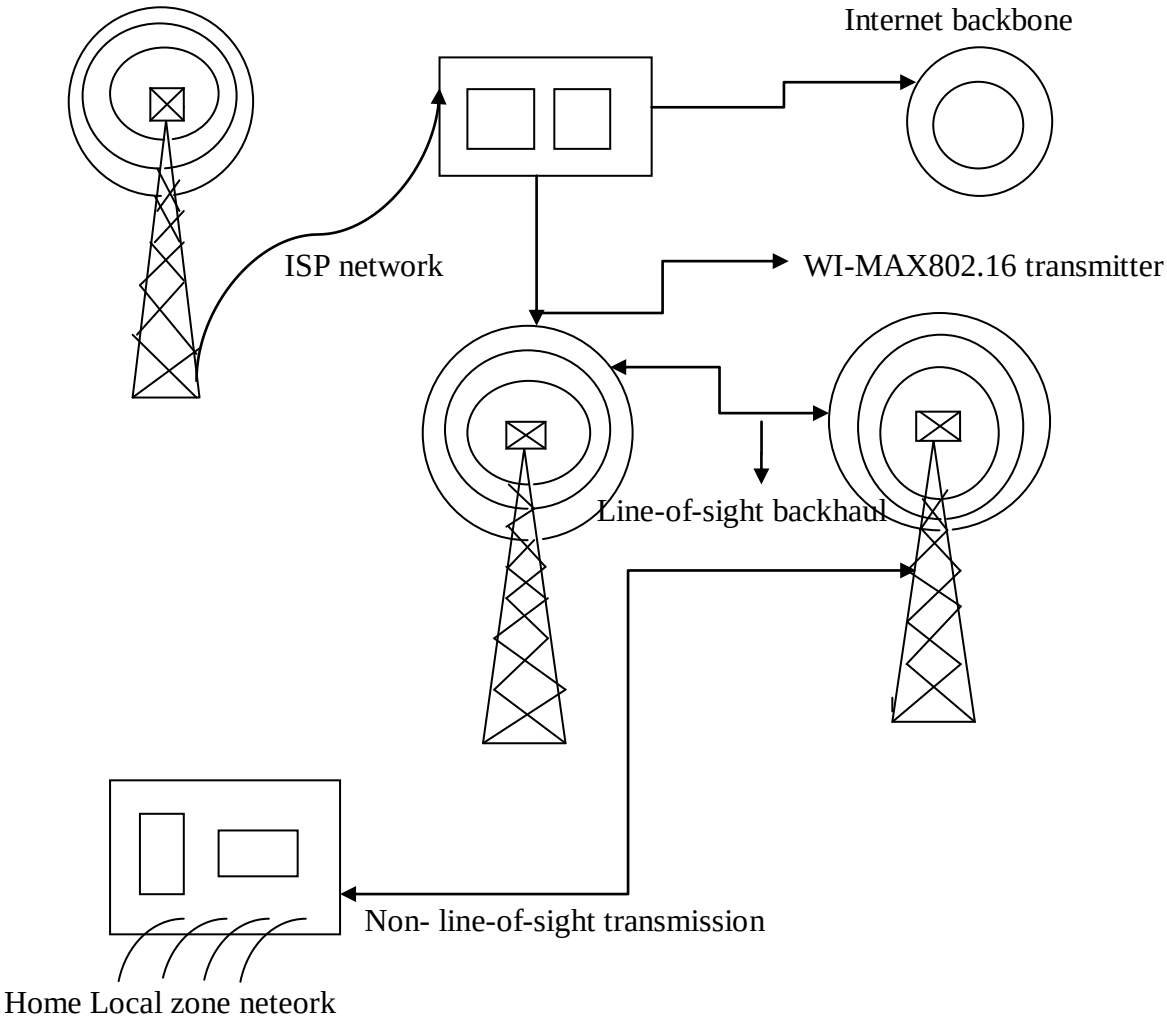

Figure 1:WI-MAX working

Non line of sight service permits WI-MAX to works between the frequency range of 2 Ghz to 11 Ghz and use low frequency transmission of signals whereas line of sight service permits WI-MAX working within the range of 66Ghz.It will make robust connection and stable connection for multiple users. Because of less interference appears at high frequency and bandwidth.

So, WI-MAX plays an important role as a fast and latest technology for various users. Through which users are able to face minimum internet services problem and utilize all services

efficiently and safely. WI-MAX is a fourth generation of wireless mobile communication method in which users are applicable for dissimilar services including video as well as voice at very high rate.

Multiple users are permits to use multiple services without any disturbance of signals. Few companies like Bharat Sanchar Nigam limited (BSNL) ,sprint, HTC etc… launches WI-MAX to overcome all the disadvantages of third generation.

WI-MAX working can be easily understand by figure 1 which consists WI-MAX receiver, receiver, internet backbone, Internet service giver network gives services to multiple customers, line of sight connection, non line of sight connection and home local zone network.The above diagram represents the complete working of WI-MAX. The main differences between fixed and mobile WI-MAX may be explained by table 1, through which take a brief outline among all parameters of fixed and mobile WI-MAX such as gross data , coverage are , services name etc.

Mobile WI-MAX is a broadband wireless service which offers convergence of mobile and fixed broadband networks through a common wide area broadband radio access technology and flexible network architecture. The Mobile WI-MAX carries Orthogonal Frequency Division Multiple Access (OFDMA) to improve multi-path performance of carrier signals in the non-line-of-sight environments.

802.16d was specifically developed for fixed wireless communication system applications because it does not attempt to support mobility, the terminal devices or Customer Premises Equipment (CPE) are not constrained by battery operation small form factor for handheld operation. Customer Premises Equipments are indoor, outdoor and USB (universal serial bus).Typically both the customer premises equipment and base station can support high output power through the combination of radio and antenna. The end result is excellent throughput over long distances. It is reasonable to operate at 3.5GHz to broadband services from 5-40km. WI-MAX Forum improves the Mobile WI-MAX network system profiles which will define the mandatory and selected features of the IEEE standard those features are necessary to build a Mobile WI-MAX compliant air interface, certified by the WI-MAX Forum [4].

STANDARD	**802.16d-2004 (FIXED WI-MAX)**	**802.16e-2005 (Mobile WI-MAX)**
Releasing year	June 2004	December-2005
Frequency band in GHZ	2GHz-11GHz	2GHz-11GHz for fixed; 2GHz-6GHz for mobile application
MAC Architecture topology	Point –to multipoint mesh	Point –to multipoint Mesh
Supported services names	Fixed, Nomadic and Portable	Mobile, Fixed, Nomadic and Portable
Gross data rate in Mbps	1Mbps-75Mbps	1Mbps-75Mbps
Coverage area in kms	Up to 50Km maximum	2-6 km approximately
Diversity technique	SISO	MIMO: Matrix A and Matrix B
QOS classes	UGS, rtPS, nrtPS, and BE	UGS, rtPS, nrtPS, ertPS and BE
WI-MAX implementation based c technology	256-OFDM as Fixed WIMAX	Scalable OFDMA as Mobile WI-MAX

Table 1-Important differences between fixed and Mobile WIMAX

1.7 M-QAM Performance

A motivation for the usage of quadrature largeness variation derives from the detail that is conventional amplitude moderated indication, i.e. dual sideband straight with a suppressed carrier dwell in two times the bandwidth of the moderating signal. This is actual uneconomical of the obtainable occurrence spectrum. QAM reinstates the stability by placing two self-governing paired sideband repressed carrier signals in the similar selection as one regular double sideband suppressed carrier signal [12].

When using QAM, the collection points are generally organized in a square grid with equal perpendicular and horizontal spacing and as a result the most common forms of QAM use a pattern with the number of points equal to a power of 2 i.e. 4, 16, 64 . . . .

By using advanced order inflection formats, i.e. more points on the pattern, it is likely to convey more bits per symbol. However the opinions are earlier together and they are therefore more susceptible to noise (sound) and statistics errors. Normally a QAM pattern is square and therefore the most common forms of QAM are 16QAM, 64QAM and 264QAM [10]

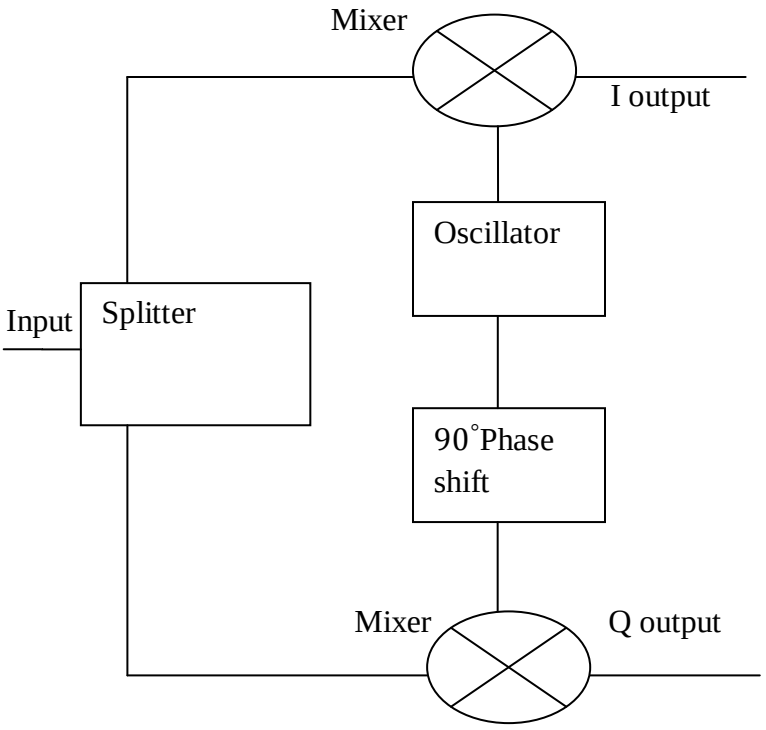

Figure 2: Quadrature Amplitude Inflection

QAM, Quadrature amplitude inflection is extensively castoff in numerous digital statistics wireless infrastructures and statistics infrastructures applications.

A variability of approaches of QAM is obtainable and certain of the other collective forms comprise 16 QAM, 32 QAM, 64 QAM, 128 QAM, and 266 QAM. Now the statistics denote to the number of facts on the group, i.e. the number of separate situations that can occur.

The numerous senses of QAM may be used after statistics-rates outside those accessible by 8-PSK are compulsory by a wireless communication method. This is for QAM attains a better distance between composed points in the I-Q level by assigning the facts more consistently. Then in this method the facts on the group are more separate and statistics faults are reduced [12]. While it is probable to take more bits per symbol, if the energy of the assembly is to continue the same, the points on the collection must be earlier composed and the broadcast develops more susceptible to noise (sound).

These outcomes in a compound bit error rate than for the minor order QAM variants. In this performance there is symmetry between obtaining the higher statistics rates and maintenance acceptable bit error rate for any wireless structures method.

1.8 ICI Reduction

Frequency zone equalization procedure is advanced for reduction of ICI by using appropriate equalization system [10]. We can evaluation the ICI for every frame by presenting frequency province pilot symbols in every frame it can individual reduce the ICI produced by fading change which is not the main basis of ICI. Over it is individual suitable for flat fading channel (frequency)s, but in mobile statement the stations are frequency discerning fading in nature since of multipath devices.

Now similarly the channel (frequency) wants to be measured for every frame. Approximation of channel (frequency) is complex, select& time overriding. Therefore the performance is not actual one. ICI self cancellation scheme is represented by the following diagram in a proper manner. On the other hand ICI affects the system performance in a big manner and degrades the system performance parameters. Reduction of ICI is essential to prevent the communication system and hence for reduction self cancellation method is being used in implementation and proposed work.

