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Analysis of Modulation Techniques and Network Technologies for LTE System: A Survey

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ABSTRACT

Now days, we are existing in the period of mobile data advancement. With a great extension of electonic devices like computers, tablets, mobile phones, laptops users are demanding for such applications and services that are not only restricted to simple voice but for more advance applications [11] . The fast expansion and enlargement in services and applications like music, social networking, web browsing, video streaming and many more has driven the mobile data technology towards next generation of wireless communication standards. In this paper a detailed survey carried out on LTE and its main technologies. To implement LTE there is a requirement of advanced technologies like MIMO, OFDM etc. Modulation methods are of two types analog and digital but for implementing LTE digital modulation techniques are required. Our main objective is to make a comparative analysis of digital modulation schemes among QPSK and QAM for different channels against signal to noise ratio (SNR). Besides this in this article we also mention problem formulation to implement LTE system along with objectives. The research part will be carried out using MATLAB for various parameters.

Keywords: OFDM, LTE, MIMO, BER, QAM, QPSK, SNR

1. INTRODUCTION

The mobile communication systems have grown popularity day by day due to rapid advancement of mobile technology. Starting from the first generation analog mobile communication to the fourth generation mobile communication with smart phone devices, every generation arises with new technologies and new possibilities compared to the previous generation. Consequently user expectation from the new generation of mobile network in terms of speed and reliability is increased.

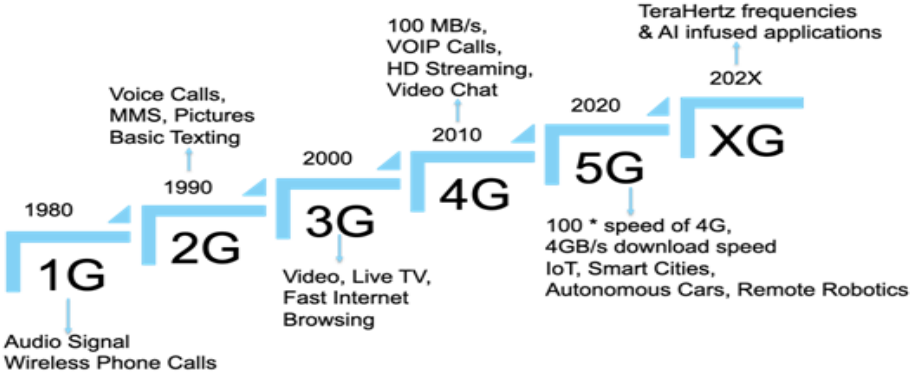

Figure 1 Evolution of communication from 1G to 5G

Modulation is of utmost importance to all wireless communications. Most wireless transmissions as of today are digital with limited available spectrum; thus the type of modulation employed is crucial. The transition of analogue to digital

modulation offered improved data security, enhanced quality communication, additional information-carrying capacity, compatibility with digital data services, swift system availability as well as RF spectrum sharing to accommodate added services [1]. Digital Modulation techniques provide numerous benefits such as greater capacity to transmit large quantity of data with high noise immunity. Another silient advantage is easy detection of its distinct transmission state at the receiver in a noisy medium [4]. Fourth generation (4G) is the most advanced existing technology which can cope up with this user expectation. In the presence of different modulation schemes such as QPSK and M-QAM (M=16, 64), a performance analysis of LTE signal in terms of signal to noise ratio (SNR), channel power, occupied bandwidth (OBW) etc is obtained.

2. LITERATURE sURVEY

Fitch, Michael et al: In this paper, right now there is an extremely key change occurring in range guideline, perhaps the most key ever in its history. This is the empowering of range sharing, where essential (authorized) clients of the range, are compelled to permit imparting to optional clients, who use permit absolved gear. Such sharing is free for the auxiliary clients, subject to the condition that they don't make hurtful obstruction the essential clients. The main occurrence of such sharing is happening with the UHF advanced TV range, in what is generally called TV void area. Controllers, for example, the FCC in the United States & Ofcom in the United Kingdom have shown that other range will stick to this same pattern. Intellectual radio is an empowering innovation that permits such sharing. Following ongoing decisions by FCC & Ofcom & the development of a progression of related industry norms, CR activity in TVWS is moving from the examination space towards execution & commercialization, with use-cases that are important to telecom administrators. In this article we depict three such use cases: future home systems, inclusion of the road from inside structures, & broadb& access to provincial & underserved premises. We present aftereffects of displaying & preliminaries of specialized achievability, embraced by the Innovate & Design group at BT. In light of our experience we reach inferences with respect to the practicality & business significance of these utilization cases, & distinguish a portion of the staying specialized & business challenges [1].

