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A Simulation Design of LTE Communication System under Adaptive Modulation Schemes

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ABSTRACT:

To adapt to diverse cable circumstances and enhance performance data, LTE standards use three separate editing mechanisms. QPSK, 16-QAM, and 64-QAM are the three systems. This article gives a description of the LTE Digital Communications System, which was created to look at the effects of QPSK, 16-QAM, and 64-QAM on the BER implementation using the AWGN model. The block and the receiver both have their own subsystems. To deliver dependable and secure user services, LTE employs Turbo Digital Encoding and Bit Code Encryption. The 64-QAM, 16-QAM, or QPSK module schema on the transmitter side, as well as the matching demodulation scheme by the receiver, is automatically determined depending on the condition of the channel, which is presumed to be clear, precise, or disruptive. The resultant bitrate error rate is studied, compared, and discussed based on the BitDefender data downloaded.

Keywords—LTE; QPSK; 16-QAM; 64-QAM; AWGN, Turbo coding, Bit-level scrambling, BER.

1. INTRODUCTION

The Physical Layer simulation of the LTE communication system is critical for assessing and understanding why and how the modulation scheme chosen affects the system's dependability in terms of BER performance. One of the most distinctive qualities of LTE technology is its ability to deliver services with very high capacity and speed. The LTE system must adjust its modulation scheme to the communication channel's circumstances in order to preserve such key characteristics. Because it affects the system's BER performance, this change of the LTE modulation scheme has an influence on its dependability.

The mathematical underpinning and accompanying algorithms of LTE enabling technologies such as Turbo channel coding and bit-level scrambling are presented in this work. This design research makes a significant contribution to the knowledge of LTE digital communication PHY models and the enhancement of the system's BER performance using Turbo channel coding. The emphasis of this study then

Vol 13, Issue 06, June/2022

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shifts to synchronizing and integrating the various subsystems of a fully operating LTE digital communication Simulink model. This research focuses on the effects of adaptive modulation depending on channel circumstances and Turbo channel coding on the system's BER performance.

Unlike previous comparable research, this design investigates the isolated influence of LTE modulation scheme modifications on the system's BER. It then investigates the combined impacts of modulation scheme adaptability and Turbo channel coding on the communication system's dependability, as measured by the BER performance.

Before the simulated BER findings from the simulation of the fully integrated LTE Simulink model, a theoretical BER performance model for the AWGN channel model is examined. Before being compared to each other, the obtained simulation results for the three modulation schemes are analyzed, discussed, and compared to the theoretically expected results.

2. LITERATURE REVIEW:

Mehnaz Khursheed et.al: Wireless communication is one of the mainly active areas of tools progress and has become an ever-more essential and prominent part of everyday life. Simulation of wireless channels accurately is very important for the intend and performance evaluation of wireless communication systems and components. We evaluated the act of available transmission modes in LTE. However, performance analysis can be done straightforward using evaluation of LTE. The performance of transmission modes are evaluated by calculating probability of Bit Error Rate (BER) versus Signal Noise Ratio (SNR) under the frequently used three wireless channel models (AWGN, Rayleigh and Rician). We will consider the data modulation and data rate to analyze performance that is BER vs. SNR. A comparative analysis of QPSK and 16QAM, 32 QAM and 64 QAM will also provide knowledge base which helps for application development in real-world.

Delson T R, Iven Jose et.al: developing wireless communication transceiver designs based on the Long term evolution (LTE) architecture initiated by 3GPP consortium. Initially, performance comparison on Bit error rate (BER) and Signal to noise ratio (SNR) both in fading (Rayleigh channel) and non-fading (AWGN) channels are evaluated for a single transmitter and receiver system design. Different modulations schemes are used such as Binary Phase Shift Keying (BPSK), Quadrature Phase Sift Keying (QPSK), and Quadrature Amplitude Modulation (QAM) are used. Later, the transceiver designs incorporate Orthogonal Frequency Division Multiplexing (OFDM) with suitable LTE modulation formats specifications [8]. Performance evaluation of BER and SNR are analyzed on designed transceiver structures. This paper further evaluates the capacity or throughput of the channel using Shannon capacity equation for a band limited

AWGN channel with an average transmit power constraint [7]. The capacity of the channel is analyzed using parameters such as bandwidth and transmitting power as constraints. These parameters define the bounds on communication system.

Vaishaleekumawat, Pallavi Pahadiya et.al: Long-Term Evolution (LTE) is a standard for high-speed wireless communication for mobile phones and data terminals, based on the GSM/EDGE and UMTS/HSPA technologies. It increases the capacity and speed using a different radio interface together with core network improvements. The LTE standard uses three different modulation schemes to adapt to various channel conditions in order to improve achievable data rates. These modulation schemes are the QPSK, 16-QAM and 64-QAM. This paper presents an overview of a LTE digital communication system. A Simulation model, designed in order to study the effects of the different modulation schemes on the basis of BER performance with an AWGN channel model. Different subsystems within the transmitter and receiver blocks are implemented in MATLAB. It is noted that the LTE system uses different coding techniques to offer reliable and secure services to the users. Depending on the assumed channel condition (clear, medium clear or noisy), the 64-QAM, 16-QAM or QPSK modulation scheme, on the transmitter side as well as the corresponding demodulation scheme, on the receiver side is used. Based on the recovered data bits, the obtained bit error rates are analyzed, compared and discussed.