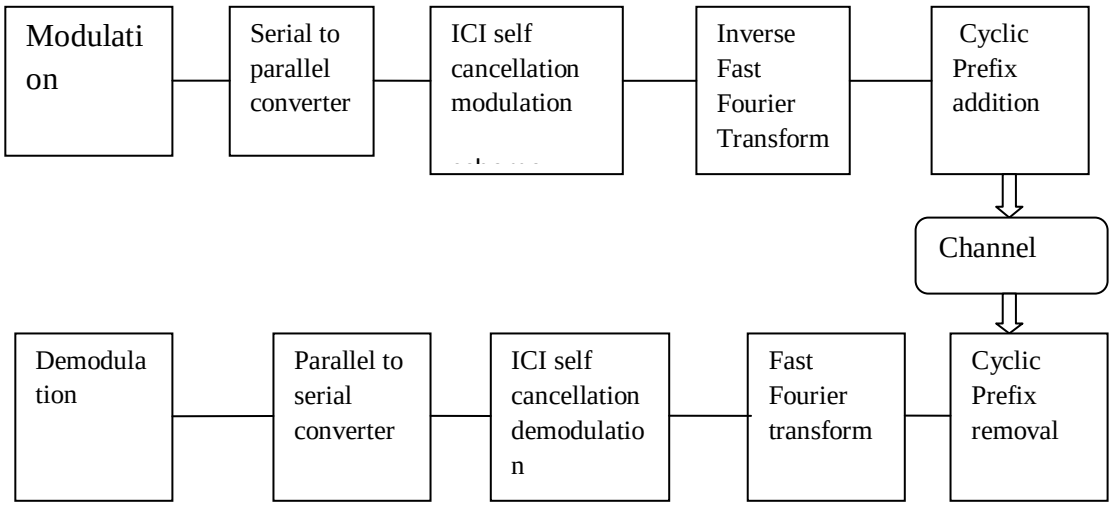

Figure 3: Self cancellation insertions

1.9 OFDM

The block diagram representation of OFDM is given as below-

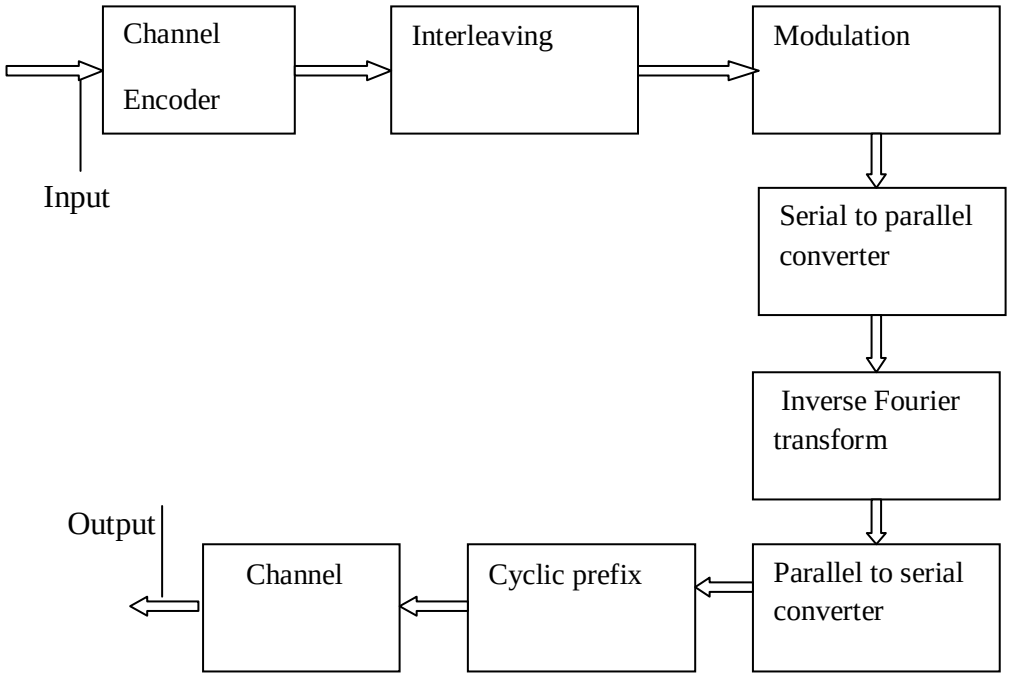

Figure 4: Block diagram of OFDM

Now a Days OFDM is actual valuable for great speed statistics transmission approaches, for the reason that it has many exclusive structures like Robustness to multipath fading, high spectral competence, and resistance to instinct interference, elasticity and easy equalization finished single carrier communication pattern Input source

The simple Principle of OFDM pattern is to distribute the accessible bandwidth into 'N' narrow sub-channel (frequency) [19] at equidistance frequency .the sub channel (frequency)range over layer every other but the subcarriers symbol are still orthogonal.

But one of the core faults of OFDM method is ICI[19], which effect from Doppler shift in the channel (frequency) or by modification among the Receiver and Receiver local oscillator frequency this ICI dismiss the orthogonally of the spectrum and signal can't be established devoid of intrusion. This striving of ICI can be resolved by numerous systems predictable by several researchers which include Time domain windowing, Frequency domain equalization, Maximum Likelihood estimation (MLE), and Protracted, Pulse determining and ICI self-cancellation method. This Thesis deliberates all the protruding ICI reduction method considered above. The rest Thesis is prepared as surveys segment and discuss OFDM method perfect and ICI.

1.10 Additive White Gaussian Noise (sound) (AWGN)

The AWGN is a sound (noise (sound)) channel (frequency). These channel (frequency) belongings on the signals once a signal permits concluded the channel (frequency).

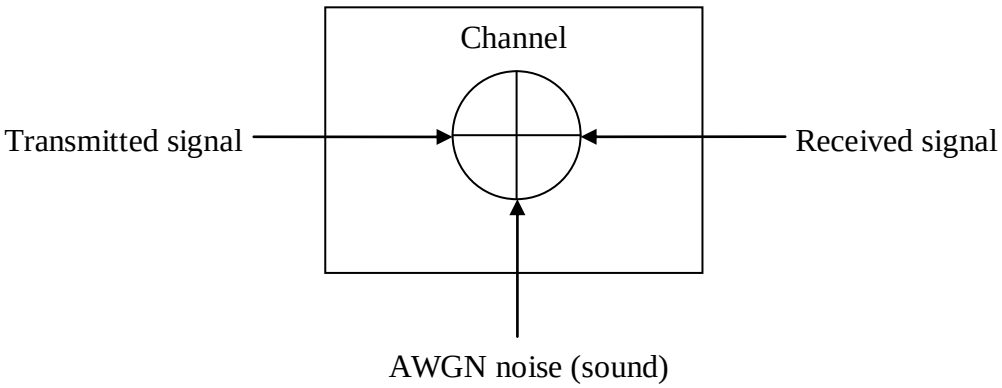

Figure 5: AWGN channel

This noise (sound) channel (frequency) classical is decent for cable and profound space communication but not in experienced communication since of multipath, land obstructive and interfering.

AWGN is used to pretend contextual noise (sound) of channel (frequency). The scientific appearance as in established signal is represented as-

r(t)=s(t)+n(t)[4]……..(1.1)

Which approved finished the AWGN channel (frequency) where s(t) is conveyed signal and n(t) is contextual noise (sound)[12].

$$(C)_{awgn} = W\log_2(1 + P/N_0W)\text{bits/hz} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1.2)$$

1.11 BPSK &QPSK

Unlike custom of PSK such as BPSK (2-PSK), QPSK (4-PSK), 8-PSK and 16-PSK has been recycled to quantity to discovery which inflection method will be appropriate to get determined advantage after obtainable network. For simulation the whole number of bits that has been elated is familiar conferring to the modulation method that has been used. For BPSK we have measured 12000 bits of statistics and amplified the significance to24000, 36000 and 48000 for QPSK, 8-PSK and 16-PSK correspondingly [13].

1.11.1 Segments Involved in Simulation:

[1]. Proceeds contribution .It can be random statistics, sine wave, cosine wave or
[2]. Complete input.
[3]. Encrypt the statistics using Difficulty encoding method.
[4]. Modulation-The modulation approaches used in this development are 2-PSK, 4-PSK (QPSK), 8-PSK and 16-PSK. The manufacturing of this into nation performance is actual and conceived value. Separate the actual portion is occupied into thought. The actual portion is directed to following block for more handling
[5]. OFDM modulation-Modification of serial statistics into similar relate IFFT to the comparable statistics. Add cyclic prefix to the achieved statistics. Change similar statistics to consecutive.

1.12 Mobile Communication Generations-

There are four generations of mobile wireless communication system. All generations concludes their own features, abilities, limitations, advantages and disadvantages etc. Each generation proved itself better than previous than other wireless generation. Brief description of each generation is given as-

1G Mobile communication generation

The 1G main generation mobile wireless communication approaches was equivalent method, which was founded on a tools identified as Advance Mobile Phone Service (AMPS). The AMPS method was frequency variation wireless method using frequency division multiple access (FDMA) with channel (frequency) Volume of 30 KHz and frequency band was 824-894 MHz [2]. In 1988 10MHz new bandwidth was allotted to The first generation has certain conditions which are as subsequent.

2G Mobile communication generation

In mobile commutations system 2G another generation of mobile communication method is digital method. This method was commercially launched in Finland in 1991. This method is static generally used in dissimilar fragments of the world. This generation is for statistics and voice services. In this generation dual digital modulation organizations are used; one is time division multiple access(TDMA) and the 2nd is code division multiple access (CDMA) [20]

3G Mobile communication generation

The development of GSM to 3G is about progressively accumulation more functionality, possibilities and assessment to the current GSM network and occupational. In examination of high speed, fast statistics rate size and good QoS, the development of mobile generation extended to 3rd generation mobile communication method. This method was accepted by Japan and South Korea in 2001 for the first time. 3G UMTSTM (universal mobile telephone service) is developed by ETSITM with in ITU's IMT-2000 framework. Second and third tier cellular companies have not invested in 3G technologies are directly looking towards WI-MAX whereas first tier cellular companies like Sprint are investing for long

term economic and time to time market advantage of WI-MAX over various advanced technologies.

4G Mobile communication generation

An enormous increase in the mobile contribution has made the consideration of researchers and productions to move the next generation of mobile wireless technology. The foremost (main) aim of 4G technology is to offer high speed, high quality, high capacity and low cost services for example voice, multimedia and internet over IP. 4G is completely IP founded technology with the competence of 100Mbps and 1Gbps speed for both inside and outside. This generation is in the below development segment. A period MAGIC is used to clarify the 4G technology. [35]

M= mobile software
A= every time every where
G= universal mobility support
I= combined wireless solution
C= modified personal service.

In 1971, Weinstein and Ebert recommended an adapted OFDM method [31] in which the discrete Fourier Transform (DFT) was functional to produce the orthogonal subcarriers waveforms in its place of the banks of sinusoidal generators. Their system condensed the application difficulty suggestively, by creation use of the inverse DFT (IDFT) components and the digital-to-analog converters. In their recommended classic, baseband signals were moderated by the IDFT in the spreader and then demodulated by DFT in the receiver. Consequently, all the subcarriers were overlay with others in the frequency zone, while the DFT inflection still promises their orthogonally. Cyclic prefix (CP) or cyclic allowance was first announced by Peled and Ruiz in 1980 [3] for OFDM approaches.

In their system, conservative insignificant watch intermission is relieved by cyclic postponement for fully-loaded OFDM modulation. As a result, the orthogonally between the subcarriers was certain. With the trade-off of the conveying energy efficiency, this new arrangement can result in a remarkable ISI (Inter Symbol Interference) reduction.

Hence it has been accepted by the present IEEE standards. In 1980, Hirosaki familiarized an equalization algorithm to overpower both inter symbol interference (ISI) and ICI [4], which may have occasioned from a channel (frequency) distortion, synchronization error, or segment error.

In the interim, Hirosaki also modifies QAM modulation, pilot tone, and trellis coding system in his high-speed OFDM method, which activated in voice-band spectrum. In 1986, Cimini presented a pilot-centered method to decrease the interference originating from the multipath and co-channel (frequency) [2]

1.13 Impact of PAPR on the system

WI-MAX gives wireless transmission of statistics by a diversity of transmission modes, from point-to-multipoint relations to movable and completely mobile internet access. According to the manufacturing forum WI-MAX opportunity, numerous tools presently obtainable for secure wireless access can individual give line of sight (LOS) attention, the technology overdue WI-MAX has been enhanced to give non line of sight (NLOS) coverage as well. The 802.16m (Mobile WI-MAX Release 2) Task-force is presently working on the next-generation approaches with an goal for optimizations for better interworking and existence with additional access technologies such as 3G cellular approaches, Wi-Fi and Bluetooth and improve the peak charges to 4G values usual by the ITU under IMT-Advanced umbrella which calls for statistics rates of 100 Mbps for high mobility and 1 Gbps for secure/nomadic wireless access.