Bezabih, Hemdan et al:In this paper, today, TV void areas are the most encouraging range wherein psychological radios (CRs) can be sent. The objective of this article is to examine the potential increment in accessible range utilized by the CR gadget. We characterize two information levels & show that data about the TV collectors can exp& the measure of accessible range for CR gadgets in the TV groups by as much as 120 MHz. Over the most recent couple of decades, interest for remote administrations had detonated. As indicated by Cisco, portable information traffic is required to have a 26-overlay increment from 2010 to 2015 [3]. We know from Shannons limit equation that exp&ing the accessible data transfer capacity builds the limit of correspondence frameworks. Regarding data transmission inhabitance, the development of advanced innovation over simple innovation had opened up some transfer speed. At the point when TV broadcasting frameworks changed from simple to advanced telecom, around 100 [2]

Bouida, Zied et al: In this paper, under the situation of an underlay psychological radio system, we propose in this paper a versatile plan utilizing communicate power adjustment, exchanged send decent variety, & versatile regulation so as to improve the presentation of existing exchanging effective plans (SES) & data transfer capacity productive plans (BES). Exploiting the channel correspondence rule, we expect that the channel state data (CSI) of the impedance interface is accessible to the optional transmitter. This data is then utilized by the optional transmitter to adjust its send power, balance group of stars size, & utilized communicate branch. The objective of this joint adjustment is to limit the normal number of exchanged branches & the normal framework postpone given the blurring channel conditions, the necessary mistake rate execution, & a pinnacle obstruction imperative to the essential collector. We dissect the proposed plot regarding the normal number of branch exchanging, normal deferral, & we give a shut structure articulation of the normal piece blunder rate (BER). We exhibit through numerical models that the proposed conspire gives a trade off between the SES & the BES plans [3].

Sun, Songlin et al: In this paper, we incorporate overlay intellectual radio innovation into 4G cell systems for the sharing of TV range. On one h&, OFDM is a promising method for fast information transmission over multipath blurring channels &had been viewed as the best possibility for 4G portable systems. On another h&, the overlay psychological radio model makes it conceivable to have two simultaneous transmissions in a given impedance district, where traditionally just a single correspondence happens at a given time. We examine distinctive assistance arrangement situations & propose both time space & recurrence area overlay intellectual radio OFDM frameworks for cutting edge cell systems. Numerical outcomes show our proposed plans can accomplish fulfilling execution in various use cases [4].

3. PROBLEM FORMULATION AND OBJECTIVE

Problem Formulation:

A few transmission modes are characterized in LTE principles. A next to no transmission modes are thinking about for LTE in physical layer boundaries & remote channel qualities. We assessed the demonstration of accessible transmission modes in LTE. Be that as it may, execution examination should be possible direct utilizing assessment of LTE. The presentation of transmission modes are assessed by computing likelihood of BER (BER) versus Signal Noise

Ratio (SNR) under the much of the time utilized three remote channel models (AWGN, Rayleigh & Rician). We will think about the information adjustment & information rate to break down execution that is BER versus SNR. We additionally consider multipath got signals. The impersonation results will execution of transmission modes under various channel models & number of radio wires. In view of reenactment results, we will likewise watch the transmission modes are not effective in LTE. The assessment of execution will affirm increment in the inclusion zone of the physical layer in the LTE gadgets.

