LTE- 3GPP Uplink and Downlink Transmission

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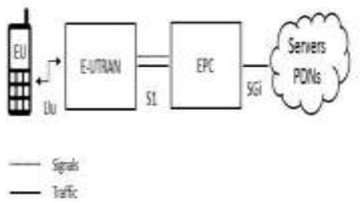
Abstract: **LTE (Long Term Evolution) is fusion of both radio and core network.3GPP is (3rd generation partnership project). LTE is the new standard specified by the fourth generation (4G) wireless communication. Uplink and downlink transmission is analyzed by LTE transceiver and hence the simulations results are obtained by the KEYSIGHT SYSTEMVUE .And also measure the parameters such as Throughput, Bit Error Rate (BER), and Frame Error Rate (FER) by the simulation configuration.**

Index Terms- **LTE, 4G, PDSCH, PHY, BER, FER, Simulations.**

I.INTRODUCTION

LTE (Long Term Evolution) is the fusion of both radio and core network. **Radio** means radiation wireless transmission of the electromagnetic energy through space. It carry the information such as sound by the modulating property hence this part is more involved in both the transmitter and receiver antenna and **core** network is nothing but the central part of the telecommunication network. This core network is the mainly important network and this is also called as the backbone of the network because its exchange the information between the different part of the subnetwork.hence



User equipment: This is also known as Mobile Equipment (ME) this includes the

- **Mobile termination:** This termination holds the all communication functions.
- **Terminal equipment:** This leads to terminates the data streams
  - **UICC:** This is also known as the SIM card of the LTE equipment hence it runs the application of Universal Subscriber Identity Module(USIM) stores the user specific data very similar to the 3G simcard. This helps us to keep the information about phone number, network identity, security keys etc.
  - **Evolved Packet core:** This is used for packet data network used to communicates the outside world such as internet, private corporate network or the IP multimedia subsystem.

It provides the high peak data rate, Spectral Efficiency, frequency flexibility. LTE provides seamless service and multimode devices for the customers.it follows the robust channel coding, scheduling and link adaptation. Multiple numbers of releases which have been led to improve the data throughput, lower latencies and also increasing the flexible configuration.

3GPP: 3GPP standard for the telecommunication developmental organization known as the “organizational partners” it provides the stable environment for the cellular network, and also the network technologies which have been including the radio access. This 3GPP have planned to work on the new radio technology concept.

II.OVERVIEW OF LTE

This network architecture comprised of three main components:

- User Equipment (UE)
- Evolved packet core(EPC)
- EUTRAN (Evolved Universal Terrestrial Radio Access Network).

E-UTRAN

The E-UTRAN exchanges the information between the mobile devices and the Evolved Packet Core (EPC). The one component which includes in the base station called eNodeB or **eNB.**In E-UTRAN several modulation schemes are available such as QPSK, 16QAM, and 64QAM.

III.DOWNLINK PHYSICAL LAYER PROCEDURES

Lte transceiver downlink physical layer have a some procedures that are distinctively important in various areas such as,

- Cell search
- Cell synchronization
- Link adaptation
- Hybrid ARQ(Automatic Repeat Request)

IV.LTE GENERIC FRAME STRUCTURE

LTE signal frames are mainly based on the time domain 10 subframes each of 1 ms duration consists of 10 ms long .two slots are subdivided as each 0.5ms long subframes.in each slot 6 or 7 symbols of OFDM contains depending on whether its normal or short cyclic prefix is used. lte downlink signal structure of lte downlink can be mentioned below.