LTE is designed as a simple and flat, all-IP statistics-centric network architecture resulting in low operating costs for operators. LTE has an extremely low latency between network elements and end-to-end devices which is about 10 times lower than that of current 3G networks. LTE leverages existing mature wireless technologies while also taking advantage of the fast moving semiconductor processing technologies that enables a low cost deployment even from the very beginning [Ayvazian, B., 2010] It is felt that some of the most pressing concerns that will have to be weighed in by Telecommunication Service Givers (TSPs), Mobile Network Operators (MNOs), Investors etc. are the state of Existing Infrastructure, Backward compatibility, Cost and its effectiveness, and Competition. Generally**,** the wireless method uses HPA in the receiver side to get maximum output power efficiency. The operating zone of HPA is normally at or near

the saturation region. Also the nonlinear characteristics of the HPA are very tender to the difference of the signal amplitudes. This difference in the OFDM amplitudes is very large with high PAPR. So, the high PAPR on the HPA will introduce inter-modulation between dissimilar sub-carriers and interference into the approaches. This interference decreases the BER performance. Also, this high PAPR forces the amplifier for having huge back off power for linear amplification of the signal. This type of linear working amplifier has poor power efficiency [32] [34].

Digital to Analog Converter (DAC) would have sufficient dynamic range to accommodate the large peaks of the OFDM signals because of the high PAPR. Even if, a high precision DAC supports high PAPR with low quantization noise (sound) but it is very exclusive. On the other hand, low accuracy DAC is inexpensive and its quantization noise (sound) is more [23].

For large number of OFDM sub-carriers, OFDM signals follow the Gaussian distribution. In such type of distribution average of the peak signal seldom follow and unchanging quantization by the Analog to Digital Converter (ADC) is not desirable. If clipping of the signal is done, in-band alteration and out-of-band expansion (adjacent channel (frequency) interference) will be occurred [28] [34]. The major impact of a high PAPR are-

1. Amplified difficulty in the ADC and DAC.
2. Reduced in efficiency of wireless frequency (RF) amplifiers.

1.13.1 Signal scrambling (Probabilistic) performance

Signal Scrambling performance scramble every OFDM symbol with dissimilar scrambling system and excellent the classification that gives the minimum PAPR value. It includes approaches like Selective Mapping (SLM) and Partial Transmit Classification (PTS).

1.13.2 Signal distortion performance

This performance decreases the PAPR by altering the OFDM signal non-linearly. The approaches similar clipping and clarifying, peak windowing, and non-linear impressive are the instance of this performance. These approaches are functional after the generation of OFDM signals (subsequently the IFFT).

1.13.3 Coding performance

The coding performance active some error modifying codes for the PAPR reduction. These approaches are modifying before the generation of OFDM signal (before IFFT). When signals are new with the same segment, they produce a peak power, which is times the average power. The basic idea of all coding patterns for the reduction of PAPR is to reduce the occurrence probability of the same segment of many signals [25]. The coding approaches choice such code words that minimalism or decrease the PAPR. It causes no alteration and generates no out of ensemble radiation, but it suffers from bandwidth efficiency as the code rate is reduced. It also suffered from the difficulty to discover the best codes and to accumulation large lookup boards for encoding and decoding, especially for a big number of subcarriers. The error modifying codes like block codes, cyclic codes, Golay balancing classification, Reed-Solomon (RS) code, Reed-Muller (RM) code, Hadamard code and Low Density Parity Check (LDPC) code can be used.

1.13.4 Pre-distortion performance

The pre-distortion performance is centered on the reorientation or increasing the energy of statistics symbol earlier taking IFFT. The pre-distortion pattern includes DFT increasing, pulse determining or pre-coding and pattern determining.

1.14 Factors for selecting the PAPR reduction performance

Several factors would be considered for selecting the performance that can reduce the PAPR effectively as well as can maintain high quality performance. These following factors are to be considered [32] [28] as without introducing in-band distortion and out-of-band radiation, PAPR reduction system would be unable to reduce the PAPR.

- **Low average power:** The raise in power needs a high linear process region in HPA and hence degrades the BER performance.
- **No BER performance deprivation:** The motive of PAPR reduction is to get better method performance as well as BER than that of the original OFDM method.
- **Addition power:** Power efficiency would be considered while reducing the PAPR. If the process of the performance which decreases the PAPR needs more additional power, then

it degrades the BER performance when the transmitted signals are normalized back to the original power signal.

- **No spectral spillage:** The PAPR reduction performance would not destroy the inherent feature (orthogonally) of OFDM signal.

The extensively used performance of PAPR reduction is amplitude clipping. This performance can be implemented by clipping parts of the OFDM signals (after IFFT) that are greater than a threshold level. If OFDM signals are trimmed, it will present in-band alteration and out-of-band radiation (together channel (frequency) interference) into the communication method as a result BER performance of the method degrades. Hence, the greatest explanation is to decrease the PAPR before formation of OFDM symbols as well as prior transmitted OFDM symbols into nonlinear HPA and DAC [2].

Research in mobility is an advertised zone right now and a lot of work is complete by numerous dissimilar persons and businesses. Associations like IEEE improve and change current values or generate new ones. Businesses put composed working groups with every other to assure interoperability among equipment and a lot of students make thesis works with studies of and proposals to existing coming standards. This portion carries forth some of the stimulating developments that have been originate during the course of this thesis. 802.16d with mobility support. The 802.16d (now called 802.16-2004) only insurances fixed networks which have led to IEEE leading work in a mobility form, 802.16e.

A different approach to resolve the absence of mobility in 802.16-2004 have been made in "Mobility Provision for IEEE 802.16d Wireless Networks" [12]. Their approach has the goal to allow mobility in 802.16-2004 without modifying the standard. To complete this mobility, tools such as hierarchical MIP, designated parts of the 802.12-2004 initialization process and a in the standard predefined message have been operated. An existing message has been selected to help as handover appeal and acknowledgment. The MS will send this communication to the BS when it needs to achieve a handover and the BS will answer with the same message. The communication selected does not touch whichever of the MS or BS if they do not have the mobility functionality; it only tells the receiver to transmit on as normal. In the initialization segment throughout the handover the target BS skip parts such as authentication and conversation of encryption keys and this information is in its place sent through the backhaul.

By recycling only essential portions of the initialization procedure the interruption during the handover is reduced. In this solution the constraints that only the MS can request a handover have been complete. This is owing to the fact that a MS can break silent during a period of time once it has nonentity to send [17]. The problem lies in the BS clarification of this silence; is the MS not distribution or is it out of broadcast range? If the MS receipts care of the handover request the BS do not need to figure out the answer to this question.

More in this object they demonstration that the PHY-layer of 802.16-2004 is appropriate for mobility. Their controls demonstration that such a method would be talented to sustenance stirring stations with imperfect speed. With respect to this information with the recommended instrument for the purpose of handling handovers demonstrations that it is likely to get mobility in 802.16-2004. 802.16e with unified mobility Even however IEEE just finished the work on the 802.16e standard there have previously been optional a device for allowing seamless handover in networks centered on the standard.

It is labeledin "A Seamless Handover Appliance for IEEE 802.16e Broadband Wireless Access" [6] [6]. The appliance is called Last Packet Marking (LPM) and participate MAC-layer handover with the Network layer handover to decrease the handover effects on TCP service performance. LPM mostly contains of the handover provision in 802.16e, a few new communications and defending of packets at BSs. The communications new cover information around routing. The network classical used contains of BSs and a hierarchy of routers confectioning BSs, on the following page. The central idea of LPM is to send incoming MS packets to together allocation BS and board BS from the point in time once the MS is rational of execution a handover.

The goals BS will buffer received statistics and advancing it to the MS when the handover is whole. LPM simulations were achieved on an 802.11 WLAN since the designated network simulator does not have the 802.16e applied. The author's rights that throughout the conditions the chosen substitute works as good as an 802.16e application would have [17].

To estimate the LPM appliance the throughput of TCP packets per second was dignified. The outcome shows that the method agonized from large finished place drops during handover when not using LPM. With LPM the handover effects on the through put was minimal. These demonstrations are that LPM is an effective and valuable appliance.

CHAPTER 2

REVIEW OF LITERATURE

Purpose of literature survey is to collect the published information through the various research papers. Filter useful information for research work by doing literature survey. Literature survey interprets old information and generates a combination of new information with old information. So, in this section there is a brief description of various research papers and occurrence of summary and synthesis of research papers.

2.1 Research papers

Kai-jiun Yang et.al [Base paper] proposed that requirements of the memories affected to the die area of fourier transforms. Due to this reason the complexity level in multiple input multiple output OFDM system will increase with the increment in data streams. In MIMO systems data can be increased dramatically. Author examines the complexity level of current processor and compares it performance with another processor and rate the complexity level. Also explain the advantages and limitations in terms of power and power consumption. Fourier transforms are the important cause of OFDM systems popularity. Fourier transforms perform time domain to frequency domain and frequency domain to time domain as per requirement. Hence long term eVolution and WI-MAX are used to implement fourier transform processor. So there is a good balance among complexity level, energy consumption, and chip area.

Dahlman, E. et.al [9] suggested that there has been widespread adoption of GSM/CDMA as 2G technologies and WCDMA/UMTS/HSPA/CDMA 2000/EVDO for 3G service. LTE has been defined as the next step in the technological roadmap. LTE evolves from the Third-generation technology which is centered on WCDMA and defines the long term evolution of the 3GPP UMTS/HSPA cellular technology. The specifications of these efforts are formally known as the evolved UMTS terrestrial wireless access (E-UTRA) and evolved UMTS terrestrial wireless access network (E-UTRAN), commonly referred to by the 3GPP project LTE. It offers higher statistics rates, lower latency and greater spectral efficiency than previous technologies.

Compatibility of services Enhanced peak statistics rates to support advanced services and applications (100 Mbit/s for high and 1 Gbit/s for low mobility). Peak statistics rate of 1 Gbps will be achieved by 4- by 4- MIMO and transmission bandwidth wider than approximately 70 MHz Spectrum efficiency: 3 times greater than LTE. Peak spectrum efficiency: down connection – 30 bps/Hz; up connection – 6.76 bps/Hz. Spectrum use: the ability to support scalable bandwidth use and spectrum aggregation where non-contiguous spectrum needs to be used. Latency: from Idle to Connected in less than 60 ms and 10 msec (dormant state to active state) Cell edge user throughput to be twice that of LTE.

Zeyad T. Sharef et.al [39] proposed that it has been adopted by the current IEEE standards. In 1980, there is an existence of an equalization algorithm to suppress both inters symbol interference (ISI) and ICI which may have resulted from a channel (frequency) distortion, synchronization error, or segment error.

In the mean time ,it also modifies the qam modulation, pilot tone, and trellis coding system in his high-speed OFDM method, which operated in voice-band spectrum. In 1986, Cimini introduced a pilot-centered method to reduce the interference emanating from the multipath and co-channel (frequency)

Kyung ah Kim et.al [21] described that OFDM approaches have been exploited for high statistics rate communication. In the IEEE 802.11 standard, the carrier frequency can go up as high as 2.4 GHz or 6 GHz. Researchers tend to pursue OFDM operating at even much higher frequencies nowadays. For example, the IEEE 802.16 standard proposes yet higher carrier frequencies ranging from 10 GHz to 60 GHz. However, one of the main disadvantages of OFDM is its sensitivity against carrier frequency offset which causes inter-carrier interference (ICI). The undesired ICI degrades the performance of the method. ICI self-cancellation is a pattern that was introduced by Yuping Zhao and Sven-Gustav Haggman in 2001 to combat and suppress ICI in OFDM.

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T. Jiang and Y. Wu et.al [33] analyzed that PAPR occurs due to large dynamic range of OFDM symbol waveforms. High PAPR in OFDM essentially arises because of IFFT pre-processing (i.e. OFDM signal consists of a number of independently modulated sub-carriers which can give a large peak when new up with same segments). Here, statistics symbols across sub-carriers add up to produce high Peak value signals

As long as signal swing is limited to dynamic or linear range, input and output is linearly related (i.e. around this mean, if the deviation of the Voltage is small, then signal will still confined to linear amplification range.) But in OFDM method, swing of instantaneous power is very high compare to mean. So, it will cross over into the non-linear range where amplification is non-linear. As amplification is non-linear all the property of OFDM is lost (i.e. orthogonality is lost), then there will be extreme inter-carrier interference. So, high PAPR in OFDM results in amplifier saturation, thus leading to ISI.