3. SYSTEM ARCHITECTURE

EXISTING SYSTEM:

The length requirement for all convolutional codes might be 9. The modulo-2 expansion of selected taps of a serially time-deferred information sequence is included in convolutional encode. The duration of the information succession delay is k-1, where k is the code's minimum length requirement.

PROPOSED SYSTEM:

The LTE framework as delineated in fig:1 contains.

1. A transmitter piece made of, from source to the channel, a formatter, a Mu-law compressor, CRC blunder locator, Turbo channel encoder, bit level scrambler, NRZ base band modulator and a determination-based pass band modulator subsystem.

2. The AWGN characterized by its clamor change parameter.

3. A collector piece made of, fro channel to goal, a passband demodulator, somewhat level, descrambler, a Turbo channel decoder, a CRC mistake locator and a Mu-law expander subsystems.

Vol 13, Issue 06, June/2022

ISSN NO:0377-9254

4. METHODOLOGY

The recreation of the LTE correspondence framework at its physical layer is pivotal with a specific end goal to evaluate and comprehend why and how the determination of a specific adjustment plan can influence its dependability as far as its BER execution. One of the principle recognizing components of the LTE innovation remains its capacity to give high limit and throughput administrations. Keeping in mind the end goal to keep up such essential elements, the LTE framework needs to adjust its regulation plans to the correspondence channels conditions. This adjustment of the LTE tweak plot impacts on the unwavering quality of the framework since it influences its BER execution.

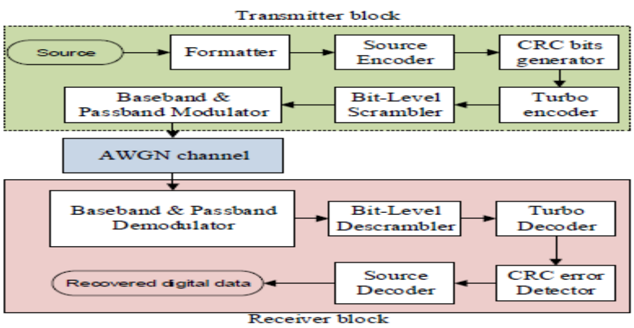

Fig 1: Digital LTE, digital communication system, block

Performing theQAM (Quadrature Amplitude Modulation) on the message signal

Quadrature adequacy adjustment, when, utilized for computerized transmission for radio interchanges applications can convey higher information rates than standard sufficiency regulated plans and stage balanced plans. Similarly, as with stage move keying, and so on, the quantity of focuses at which the flag can rest i.e. the quantity of focuses on the group of stars is demonstrated in the balance organize portrayal e.g 16QAM utilizations a16 point group of stars. When utilizing QAM, the star grouping focuses are regularly masterminded in a square framework with rise to vertical and level dividing and accordingly the most well-known types of QAM utilize a heavenly body with the quantity of focuses equivalent to an energy of 2 i.e., 4,16,64.

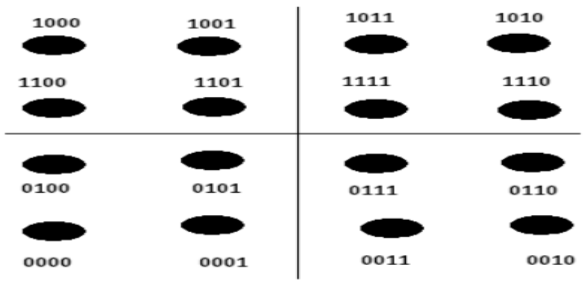

Fig 2: Bit sequence mapping for a 16QAM signal

5.RESULTS

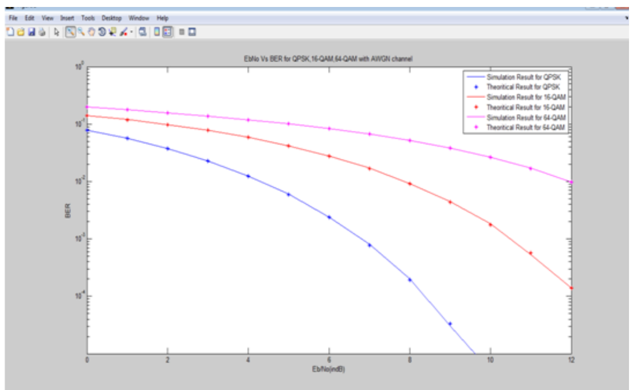

Fig 3: EbN0 vs. BER results for different

Journal of Engineering Sciences

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modulation schemes like QPSK, 16-QAM and 64-QAM modulation schemes with AWGN channel.