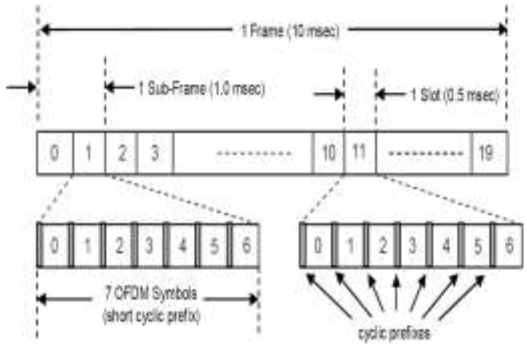


Figure: 4.a LTE downlink signal structure in time domain

V.PHYSICAL DOWNLINK CHANNEL

Physical downlink shared channel (PDSCH) is passed down to transmit the downlink user data and it's also called as the main data bearing downlink channel because it's used for all types of data users and also for (PBCH) paging broadcast channel.TD-LTE downlink OFDM is selected as an air interface. Transport blocks are grouped as a form of the resource data that starts in the physical layer transmitter.

PHYSICAL UPLINK CHANNEL

Physical uplink shared channel is used as the both control as well as the data signal. This channel is used to carry the uplink users information data. Control information is carried the MIMO related parameters control data information is multiplexed with the user information before DFT widening module in the uplink SC-FDMA physical layer. PUSCH has the platform of QPSK,16 QAM,64QAM(optional).eNodeB(eNB) selects suitable modulation based on the adaptation algorithm.

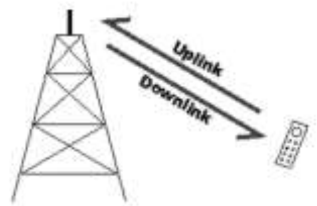
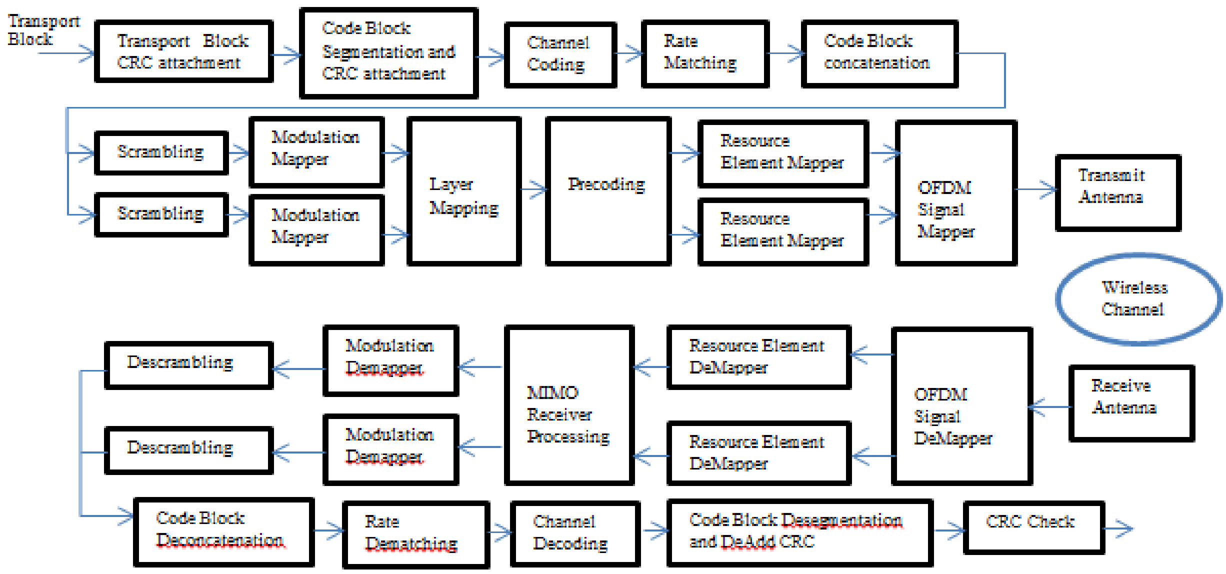


Fig:6.a:uplink and downlink transmission

According to the processing steps of transmitting and receiving the uplink and downlink in PDSCH channel are given below.



VII.DESCRIPTION OF BLOCK DIAGRAM

Transport blocks CRC attachment:

Initially bits are transmitted to the transport block that attached with the CRC which means the Cyclic Redundancy Check (CRC) that are used to identify the error detection in the transport block then the CRC parity bits are then appended to the end of the transport block

Code blocks segmentation and CRC attachment:

In the code block segmentation contains the turbo interleave which has a maximum and minimum code block sizes and these block sizes are sustained in the LTE.40 bits and 6144 bits which represent the minimum and maximum code block sizes respectively. Segmenting the input block greater than the maximum code block size.