Ali Nawaz Naqui et.al [1] described that Network Simulator (NS) version 2.34 is applicable for the evaluation of WI-MAX. Dissimilar parameters such as distance, number of subcarriers stations, dissimilar type of modulation patterns and size of transmitted packet affects the performance of 4G communication method i.e WI-MAX communication method. Performance analyzing parameters like through put, average delay and average jitter are used to research the performance of WI-MAX. Distance between the subscriber station and base station have been considered for the evaluation of WI-MAX communication method.

Claudio Cicconetti et.al [8] proposed that in metropolitan zone network for broadband wireless communication method, IEEE802.16 works as a standard which give four dissimilar services to fulfill the QOS requirements of multimedia applications. These four dissimilar services are unsolicited grant service (UGS), real time polling service (RTPS), non real time polling service (NRTPS) and best effort(BE).The main aim of this research paper is verification through simulation and the effectiveness of all these four services in managing traffic. WI-MAX works on point to point topology with frequency division duplex (FDD) and full duplex subscriber station (SS). This paper represents the simulation research of WI-MAX which is operated with

the wireless MAN-OFDM air interface and full duplex subscriber stations. The communication method is highly loaded when subscriber station requests to base station for up connection bandwidth.

M. Merlyn [26] suggested that OFDM is most widely uses performance due to its robustness against frequency selective fading channel (frequency). For modulation and demodulation fast fourier transform (FFT)and inverse fast Fourier transform (IFFT) are used and both these transforms have variable size which means their size are varied according to the dissimilar applications of the OFDM method. Design and implementation process of these variable lengths transforms used for covering various applications of OFDM method. The main advantages of implementation are less memory size and less power consumption.

E. Kurniawan [11] described that channel (frequency) distortion plays an important role on amount of gain which is achieved by dissimilar modulation patterns. Achieved additional gain is demonstrated and analyzed dissimilar signal to noise (sound) ratio (SNR) values for dissimilar channel (frequency)s. This paper presents the dissimilar diversity patterns under dissimilar channel (frequency) conditions through intensive simulation studies. There is no improvement gained by using conventional diversity patterns because of high Doppler spread spectrum. Hence proposed patterns generate improvement of 2db compared to other modulation patterns. Verification of achieved gain is essential for computational burden offered by various modulation patterns to the communication approaches and only one bit is required for feedback communications.

S.Askar et.al [29] proposed that WI-MAX is latest most promising performance which gives high speed statistics communication including audio, video, and voice services to the customers dominated by cables and digital subscribers line(DSL) technologies. Various broadband applications have the main advantage of increasing capacity and simulation of OFDM IEEE802.16 under the combination of dissimilar digital modulation patterns such that BPSK, QPSK and 16-QAM.Under BPSK and QPSK implementation of channel (frequency)s are satisfactory and achieve high delay and high signal to noise (sound) ratio values.

Paul H. M Qose [26] describes that now a day's OFDM is bandwidth efficient signaling pattern which is used for high speed digital communication approaches. There is very minor difference between frequency division multiplexing (FDM) and orthogonal frequency division

multiplexing (OFDM) that is FDM and OFDM is in case of spectrum of individual subcarriers these are mutually overlap with every other and gives optimum spectrum efficiency. Because of the frequency offset there are two main effects one is decrease in signal amplitude in the output of matched filter and second one is appearance of inter-carrier interference due to other subcarriers because in OFDM communication method subcarriers are closely spaced with every other in frequency spectrum. OFDM is most widely used digital multicarrier modulation performance which gives better communication.

Chandrakanth.V et.al [6] proposed that a simple architecture for performing hardware efficient real time configurable variable point fast fourier transform implementation. The architecture gives the information about fast fourier transform core which is provided by field programmable gate array vendors. Firstly the data obtained from the receiver side which has to be recorded range from cell wise to pulse repetition interval wise. In the real time operation the data flow is continuous and buffered to provide the time required for the computation of fast fourier transform. Data will be flowing continuously at the amount of rate of write in fast fourier transform clock and read out clock. The amount of the time is required to read out the data buffering to the slower read out clock [6].

K. Harikrishna et.al [19] describes that a memory based designing of fast fourier transform processor has much less gate counts, low power consumption and high speed. The architecture has three main advantages these are butterfly iteration to reduce power consumption, pipeline of radix-2 butterfly to speed up the clock frequency and the main advantage is distribution of memory to make utilization efficiency in SRAM ports. WI-MAX uses OFDMA with 2K-FFT, 1K-FFT,612-FFT and 266-FFT and gives up to 10Mbps broadband speed without the requirement of cables.FFT algorithm removes the redundant calculations and become very suitable for efficient hardware implementation Widely used OFDM systems use FFT and IFFT processors to modulate and demodulate the data constellation on the sub-carriers. In this paper there is high level implementation of FFT processor for OFDM modulator and demodulator.FFT finds the applications in linear filtering, digital spectral analysis and correlation analysis, ultra-wide band (UWB) applications.

Lokesh C et.al [22] proposed that according to OFDM kernel inverse fast fourier transform and cyclic prefix blocks are inserted in downlink flow whereas fast fourier transform and cyclic

prefix removal blocks are inserted in the uplink flow. For supporting OFDMA there is an extension to the OFDM kernel that allows every user to be allocated with a portion of the available subcarriers. This process is known as sub channelization. OFDMA symbol level processing blocks demonstrate sub channelization and de sub-channelization with cyclic prefix insertion which is supported by the FFT and IFFT [8]. In this paper downlink OFDM concept is used. Downlink OFDM module performs an IFFT of frequency domain input data and create addition of cyclic prefix to the resulting time domain data. Cyclic prefix code block includes a controller and make an appropriate proportion of the end of the output packet to the starting of output packet.

CHAPTER 3

RATIONALE AND SCOPE OF RESEARCH

3.1 The WI-MAX (IEEE 802.16 standard)

It gives wireless transmission of statistics using a selection of broadcast styles, after point-to-multipoint associates to movable and completely mobile internet access.

Permitting to the manufacturing opportunity WI-MAX Medium, numerous technologies presently obtainable for secure wireless entrance can single give line of sight (LOS) coverage, and the knowledge overdue WI-MAX has been enhanced to give non line of sight (NLOS) reporting as well.

The 802.16m (Mobile WI-MAX Release 2) Task-force is presently employed on the next-generation approaches with an goal for optimizations for better interworking and existence with other entrance technologies such as 3G cellular approaches, Wi-Fi and Bluetooth and improve the peak rates to 4G standards usual by the ITU under "IMT-Advanced" umbrella which calls for statistics rates of 100 Mbps for high movement and 1 Gbps for fixed/nomadic wireless access.

3.2 Scope of the research

The Community broadband admittance through wireless is not individual an advantage to commercial explorers then is also a stimulating commercial initial in itself. In Broadband wireless internet access through hot spots in hotels, airports, agreement centers, coffee shops, restaurants, etc. is a fast growing tendency.

Hot spots give internet entrance for hire. Comparatively inexpensive to set up, all that is compulsory to generate a simple hot spot is abroad band connection and a wireless router. Possibly will hot spots use T1 for its high bandwidth, but DSL, cable and static wireless can also be used. WI-MAX expertise can make high speed wireless broadband internet services available to greatly larger zones than can typical Wi-Fi hot spots.

WI-MAX applications can give a wireless range of up to 30 miles or 60 kilometers, much

greater than the physical distance limitations of Wi-Fi hot spots or DSL, WI-MAX technology can also be used to intersect existing Wi-Fi networks.

WI-MAX is able to produce internet connectivity at home; work or any where surrounded the world. Use the hotspot to access internet anywhere via WI-MAX connectivity, similar to wi-fi hotspot. By using hotspot we are able to access internet in the laptop or desktop personal computers through mobile. But in this connectivity of internet through mobile speed is the main problem. Sometimes networks are not properly available to the user to access the internet then hotspot would not be worked. WI-MAX removes all these problems like connection, signal availability and speed of the connection. It allows transmission of data at high speed data rate in any location overall the world. WI-MAX also used to connect wi fi networks internally. WI-MAX becomes more popular in the area of both developed countries and the countries which are under developing for broadband accessing because of low cost and fast deployment. WI-MAX works as a perfect chance to pay attention in wireless business.

CHAPTER 4

OBJECTIVES OF THE RESEARCH

4.1 Problem Formulation

In this thesis, a methodical overview of various systems presented. First and second moments of the examples (such as the power spectrum and autocorrelation functions) contain no segment information hence for segment approximation of QAM communication method initially higher order statistics (HOS) founded method are used in which gain control was compulsory and information of conveyed statistics was essential. Modification over subsequent problems was performed by various scientists. For better competence, technology changes from statistics assisted to non-statistics aided method. Segment approximation developed very problematic task as the gathering size increases. Channel (frequency) noise (sound)s introduce problems and error in valued segment. So the work can be protracted for 16-QAM 64-QAM or for other bulky size patterns, in the occurrence of other types of noise (sound).

WI-MAX is extensively used to attend this purpose. Fading and inter symbol interference are the main problems with wireless WI-MAX transmission. OFDM is used as answer for this problem [14]. With the cumulative wireless network user's, efficient bandwidth process is the major practical challenge.

Therefore, many inflection systems have been intended to recover the higher statistics rates. Presentation of this inflection system must be examined in order to deliver the quality wireless broadcasts in varying fading channel (frequency) environments.

OFDM is spectrally actual well-organized and healthy in dealing with the frequency discerning wireless fading channel (frequency)s, yet some mixtures of spread spectrum system and OFDM are being careful to develop even better approaches. Though some everything give particulars of their presentation, it is significant to liken them in contradiction of OFDM in the same test circumstances, which comprise among others non ideal receiver processes.

4.2 Objectives

The leading objective contain for taking up this proposal is given below-

[1] To discuss complete architecture of WI-MAX Broadband Technology
[2] Converting some determined safety loopholes in WI-MAX Internet Communication.
[3] Using MATLAB SIMULATION CONNECTION classic to cabinet how security control can be enabled for this loopholes.
[4] Emerging an IP tracking tool for examination misuse of explanation holder's privacy and other benefits.

The foremost objective behind pattern this classic was to construct active the real time perfect for the WI-MAX method lengthways with the appropriate wireless channel (frequency)s well-matched to various impressive circumstances for the signal broadcast.

The classic deliberated here is constructed on QAM inflection pattern and OFDM performance centered on the platform of MATLAB 2012a, running on Windows7. MATLAB Simuconnection contains all the compulsory function blocks as quantified by the normal papers. The classic shown in fig.3 includes of receiver, receiver and channel (frequency) which is AWGN channel (frequency) in the first case.

Major objective of this Thesis is to pretend and examine the OFDM using the physical layer specification of IEEE 802.16e and IEEE 802.64e. Examine the performance of OFDM with dissimilar numerical inflection system for mobile WI-MAX method. It is similarly to examining the result of the OFDM pattern below the dissimilar Doppler shifts. Performance is assessed centered on the replicated Bit-Error-Rate (BER) since diverse digital inflection pattern below dissimilar fading channel (frequency) delivers the dissimilar BER presentation. Consequently it is wanted to examine the performance of the OFDM method under the mutable flat and frequency discerning fading environments.

CHAPTER 5

RESEARCH METHODOLOGY

5.1Methodology

5.1.1 WI-MAX Method

WI-MAX pattern regulate the indication inflection and coding method on the foundation of Signal to Noise (sound) ratio (SINR) disorder of the wireless connection. When the wireless connection excellence is high the maximum modulation pattern and light coding is used generous the pattern more capacity. Throughout a signal fade or protracted signal path the WI-MAX pattern can shift to a lower order inflection pattern with heavier coding to support the assembly excellence and connection stability.

An OFDM carrier signal is the calculation of a quantity of orthogonal sub-carriers, with baseband statistics on every subcarrier being self-sufficiently moderated usually using certain type of quadrature amplitude modulation (QAM) or segment shift keying (PSK). This compound baseband signal is typically used to modest a main RF carrier. s[n] is a sequential river of binary digits. By opposite multiplexing, these are first DE multiplexed into N parallel streams, and everyone mapped to a (perhaps complex) symbol stream using some inflection pattern (QAM, PSK, etc.). Note that the collections may be unlike, so some streams may carry a higher bit-rate than others.

