Development of Improved LTE Wireless System using Carrier Length with PAM

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Abstract - The information sharing is everyone's part of life from morning to evening, from sharing of images, videos to chats on social media. Technology is becoming the integrated part of each work we do, which involves operation of devices, intelligent system, surveillance, monitoring of electronic appliances of home from any corner of this world. Such intelligence need affect medium to communicate which only can only be possible with the strong reliable wireless network and such demands can be fulfilled by modern fourth generation and upcoming 5th generation of communication system. Current LTE technologies is taking stands to serve the efficient communication mean to human being and it is the proof of great innovation to fulfill the communication needs and taking technology advancements too far. This exploration analyzes the performance of LTE technology keeping the architecture of fading channels and its basic parameters. Here we have analyzed the OFDM in different aspects like subcarriers and that was done with the encoded signals. Encoded signals are achieved using phase encoding which is not complex but very effective to protect signals from noises and interferences. The simulation performed for numerical analysis of bit error rate with different length of subcarriers.

Keywords - BER, LTE, Fading Channel, Phase Encoding, OFDM, QAM, PAM.

I. INTRODUCTION

4G technology merges particular existing and future wireless network advances to guarantee flexibility of development and consistent wander starting with one innovation then onto the next. It gives sight and sound applications to the end client by various advances through nonstop and constantly most ideal association.

4G systems are incorporated with center system and a few radios get to systems. The center interface is utilized for communication with the center system and radio get to systems, the accumulation of radio interfaces are utilized for communication with the radio get to systems and mobile users. The fundamental recognizing component somewhere around 3G and 4G is data rate. 4G can bolster no less than 100Mbps pinnacle rate in full-portability wide zone scope and 1Gbps in low-versatility neighborhood where as the speed of 3G can be dependent upon 2Mbps, which is much lower than the paces of 4G. Notwithstanding, 4G standard will base on broadband IP-based completely applying bundle exchanging technique for transmission with consistently get to union. It implies that 4G coordinates all get to innovations, administrations and applications boundlessly through remote spine and wire-line spine by utilizing IP address

OFDM stands for orthogonal frequency division multiplexing, which transmits extensive measure of advanced data over the radio wave. OFDM works by part the radio signal into various littler sub signals and after that transmit at the same time at various frequencies to the collector. Huge Area Synchronized Code Division Multiple Access (LAS-CDMA) empowers rapid data and builds voice limit. Multi-Carrier Code Division Multiple Access (MC-CDMA), which is intended for running on wide range, called large scale cell. The Local Multipoint Distribution System, (LMDS), intended for smaller scale cell is utilized to convey voice, data, web and video benefits in 25GHzand higher spectrum.

The necessities are many scrambles accessibility and non accessibility of viewable pathway between the transmitter and receiver i.e. (numerous structures and different objects lessen, reflect, refract, and diffract the signal).The way between the base station and mobile station of earthbound versatile communication is described by different obstacle and reflections.

The radio waves transmitted from the base station emanates every which way including reflected waves , diffracted wave, dispersing wave and the immediate wave from the base station to the versatile station. Since the way length of the immediate, reflected, diffracted, and diffusing waves are distinctive, the time taken to achieve the versatile station is diverse for scattered waves.

The reception environment described by superposition of postponed waves is known as a multipath propagation environment. In a multipath propagation environment, the aggregate got signal is the vector entirety of independently postponed signals.

II. SYSTEM MODEL

OFDM is created by firstly picking the range required, based on the information data, and modulation technique utilized. Every carrier to be created is doled out a few data to transmit. The desired amplitude and phase of the carrier is then figured based on the tweak plot (ordinarily differential BPSK, QPSK, or QAM). At that point, the IFFT changes over this range into a period space signal.

The FFT changes a cyclic time space signal into its identical recurrence range. Finding the equal waveform, created by an aggregate of orthogonal sinusoidal segments, does this. The amplitude and phase of the sinusoidal segments represent to the frequency range of the time space signal.

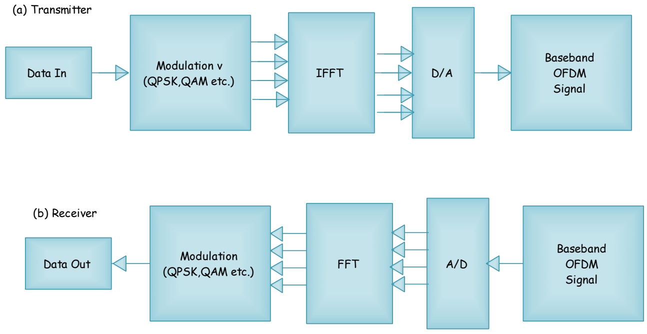

Figure 2.1 Basic OFDM system.