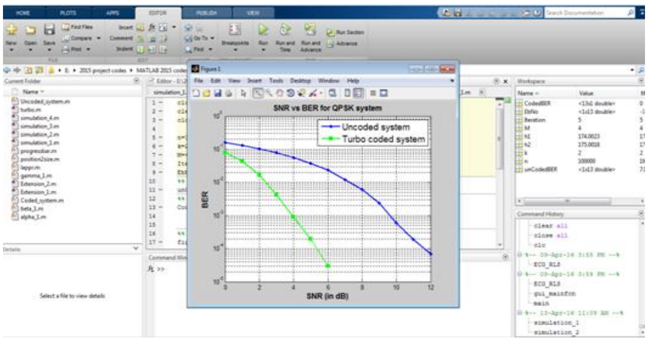

Fig 4: SNR vs. BER for QPSK system.

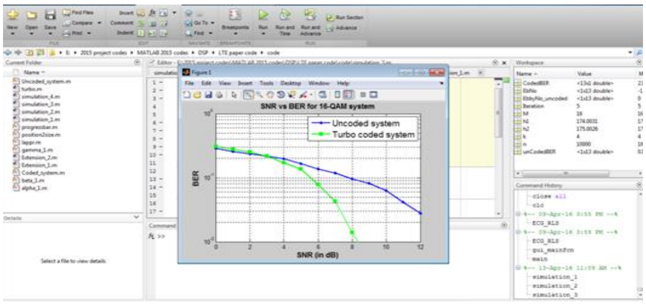

Fig 5: SNR vs. BER for 16-QAM system.

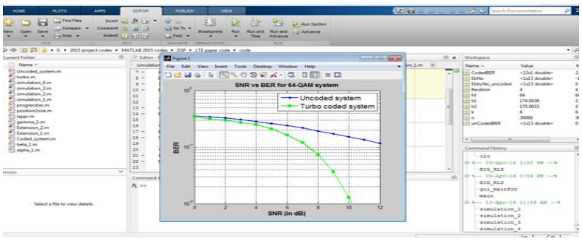

Fig 6: SNR vs. BER for 64-QAM system.

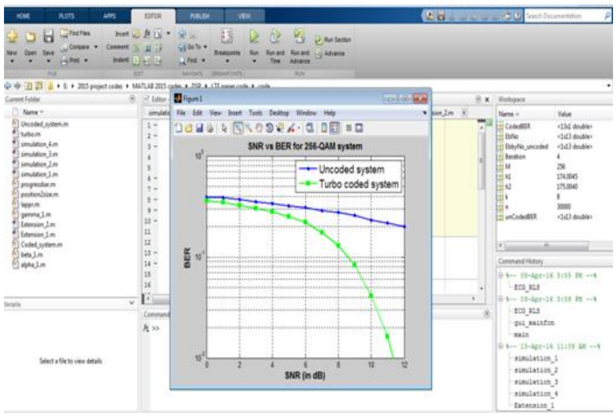

Fig 7: SNR vs. BER for 256-QAM system.

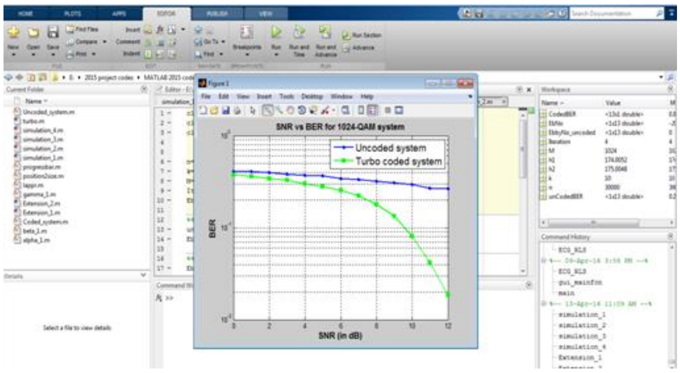

Fig 8: SNR vs. BER for 1024-QAM system.

6. CONCLUSION

In this project, the design of the LTE digital communication system has been described. Various different LTE simulations have been designed with different results. Comparison between the results obtained by fraudulent LTE without a channel system that has a passcode and with one third of the Turbo Channel code has been created. The experimental results have been analyzed and it has been observed that the LTE 1/3-Turbo module with LTE code runs better than the BER over a non-coded model. It has also been observed that in both unmanaged scenarios and 1/3 of the turbo-coded characters, the

Vol 13, Issue 06, June/2022

ISSN NO:0377-9254

Constellation Synthetic Schematic Density (QPSK to 16-QAM to 64-QAM); Its poor performance of BER means less reliability than the entire communications system. The benefits of our study to the LTE technology industry and the University are a model and research and development laboratory.

Future Scenes

In the future, we can expand the results for a higher order adjustment scheme, and we will use more robust encoding projects to improve BER performance.

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