The receiver preferences up the signal r(t), which is before quadrature-mixed miserable to baseband using cosine and sine waves at the carrier frequency. This similarly makes signals centered on 2fc, so low-pass filters are secondhand to castoff these. The baseband signals are then exasperated and digitized using analogue-to-digital converters (ADCs), and a forward FFT is used to convert back to the frequency area.

5.1.2 ICI

The predictable imprint is to first excruciating the traditional signal that is going for FFT, into two fragments. Once this every part is Fourier changed and then the productions are cooperative

together. Reflect a method with ‘n’ number of signals waiting for Fourier change at the receiver. These ‘n’ signals are split into two equal parts of length ‘n/2’.everysignal is passed complete Fourier alter. It will result in two order every of length ‘n’. These signs will be then new to generate the final distorted signal. After the demodulation of the more signal the predictable bits are compared with the conveyed bits.

Suppose that we assume that the frequency offset f_δ is a division of subcarrier design $\frac{1}{T}$ i.e.$f_\delta = \frac{\delta}{T}$.

Similarly, for shortening the calculations, lets us take on that the conveyed symbols on all subcarriers,$\alpha_k = 1$ .The received signal is,

$$y(t) = S(t)e^{\frac{j2\pi\delta}{T}}t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots. (6..1)$$

The production of the correlation for sub-carrier ‘m’ is, For$\delta = 0$, The essential decreases to the OFDM receiver with no damages case. Though for non-zero values ofδ, we can get that the amplitude of the association with subcarrier ‘m’ contains

- Alteration due to frequency offset among actual frequency $\frac{m+\delta}{T}$ and the desired frequency$\frac{m}{T}$.
- Alteration due to interference with other subcarriers with preferred frequency $\frac{m}{T}$. This period is also known as Inter Carrier Interference (ICI).

5.1.3 Simulation Model

[1] Generates an OFDM symbol with all subcarriers moderated with$\alpha_k = 1$ and present consistency offset and add noise (sound) to result in $\frac{E_B}{N_o}$=30dB.

[2] Taking the IFFT and FFT on transmitter and receiver side. Append the cyclic prefix.

[3] Formatting the received vector into symbols and remove cyclic prefix and convert from time domain to frequency domain.

[4] Novelty the difference between the anticipated and actual pattern.

[5] Calculate the rms value of error across all subcarriers.

[6] Repeat this for dissimilar standards of frequency offset.

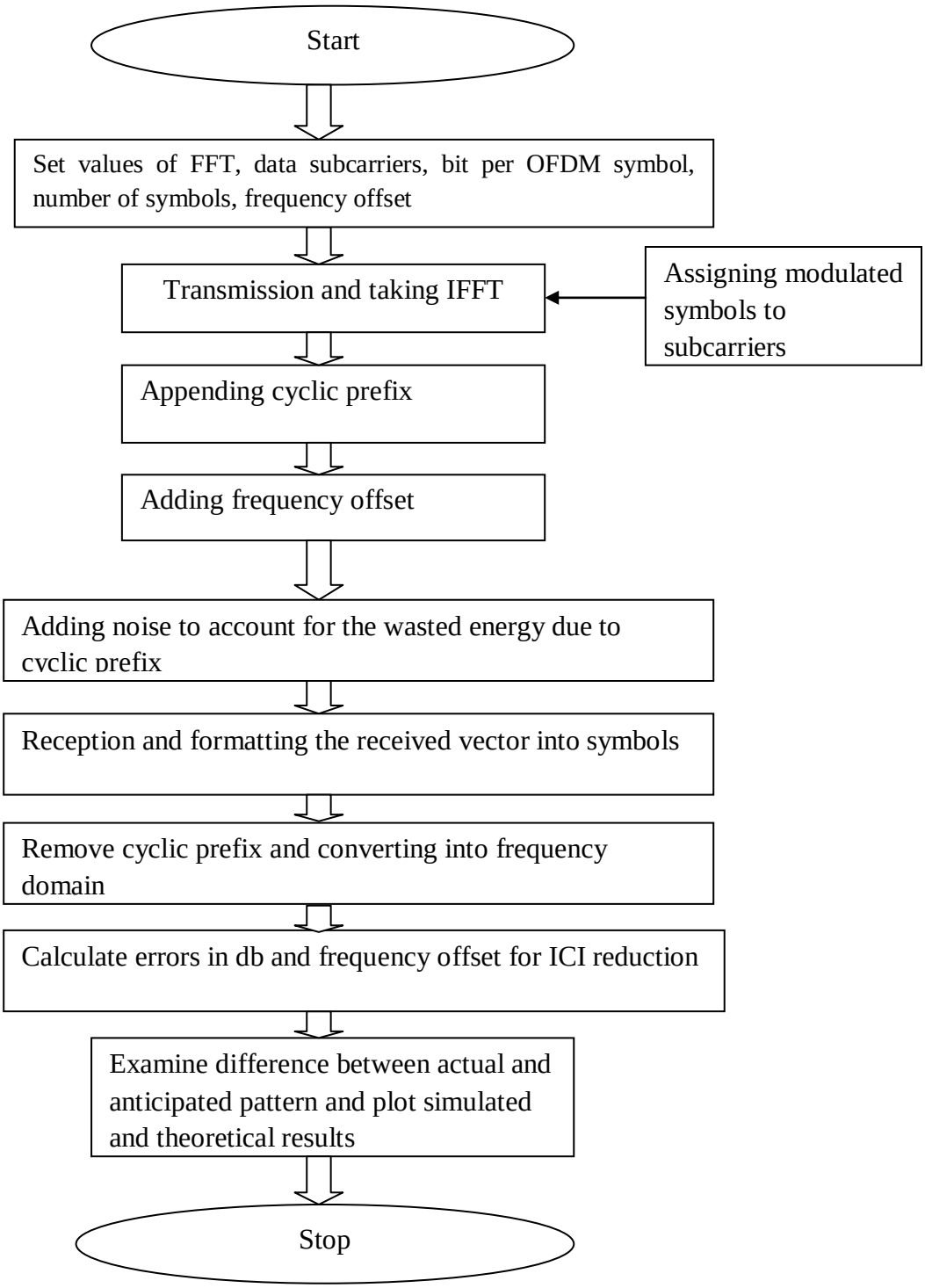

Figure 6: Research methodology flow diagram

5.2 AWGN channel (frequency)

AWGN (eng. Additive white Gaussian noise (sound)) classicequation is given as

$$V_t = U_t + N_t \quad \text{.....(6.2)}$$

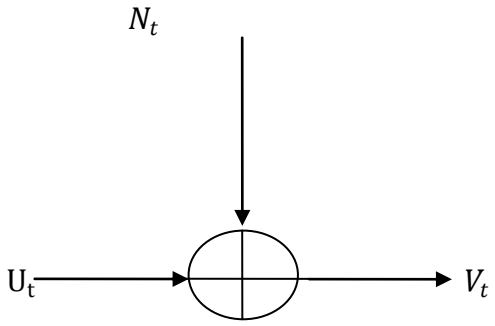

Figure 7: Blok diagram of AWGN classic

Noise (sound) occurs in all communication patterns working over an equivalent physical channel (frequency), such as wireless. The highest bases are current contextual noise (sound), and electrical noise (sound) in the receiver loudspeakers, and inter-cellular interference.

In adding to this noise (sound) can also be produced inside to the communication method as a result of Inter-Symbol Interference (ISI), Inter-Carrier Interference (ICI), and Inter- Modulation Distortion (IMD). These foundations of noise (sound) decrease the Signal to Noise (sound) Ratio (SNR), eventually warning the spectral competence of the method. Noise (sound), in entirely its forms, is the main damaging effect in greatest wireless communication approaches.

$$f_X(x) = \frac{1}{\sqrt{2\pi\sigma^2}} \cdot \exp\left(-\frac{(x-\mu)^2}{2\sigma^2}\right) \quad \text{... ... ... (6.3)}$$

It is consequently significant to research the belongings of noise (sound) on the infrastructures error rate and certain of the compromises that occurs between the level of noise (sound) and method haunted competence.

Maximum kinds of noise (sound) current in wireless communication approaches can be demonstrated accurately using Additive White Gaussian Noise (sound) (AWGN). This noise (sound) has a unchanging spectral thickness (making it white), and a Gaussian distribution in largeness (this is also referred to as a usual distribution).

The impression of OFDM originates from Multi Carrier Modulation (MCM) transmission performance. OFDM is a singular form of spectrally well-organized MCM performance, which employments thickly move apart orthogonal subcarriers and overlapping spectrums.

The usage of band pass filters is not required in OFDM since of the orthogonally countryside of the subcarriers. From now, the available bandwidth is used very competently without producing the Inter-Carrier Interference (ICI). Since, of the grouping of multiple low statistics rate subcarriers, OFDM delivers a compound high statistics rate with long symbol period.

The Signals are orthogonal if they are usually self-governing of every other. Orthogonally is stuff that permit various information signals to be transported perfectly over a common channel (frequency) and observed, without interference. Damage of orthogonally results is twisting between these info signals and degradation in communication.

Although TDMA & FDMA are also orthogonal, the period OFDM has been kept for a singular form of FDM. The subcarriers in an OFDM signal are spread out as close as is supposedly possible while preserve orthogonally between them. OFDM accomplishes orthogonally in the occurrence domain by allocating every of the distinct information signals onto dissimilar subcarriers.

CHAPTER 6

RESULTS AND DISCUSSIONS

6.1 Results

The simulation of WI-MAX method is done by using MATLAB software. The result is centered on the BER and probability of error. The graph BER for the basic OFDM classic variation BPSK and QPSK have the lower value of BER and 64-QAM has the higher value of BER while 16-QAM is in the central. At the lower BER, the modulation 64-QAM has the higher value of SNR then followed by 16-QAM, QPSK and BPSK. The BPSK and QPSK are the greatest inflection approaches for noisy disorder likened to 16-QAM and 64-QAM. The BER for OFDM classic with cyclic prefix shows of inflection pattern is similar compared to the OFDM classic without cyclic preface but have a slight improvement of value which the quality of signal is better than the basic OFDM classic for all modulation patterns. As the BER is very good near the base station, higher order modulation method is used in this zone to increase the quantity. However, in zones close to the cell boundary that is further from the base station. So, the method segments down to an inferior order inflection pattern to maintain the connection quality and connection stability. The WI-MAX method is substituted to the reduction order modulation pattern when the distance is increased to keep the connection between base stations and the user or receiver. The probability of error decrease as the signal to noise (sound) ratio is increased where the probability of error is higher for 64-QAM and then followed by 16-QAM, QPSK and BPSK. So, the higher order inflection method does not appropriate in the noisy condition rather than lower order modulation structure.

The lower order modulation pattern is the appropriate modulation method at the noisy condition cause of the lower value BER. The probability of error is the reason of the noise (sound) and fading introducing some error during the procedure and also due to the cable losses at spreader and receiver. Centered on the weather, meddling in the signal and the client distance, the Base Station vigorously selects the inflection pattern. When the connection quality is high, WI-MAX uses uppermost modulation with a low coding pattern that surges the method capacity. While the signal has to travel a long distance and feeling fading, WI-MAX can easily shift to the lower

order modulation with higher coding arrangement. This kind of adaptive modulation springs WI-MAX more steady connections and good connection quality.

There is a graphical representation of the results by taking different values of cyclic prefix along with different modulation techniques. Cyclic prefix values are 1/4, 1/8, 1/16, 1/32 etc…are taken and modulation techniques are binary phase shift keying, quadrature amplitude modulation, quadrature phase shift keying, 16-quadrature amplitude modulation methods are used to get the proper and efficient results.

Quality of service is the main factor of the any communication system and performance of the system will depends upon various parameters. One of these parameters is bit error rate, it is most important parameter. Increased of bit error rate will lead to the degradation in the system performance. Hence, always try to keep the bit error value at small. Another factor inter-carrier interference also creates great impact on system performance. ICI makes system performance slow and does not provide efficient results and proper communication.

In this section the simulation results of elementary OFDM classic and OFDM centered WI-MAX classic along with BER curves analysis of AWGN channel (frequency) are obtainable. In basic classic by increasing the signal control with respect to noise (sound) power of channel (frequency) the interference decreases due to which the BER of the method received In scrutiny of basic classic at G=0.26 using 16, 64 and 64 QAM modulation system the BER values are G=0.26, BW=28MHz,SUI=3.