The primary elements of a useful OFDM system are as per the following:

- Some handling is done on the source data, for example, coding for adjusting errors, interleaving and mapping of bits onto symbols. A case of mapping utilized is QAM.
- The signals are modulated onto orthogonal sub-carriers. This is finished by utilizing IFFT.
- Orthogonality is kept up amid channel transmission. This is accomplished by adding a cyclic prefix to the OFDM edge to be sent. The cyclic prefix comprises of the L last specimens of the edge, which are duplicated and put in the start of the casing. It must be longer than the channel motivation reaction.
- Synchronization: the presented cyclic prefix can be utilized to identify start of each of frame. This is finished by utilizing the way that the L first and last specimens are the same and along these lines associated. This works under the suspicion that one OFDM casing can be thought to be stationary.
- Demodulation of the received signal by using FFT
- Channel equalization: the channel can be evaluated either by utilizing a preparation grouping or sending known alleged pilot symbols at predefined sub-carriers.
- Decoding and de-interleaving.

A piece chart demonstrating a disentangled arrangement for an OFDM transmitter and beneficiary is given in Figure 2.1.

The OFDM signal created by the system in Figure 2.1 is at baseband; keeping in mind the end goal to produce a radio frequency (RF) signal at the required transmitter frequency filtering and modulation is required. OFDM takes into consideration a high spectral proficiency as the carrier power and modulation technique can be independently controlled for every carrier.

III. PROPOSED METHODOLOGY

The proposed system is based on the phase encoding with different modulation scheme QAM and PAM as shown in figure 4.1 we are using 4-PAM and 4-QAM modulation. The proposed scheme is not very complex but it is very efficient to protect information signal being distorted.

Transmitter:

First initialize the environment variable and generate data the modulate the generated data with 4-PAM and 4-QAM modulation scheme modulated data has converted to parallel data using serial to parallel conversion phase encoding applied on it again modulate the prepared data with OFDM modulation add cyclic prefix that can be easy to recognize the start bit . Now the data is ready to transmit.

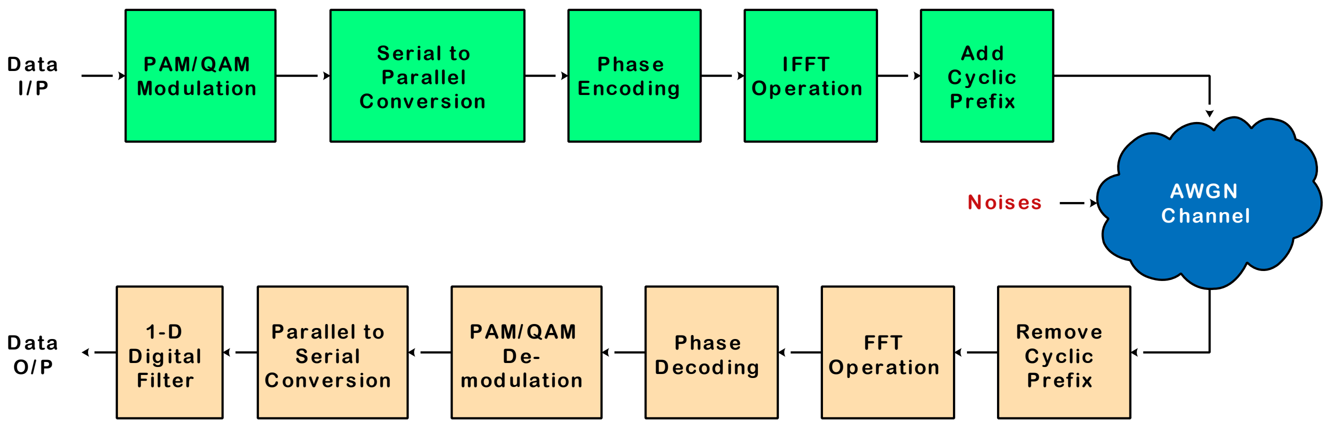

Fig. 3.1 Block Diagram of the Proposed Methodology.

Channel:

Channel is a media through which our signal reaches to receiver, in a proposed system we are using AWGN at the time signal travel through AWGN channel some external noised are added to it.