Objective:
It is critical to assess execution of remote gadgets by thinking about transmission attributes, remote channel boundaries & machine structure. The presentation of information transmission over remote channels is fine caught by watching their BER, which is an element of SNR at the beneficiary. In remote channels, a few models have been proposed & explored to figure SNR. All the models are an element of separation among sender & the beneficiary, way misfortune type & the channel gain. A few likelihood circulated capacities are accessible to demonstrate a period variation boundary for example channel gain. We will utilize the three significant & much of the time utilized circulations. Those are AWGN, Rayleigh & Rician models. Our objective for research are listed below

- To Study & analyze various technologies such as LTE, MIMO OFDM, Wireless Channel Modeling, Channel Fading & Modulation Techniques.
- To design a LTE system that supports various Modulation techniques & which can be tested using various Fading Channels.
- To evaluate the performance of proposed LTE system with various evaluation metrics such as BER & SNR.

4. LTE NETWORK TECHNOLOGIES

The numbers of mobile web users have been massively increased with the progression in mobile technology. High speed internet access is an emerging area of interest. 4G provides high speed internet access as compared to other generations. 4G is the succeeding technology of third generation (3G) and preceding technology of fifth generation (5G). The International Telecommunication Union–Radio (ITU-R) sets the necessity for 4G technology which is named as International Mobile Telecommunication advanced (IMTAdvanced). The requirement is that the peak data rate should be 100 Mbps for high mobility communication and 1 Gbps for low mobility communication.

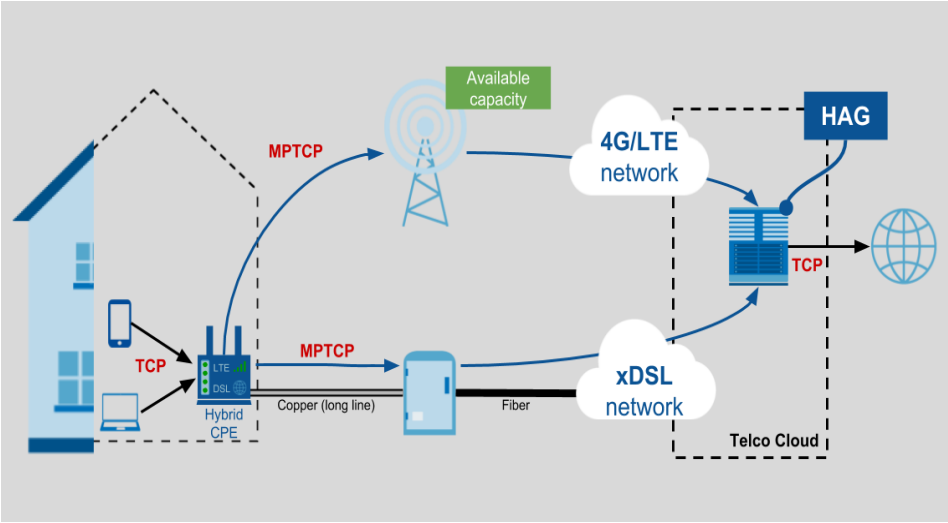

Figure 2 Hybrid access network

Adjacent Channel Power
Adjacent channel power (ACP) measures the total power in a specified channel up to six pairs of offset frequency. This measurement shows the ratio of offset power to the main channel power. ACP measurement is also called adjacent channel power ratio (ACPR) or Adjacent channel leakage ratio (ACLR).

Orthogonal Frequency Division Multiplexing
Orthogonal frequency division multiplexing (OFDM) technology [5-6] is better air access technology from its predecessor which is called Code Division Multiple Access (CDMA). It is a variant of Frequency division multiplexing (FDM) technology. OFDM divides the frequency band in narrow orthogonal part which is called sub carriers [5]. Many sub carriers are aggregated to form a Sub channel. Subcarriers contain pilot sub-carriers, data sub-carriers and Direct current (DC) sub-carrier as shown in Fig.2. The task of data sub-carrier is to carry data and that of pilot sub-carrier is to

sense the channel. DC sub- carrier marks the center of the channel. Each sub carrier is modulated by any one of the modulation scheme such as Phase shift keying (PSK) or Quadrature amplitude modulation (QAM).