High statistics rate transmission for a longer distances use OFDM performance for WI-MAX classic. In WI-MAX centered OFDM classical cyclic prefix can be used to overcome the result of ICI. In WI-MAX classic analysis by reducing the average powers of channel (frequency) the BER performance of the method decreases. Increase in values decreases the bit error rate of the OFDM method.

There are different results of this research with different cyclic prefix values and different modulation methods. Indicates various modulation methods with respect to different cyclic prefix values having bit error rate and signal to noise ratio different values as follows-

BPSK Modulation when Cyclic Prefix is 1/4

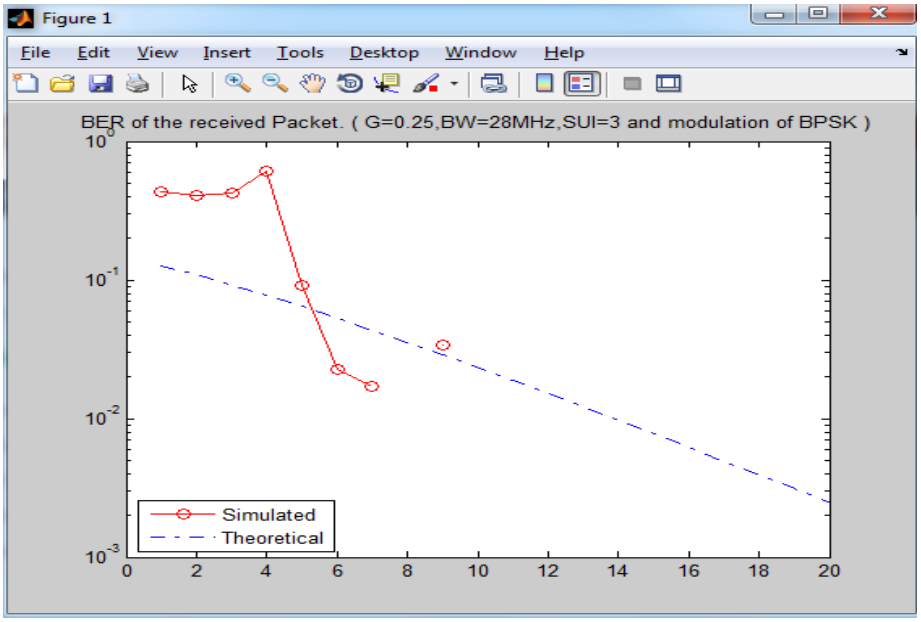

Figure 8: BER Received Packet at 28 MHz simulated in BPSK modulation Performance at 1/4 cyclic prefix

BPSK Modulation when Cyclic Prefix is 1/8

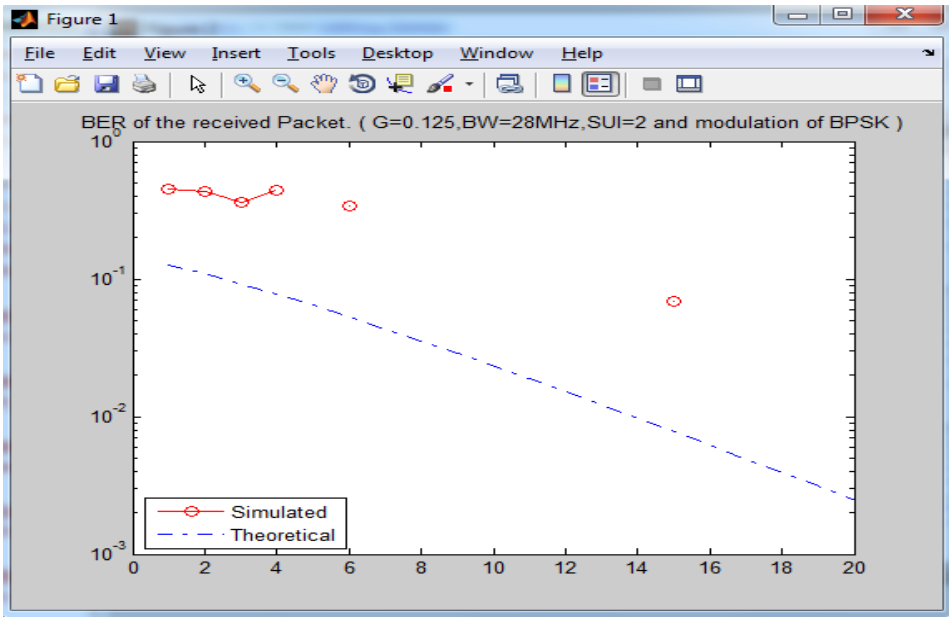

Figure 9: BER Received Packet at 28 MHz simulated in BPSK modulation Performance at 1/8 cyclic prefix

BPSK Modulation when Cyclic Prefix is 1/16

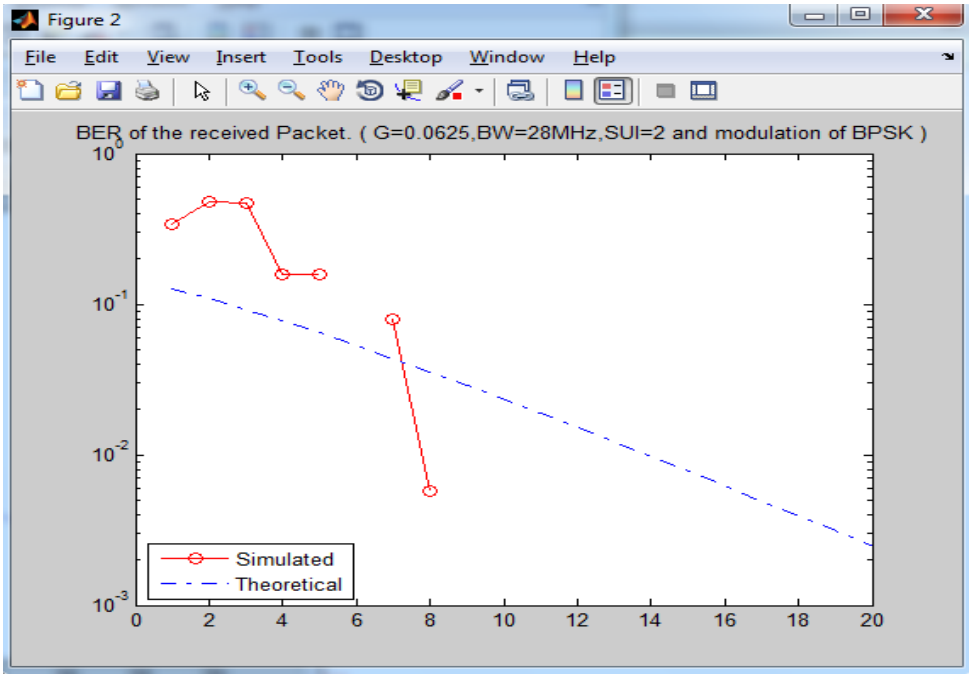

Figure 10: BER Received Packet at 28 MHz simulated in BPSK modulation Performance at 1/16 cyclic prefix

BPSK Modulation when Cyclic Prefix is 1/32

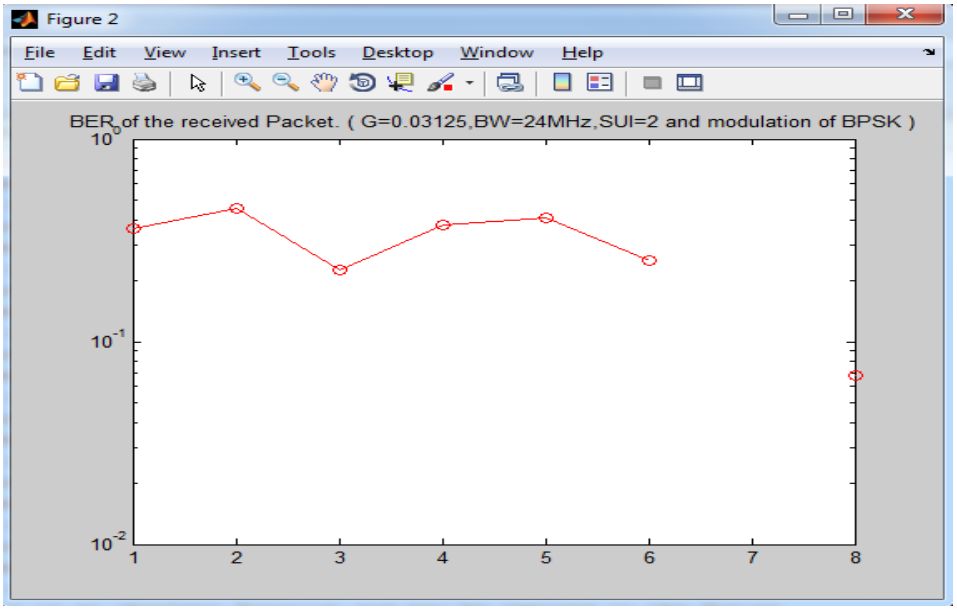

Figure 11: BER Received Packet at 28 MHz simulated in BPSK modulation Performance at 1/32 cyclic prefix with no theoretical parameter in Bit error rate

Above all results shows binary shift keying modulation in different cyclic prefix values at 28Mhz frequency and different SNR values. There is a comparison among different cyclic prefix values can be shown as following table-

Signal to noise ratio Values for BPSK Modulation	**Bit error rate for Cyclic prefix 1/4**	**Bit error rate for Cyclic prefix 1/8**	**Improvement**
2.893	2.350	1.249	0.4685
4.216	3.980	2.825	0.2902
3.452	4.534	3.190	0.2964
3.231	4.764	6.283	0.3188

Table 2: Comparison of different cyclic prefix values in case of BPSK modulation at different SNR values

QPSK modulation when cyclic prefix is 1/4

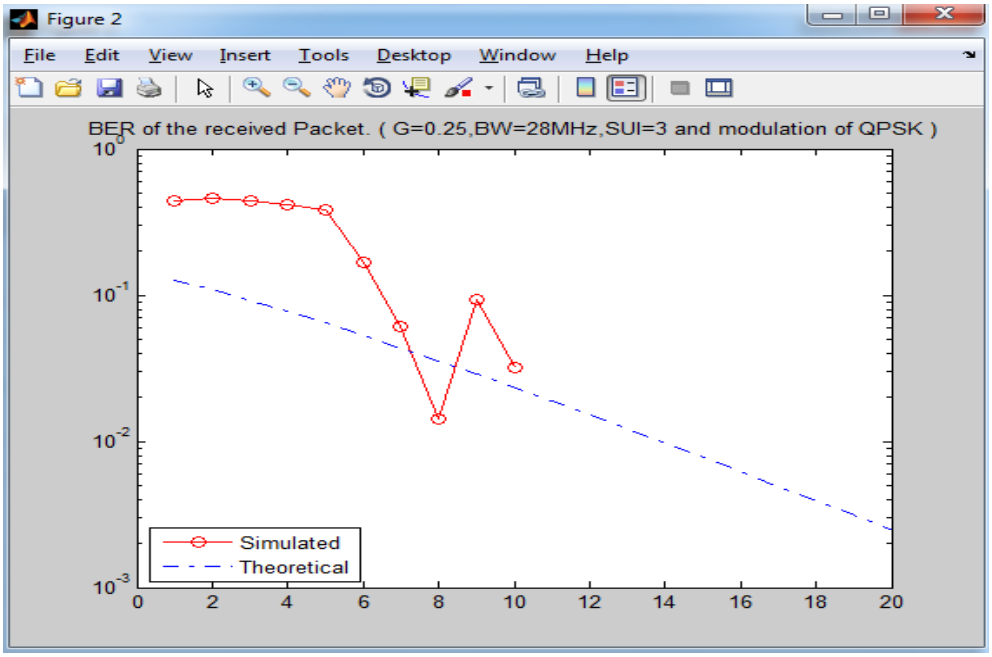

Figure 12: BER Received Packet at 28 MHz simulated in QPSK modulation Performance at ¼ cyclic prefix