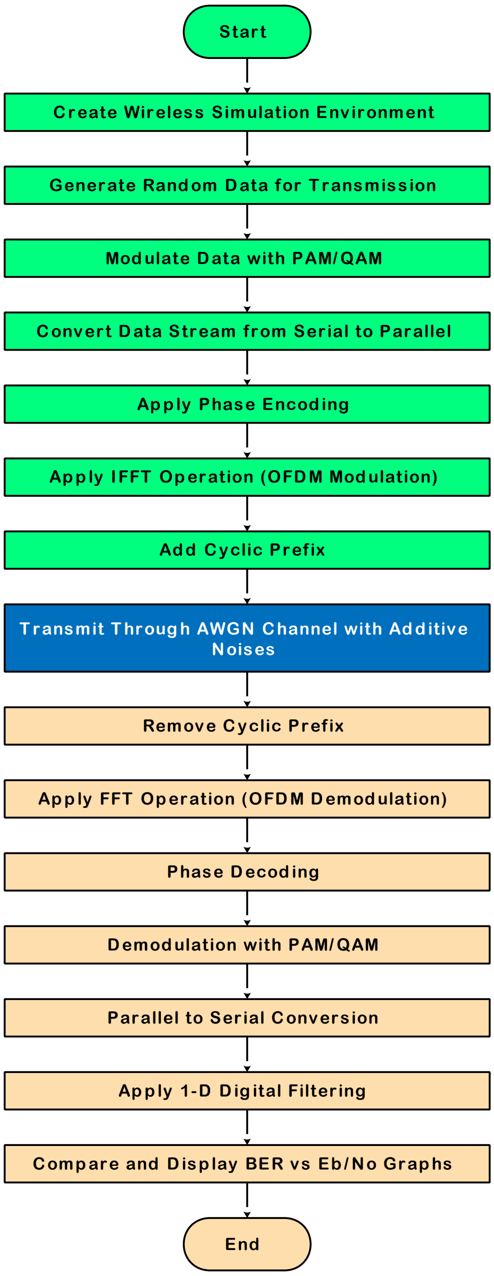

Fig. 3.2 Flow Chart of the Proposed Methodology

Receiver:

Secured encrypted noised signal received by the receiver , primarily it remove the cyclic prefix from the received signal and demodulate by using OFDM demodulation to detect the actual information signal after that phase decoding apply on it to de-encrypt the signal again Demodulate the symbol by using 4-QAM and 4-PAM to recognize the actual information the demodulated signal process through parallel to serial conversion and finally pass through a digital filter to get the perfect noise free output.

Figure 3.2 has shown the steps of implementation of proposed system the steps of implementation of proposed system are as follows:

IV. SIMULATION RESULTS

The previously explained proposed system is simulated on simulation tool and the numerical analysis of bit error rate is calculated with different length of subcarriers. The simulation results show the efficiency of proposed methodology.

Figure 5.1 shows the bit error rate performance of the system with 128 subcarriers using 4-PAM and 4-QAM and the optimum result is 1.75X10-7 with 4-PAM modulation and 1.27X10-6 with 4-QAM. In this configuration the system performs better with 4-PAM but 4-QAM has better BER also but higher than 4-PAM.

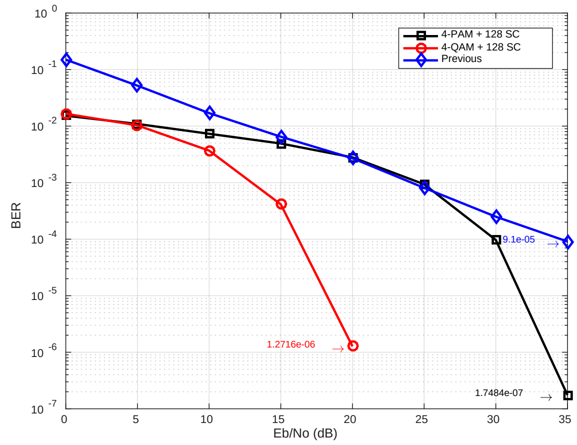

Figure: 5.1 Performance of Proposed LTE Fading Communication System using 128 Subcarriers

Figure 5.2 shows the bit error rate performance of the system with 256 subcarriers using 4-PAM and 4-QAM and the optimum result is 5.61X10-6 with 4-PAM modulation and 2.57X10-5 with 4-QAM. In this configuration the system performs better with 4-PAM but 4-QAM has better BER also but higher than 4-PAM.