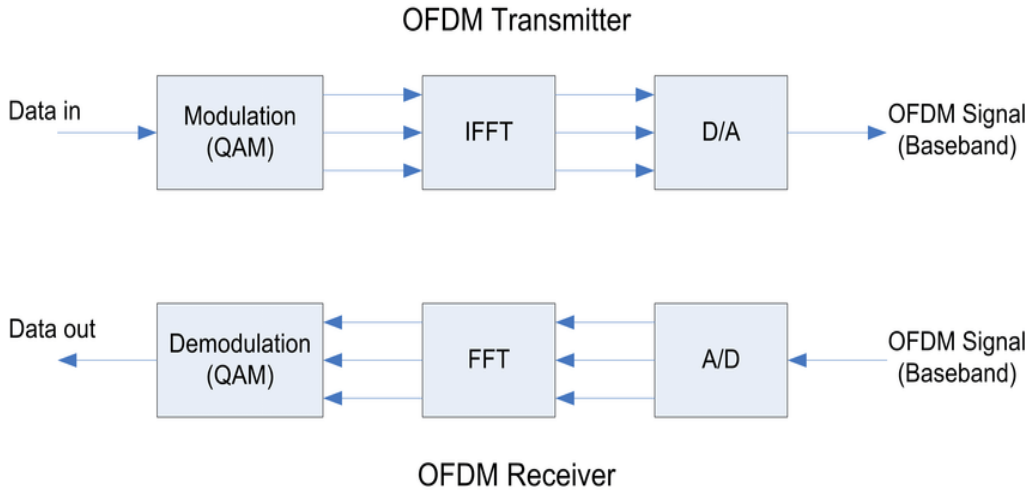

Figure 3 OFDM Transmitters and Receiver

Multiple Inputs Multiple Outputs (MIMO) Technology

Multiple Inputs Multiple Outputs: MIMO is a technology where multiple antennas [7] are used in wireless radio communication both in transmission and receiver equipments as shown in Fig.4. Multiple antennas are used to send multiple parallel signals from a transmitter. These signals are reflected by trees and building on their way to the receiver and reached to the receiver on different way. In the receiving end MIMO uses an algorithm to short out the signals and produce one signal which contained the original transmitted data.

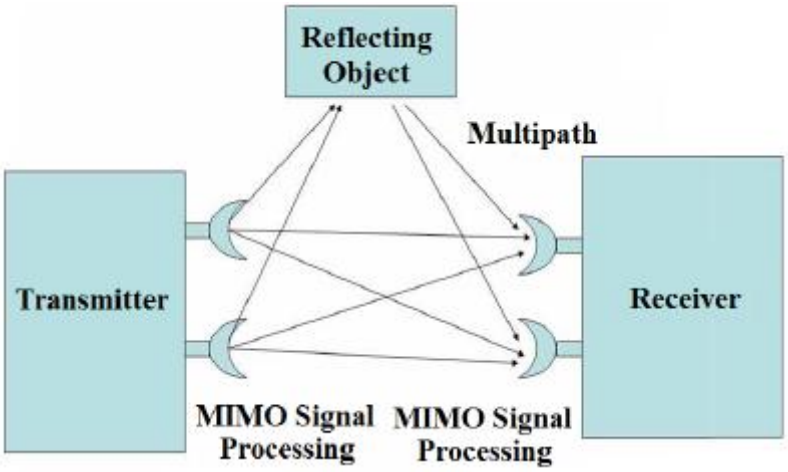

Figure 4 MIMO Antenna Architecture

Complementary Cumulative Distribution Function

Complementary cumulative distribution function (CCDF) curve of a signal gives the information about how much time a signal spends at or above a predefined power level. CCDF measurement gives the percentage of time a signal spends on particular power level.

CONCLUSION

The main focus of this survey paper is to depict a detailed survey on LTE technology by various reseachers, LTE technologies aling with problem formulation and objectives. LTE technology uses digital modulation techniques therefore in our research part our main task is to make comparative analysis among digital modulation schemes QPSK and QAM in term of bit error rate for various channels. There are so many parameters through which we can make a comparative analysis between various digital modulation techniques like bandwidth of channel, channel power, BER, channel noise; SNR etc. Digital modulation techniques are being preferred specially in high data rate systems such as LTE, LTE-A.

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