QPSK modulation when cyclic prefix is 1/8

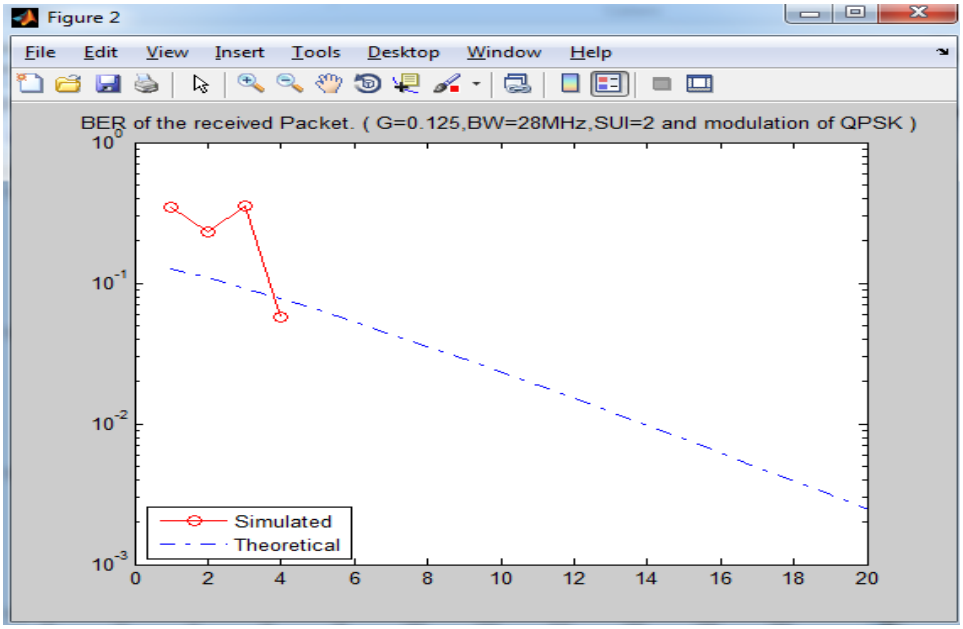

Figure 13: BER Received Packet at 28 MHz simulated in QPSK modulation Performance at 1/8 cyclic prefix

QPSK modulation when cyclic prefix is 1/16

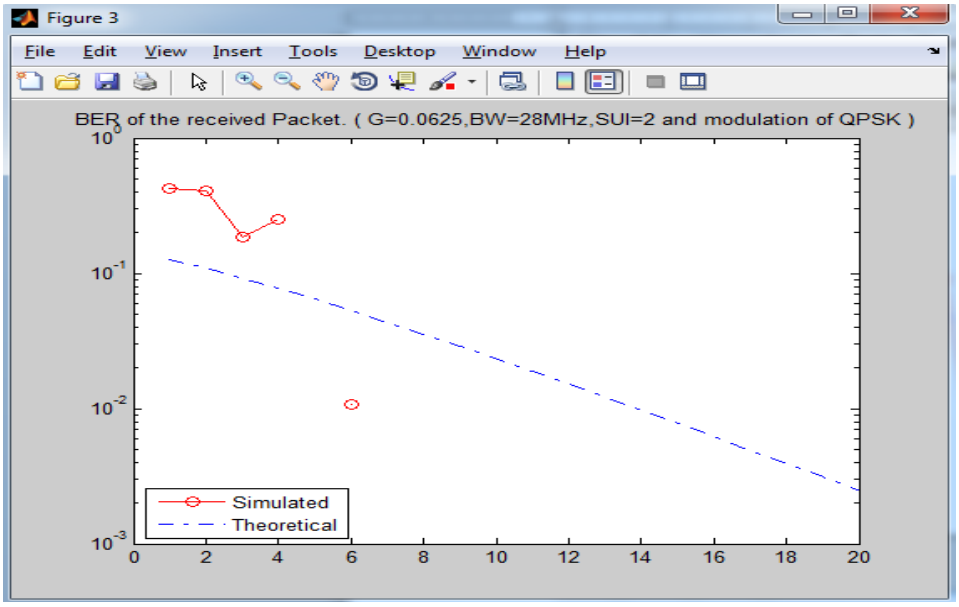

Figure 14: BER Received Packet at 28 MHz simulated in QPSK modulation Performance at 1/16 cyclic prefix

QPSK modulation when cyclic prefix is 1/32

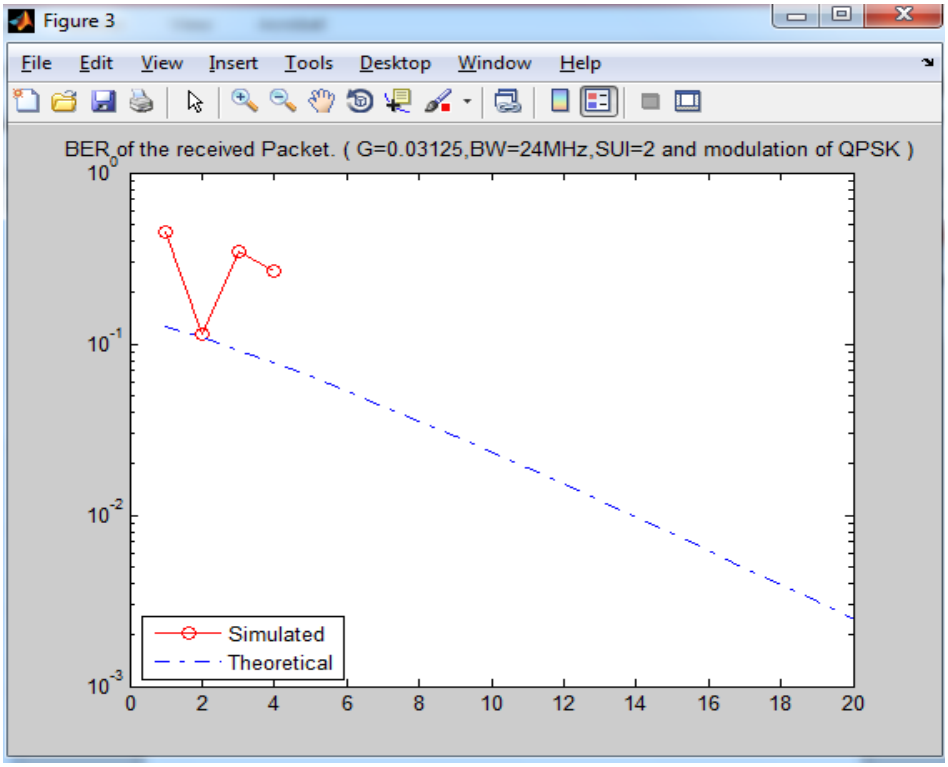

Figure 15: BER Received Packet at 28 MHz simulated in QPSK modulation Performance at 1/32 cyclic prefix with no theoretical parameter in Bit error rate

Comparison among different cyclic prefix values at different SNR values can be shown as following table-

Signal to noise ratio Values for QPSK Modulation	**Bit error rate for Cyclic prefix 1/4**	**Bit error rate for Cyclic prefix 1/8**	**Improvement**
1.883	2.567	1.542	0.3992
3.896	3.982	5.782	0.4520
4.459	4.592	3.671	0.2005
5.093	4.765	6.081	0.2761

Table 3: Comparison of different cyclic prefix values in case of QPSK modulation at different SNR values

16-QAM modulation when cyclic prefix is 1/4

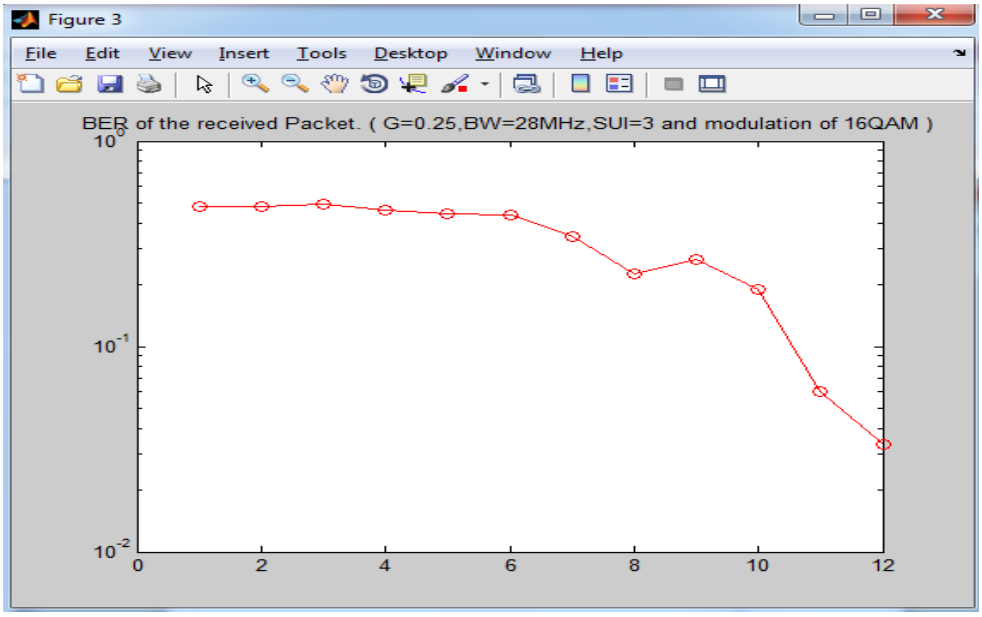

Figure 16: BER Received Packet at 28 MHz simulated in 16-QAM modulation Performance at 1/4 cyclic prefix

16-QAM modulation when cyclic prefix is 1/8

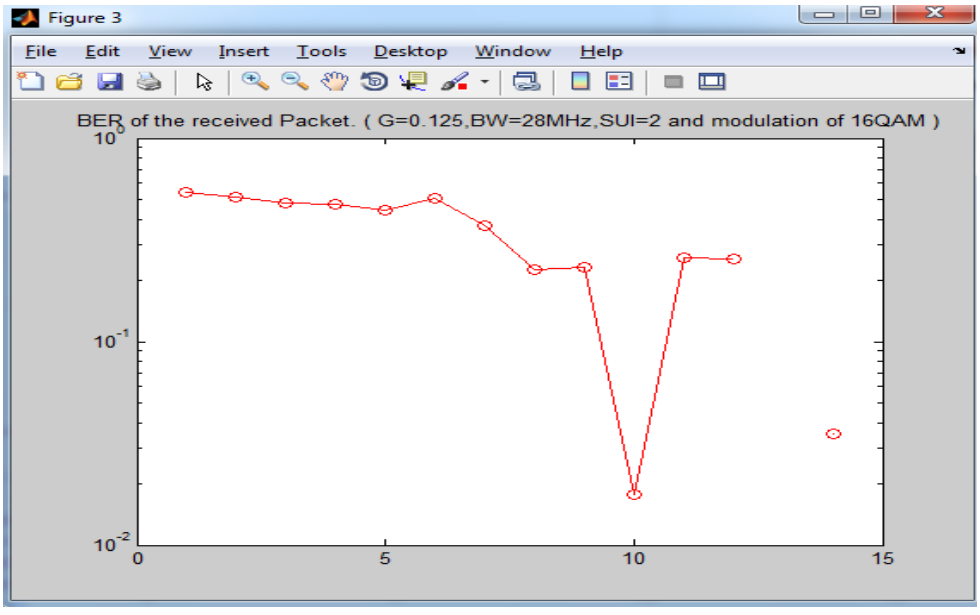

Figure 17: BER Received Packet at 28 MHz simulated in 16-QAM modulation Performance at1/8 cyclic prefix

16-QAM modulation when cyclic prefix is 1/8 with no theoretical parameter

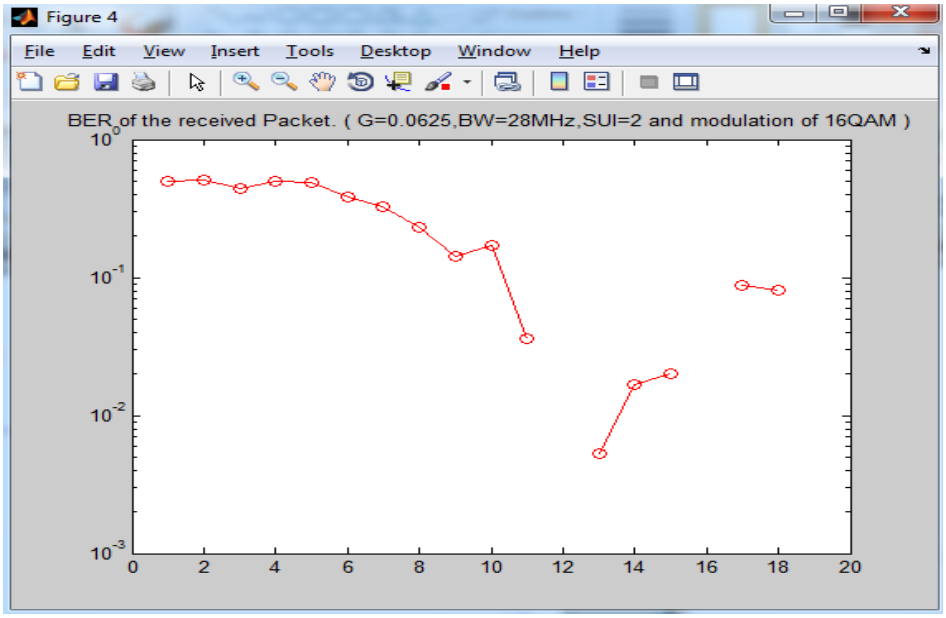

Figure 18: BER Received Packet at 28 MHz simulated in 16-QAM modulation Performance at 1/16 cyclic prefix with no theoretical parameter in Bit error rate