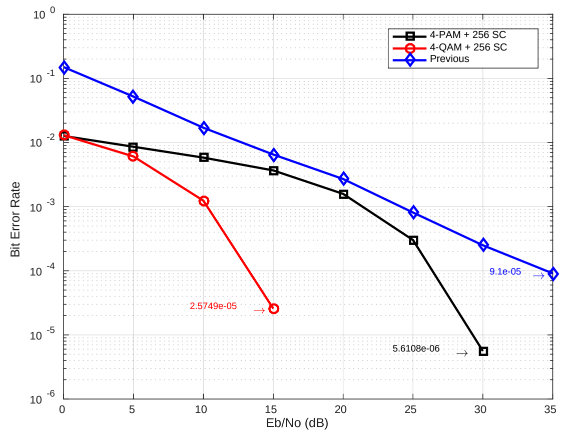

Figure 5.2 Performance of Proposed LTE Fading Communication System using 256 Subcarriers

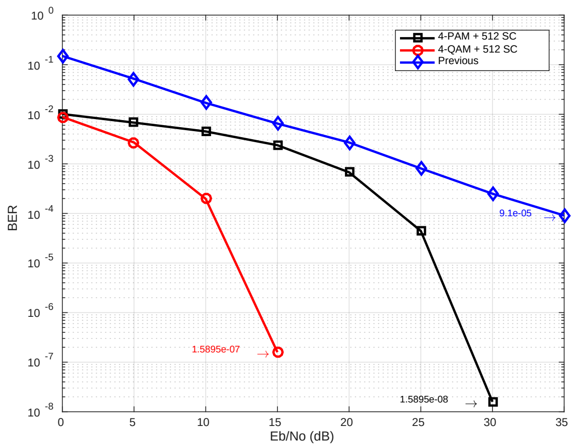

Figure: 5.3 Performance of Proposed LTE Fading Communication System using 512 Subcarriers

Figure 5.3 shows the bit error rate performance of the system with 512 subcarriers using 4-PAM and 4-QAM and the optimum result is 1.59X10-8 with 4-PAM modulation and 1.59X10-7 with 4-QAM. In this configuration the system performs better with 4-PAM but 4-QAM has better BER also but higher than 4-PAM.

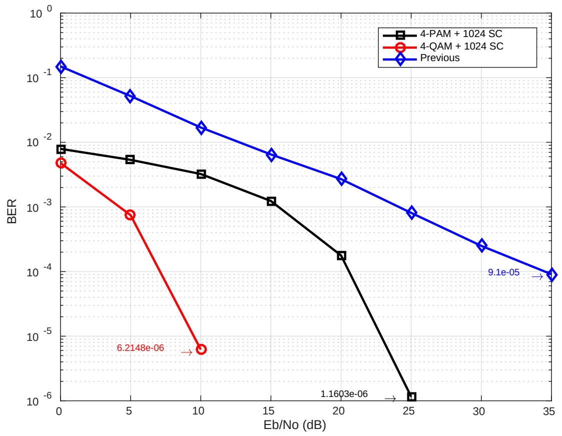

Figure: 5.4 Performance of Proposed LTE Fading Communication System using 1024 Subcarriers

Figure: 5.4 shows the bit error rate performance of the system with 1024 subcarriers using 4-PAM and 4-QAM and the optimum result is 1.16X10-6 with 4-PAM modulation and 6.21X10-6 with 4-QAM. In this configuration the system performs better with 4-PAM but 4-QAM has better BER also but higher than 4-PAM.

V. CONCLUSION AND FUTURE SCOPE

The proposed system analyzed in this work has proven by its simulation results that the bit error rate achieved is better than the existing system with which significantly better communication and reduction of noises in the system. To check the performance of the system researchers used bit error rate (BER) to measure the loss of information during transmission through channel. Loss of information depends on various factors and a calculation of BER is the cumulative measurement of losses due to different sources of noises and other miscellaneous factors. In this research simulation system was examined for different subcarrier lengths, there were other various parameters could be taken under evaluation but subcarrier is directly related to physical layer so here it is considered for analysis. As a result it has been found that with the increase in the length of subcarriers BER is getting lower and lower up to 512 subcarrier lengths and optimum performance is 1.59x10-8 using 4-PAM modulation.

Simulation for the analysis of any system has endless probability of combinations of different variations in parameters, values and factors, and with help of these various analyses can be done. In future such work can be planned to integrate the antenna diversity to reduce the fading, scattering and effect of interference. Because following parameters are the key parameters which affect the performance and increase error rate. Another area of improvement could be encoding, this will also play important role to protect signals being corrupted and there are several encoding techniques to achieve one.

REFERENCES

[1] A. Rashich and S. Gorbunov, "ZF equalizer and trellis demodulator receiver for SEFDM in fading channels," 2019 26th International Conference on Telecommunications (ICT), Hanoi, Vietnam, 2019, pp. 300-303.

[2] A. B. Abdullahi, A. Hammoudeh and B. E. Udoh, "Performance evaluation of MIMO system using LTE downlink physical layer," 2016 SAI Computing Conference (SAI), London, 2016, pp. 661-668.

[3] P. K. Korrai and D. Sen, "Performance analysis of OFDM mmWave communications with compressive sensing based channel estimation and impulse noise suppression," 2016 IEEE International Conference on Advanced Networks and Telecommunications Systems (ANTS), Bangalore, India, 2016, pp. 1-6.

[4] C. H. Chang et al., "Hybrid OFDM and Radio-Over-Fiber Transport System Based on a Polarization Modulator," in IEEE Photonics Journal, vol. 7, no. 5, pp. 1-8, Oct. 2015.

[5] V. Mary Ajitha and N. Prabakaran, "Performance evolution of downlink mimo in LTE technology," 2014 International Conference on Electronics and Communication Systems (ICECS), Coimbatore, 2014, pp. 1-5.

[6] A. Bishnu, A. Jain and A. Shrivastava, "Optimized sinc power pulse for inter carrier interference mitigation in OFDM system," 2013 Annual IEEE India Conference (INDICON), Mumbai, 2013, pp. 1-4.

[7] P. Samundiswary and S. Kuriakose, "BER analysis of MIMO-OFDM using V-BLAST system for different modulation schemes," Computing Communication & Networking Technologies (ICCCNT), 2012 Third International Conference on, Coimbatore, 2012, pp. 1-6.

[8] M. Ismail, F. Sayadi and R. Nordin, "HGS-assisted detection algorithm for 4G and beyond wireless mobile communication systems," The 17th Asia Pacific Conference on Communications, Sabah, 2011, pp. 571-576.

[9] Youn Ok, P. and P. Jong-Won. Design of FFT processor for IEEE802.16m MIMO-OFDM systems. in Information and Communication Technology Convergence (ICTC), 2010.

[10] Ajey, S., B. Srivalli, and G.V. Rangaraj. On performance of MIMO- OFDM based LTE systems. in Wireless Communication and Sensor Computing, 2010. ICWCSC 2010. International Conference on. 2010.

[11] Mohammadi, A., Ghannouchi, Fadhel M, RF Transceiver Design for MIMO Wireless Communications 2012: Spriger-Verlag Berlin Heidelberg.

[12] Shahmohammadi, F. and N. Neda. The impact of spatial correlation on performance of SFBC and VBLAST schemes on MIMO-OFDM-LTE. in Digital Information Management (ICDIM), 2012 7th Int'l Conference on.

[13] Lozano, A. and N. Jindal, Transmit diversity vs. spatial multiplexing in modern MIMO systems. Wireless Communications, IEEE Transactions on, 2010. 9(1): p. 186-197.

[14] CHOCKALINGAM, B.S.R., Large MIMO Systems. 2014, Cambridge: Cambridge University Press

[15] Rumney, M., "LTE and the Evolution to 4G Wireless: Design and Measurement Challenges". 2nd Edition ed. 2013: Agilent Technologies.

[16] Network, G.T.S.G.R.A., Physical channels and Modulation (Release 10). 2010-12, Evolved Universal Terrestrial Radio Access (E-UTRA); .

[17] Suto, K. and T. Ohtsuki. Performance evaluation of space-time-frequency block codes over frequency selective fading channels. in Vehicular Technology Conference, 2002. Proceedings. VTC 2002-Fall. 2002 IEEE 56th.

[18] Keonkook, L., et al. Adaptive switching between space-time and space- frequency block coded OFDM systems. in Military Communications Conference, 2008. MILCOM 2008. IEEE. 2008.

[19] Network, G.T.S.G.R.A., Physical layer procedures (Release 10)", . 201012, Evolved Universal Terrestrial Radio Access (E-UTRA);.

[20] Yahiaoui, C., et al. Simulating the Long Term Evolution (LTE) Downlink Physical Layer. in Computer Modelling and Simulation (UKSim), 2014 UKSim-AMSS 16th International Conference on. 2014.

[21] Network;, G.T.S.G.R.A., User Equipment(UE) radio transmission and reception (Release 10)", . Evolved Universal Terrestrial Radio Access (E- UTRA); .

[22] Jagan Naveen, K.M.K.a.K.R., Performance analysis of equalization techniques for MIMO systems in wireless communication. International Journal of Smart Home. Vol.4, (No. 4): p. Page 47 - 63.

[23] Min, L., et al. An implementation friendly low complexity multiplierless LLR generator for soft MIMO sphere decoders. in Signal Processing Systems, 2008. SiPS 2008. IEEE Workshop on. 2008.

[24] Shayegh, F. and M.R. Soleymani. Low complexity implementations of sphere decoding for MIMO detection. in Electrical and Computer Engineering, 2008. CCECE 2008. Canadian Conference on. 2008.