16-QAM modulation when cyclic prefix is 1/32 with no theoretical parameter

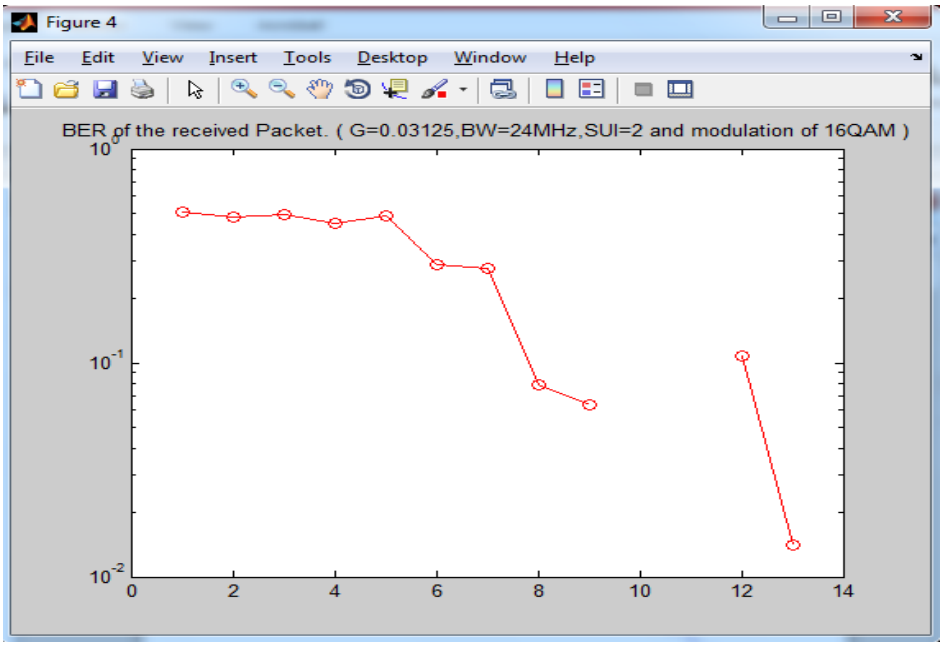

Figure 19: BER Received Packet at 28 MHz simulated in 16 QAM modulations Performance at 1/32 cyclic prefix with no theoretical parameter in Bit error rate

Above these results indicates Quadrature amplitude modulation in different cyclic prefix values at 28 Mhz frequency and the comparison among different cyclic prefix values can be shown as following table-

Signal to noise ratio Values for QPSK Modulation	**Bit error rate for Cyclic prefix 1/4**	**Bit error rate for Cyclic prefix 1/8**	**Improvement**
2.883	2.023	1.523	0.2471
3.453	2.676	3.678	0.3744
4.210	3.441	4.541	0.3196
6.891	4.765	6.914	0.4009

Table 4: Comparison of different cyclic prefix values in case of 16-QAM modulation at different SNR values

6.2 Performance of OFDM centered WIMAX 16-QAM& 64-QAM modulation using ICI self cancellation method

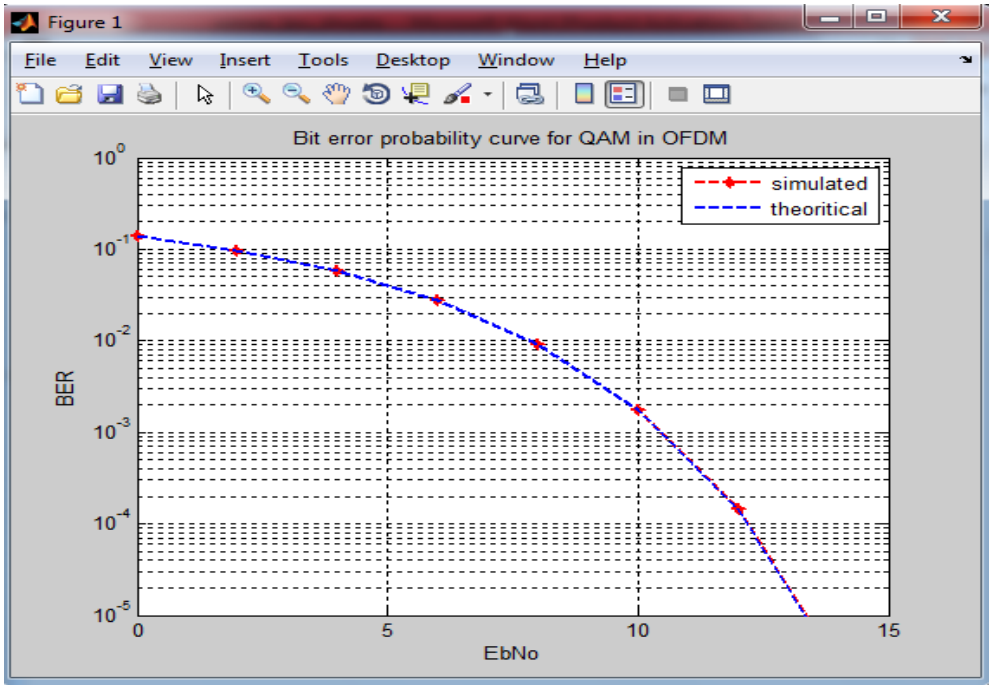

Figure 20: BER curve in QAM and OFDM

The subsequent figure displays the BER performance of WIMAX Physical layer through AWGN channel (frequency), Rayleigh and Rician fading channel (frequency)s using 16-QAM method, the classifications of AWGN channel (frequency) and fading (Rayleigh &Rician) channel (frequency)s.

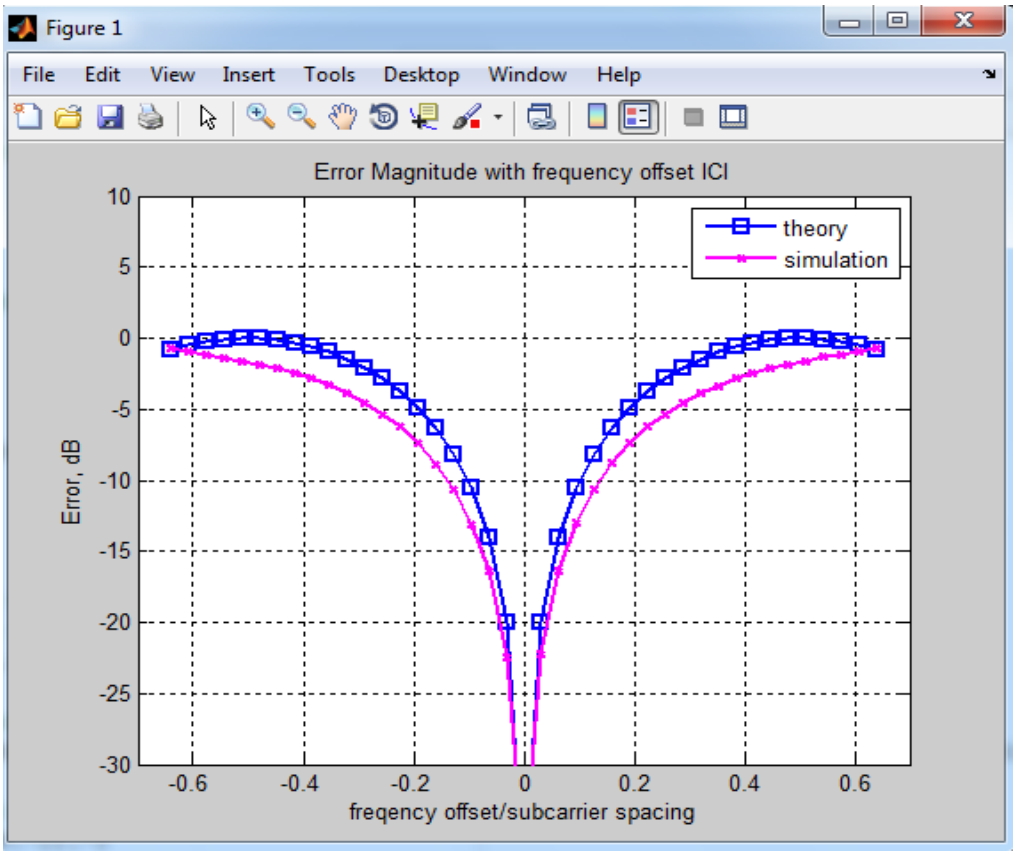

Figure 21: Error magnitude for frequency symbol ICI

The figure 21 represents the effect of ICI reduction on BER performance of WIMAX communication system**.** While using the QAM modulation pattern for ICI, BER for AWGN channel (frequency) simulate remains Error, dB is 0.

CHAPTER 7

CONCLUSION AND FUTURE SCOPE

In this thesis performance investigation of physical layer of WI-MAX pattern using simulated connection is done. First, BER for dissimilar additive modulation system are assessed in AWGN channel (frequency). Then performance is assessed using simulated connection classics. It is experiential that for a particular value of Bit error rate SNR value for BPSK /QPSK is lower than 16-QAM and 64-QAM. So 64-QAM.This thesis evaluates the present transfer condition in WI-MAX networks. In the first form of WI-MAX values, the movement was not maintained at all. Through the time developed a necessity of user mobility.

For the reason that of this motives numerous kinds of assignment in WI-MAX tools were presented. In this research we have inspected the perusing performance for an IEEE 802.16e MS. We have announced two new approaches to aid in decreasing the number of incidences to check though scanning to find a down connection from a BS and providing certain untried outcomes of a simulation focused on real-world quickness traces.

A number of pulse conclusive functions are deliberated for ICI power reduction. The presentation of every pulse determining function is assessed and associated with each other using the limitation such as ICI power and BER (Bit Error Rate). And also AWGN communication channel (frequency) gives better BER performances over Rayleigh AWGN channel (frequency). For the BPSK modulation at the different SNR values and cyclic prefix value-s such as 1/4, 1/8, 1/16 and 1/32, there is an occurrence of such improvement. For SNR value 2.893 and cyclic prefix value 1/4 and 1/8 the improvement is 0.4685 and for same cyclic prefix values but different SNR value 4.216 the improvement is 0.2902. Similarly for QPSK modulation for different SNR values the improved factors are 0.3992 and 0.4502 and for QAM improvement terms are 0.2471 and 0.3744.

7.1 Future Scope

In future scope we will have proposed that the Open broadband access via wireless is not only an advantage to profitable explorers but is also an interesting business opening in itself.

Broadband wireless internet access via hot spots in hotels, airports, agreement centers, coffee shops, restaurants, etc. is a fast increasing tendency. Hot spots afford internet access for hire. Comparatively inexpensive to set up, all that is compulsory to make a simple hot spot is overseas band assembly and a wireless router. May hot spots use T1 for its high bandwidth, but DSL, cable and secure wireless can also be used. WI-MAX technology can make high speed wireless broadband internet services obtainable to much larger zones than can typical Wi-Fi hot spots. WI-MAX applications can give a wireless range of up to 30 miles or 60 kilometers, much greater than the physical distance limitations of Wi-Fi hot spots or DSL, WI-MAX technology can also be used to interconnect existing Wi-Fi networks.4G wireless communication method WI-MAX permits the potential for flatters architectures and gives low cost and low latency communication network.

The main aim of ICI reduction generates a little impact on the performance factors of OFDM. There is an occurrence of ICI because of variance in wireless communication network method which gives orthogonally among all subcarriers. In the OFDM orthogonally permits a various subcarriers into a tight space without any interference between them .OFDM is most widely used communication performance because of its robust nature and it is more spectrums efficient for supporting multiple antenna method.

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