Channel coding:
PDSCH adopts the turbo coding, which is a robust channel coding. Turbo encoder has a coding rate of 1/3.code blocks are comes under the turbo encoding in the form of the forward error correction for improves the channel capacity thus by adding the redundant information into this block. Parallel Concatenated Convolutional Code (PCCC) the two recursive convolutional coders are contention –free Quadratic Permutation Polynomial (QPP) these two interleaver are uses the scheme of turbo encoder.

Rate Matching:
Hybrid Automatic Repeat Request (HARQ) in this error correction method is incorporated in the rate matching algorithm main task of this rate matching algorithm is to create the output bit stream which are allows transmitting of the LTE transceiver.

Code Block Concatenation:
This blocks are concatenated the prior block of rate matching main task of this block is used to create the output of the channel coding.

Scrambling:
To create the symbols for code word .the codewords are bit-wise multiplied with an orthogonal sequence and a user Equipment – specific scrambling sequence.

Modulation:
In this modulation block contains the various modulation schemes of QPSK,16 QAM, 64 QAM this scrambled codewords are undergoes any one of the PDSCH modulation schemes.

Layer Mapping:
Layer mapping consists of the two kinds of the layer mapping one is transmit diversity used to mapped the input symbols to the layers. Another one is spatial multiplexing (i.e)the number of layers are always less are equal to the number of antenna ports that is used for transmission of the physical channel.

Precoding:
In this block codes are pre-coded based on each layer of symbols for transmitting the different modes for transmission based on the various types of the antenna ports such as spatial multiplexing, and transmit diversity and also the single antenna port transmission.

Mapping to Resource Elements:
PDSCH channel which allocates the resource block that are mapped together to the number of resource elements which contains the complex valued symbols these are not occupied by the other physical downlink channels except the PDSCH.

VIII. Parametersare estimated in this paper by using the KEYSIGHT SYSTEMVUE.

- Bit Error Rate (BER)
- Throughput
- Error Vector Magnitude(EVM)
- Outage-probability

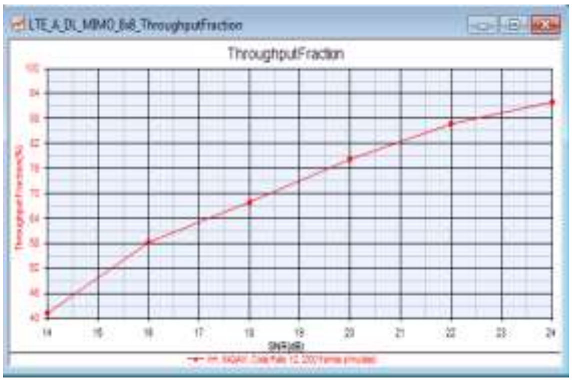
IX.TABLE I

PDSCH TRANSMIT DIVERSITY SIMULATION CONFIGURATION

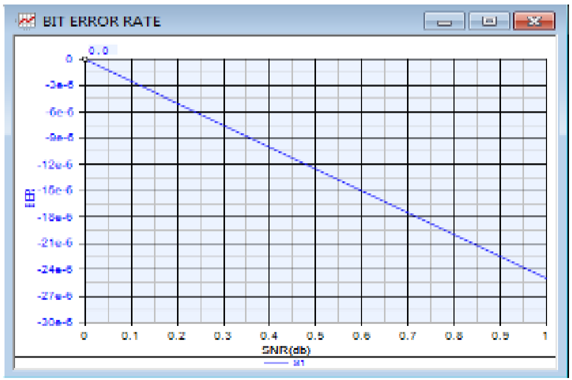
Layer	Single
Transmission Scheme	Transmit Diversity
Number of Senders	4
Number of Receivers	2
Multi-antenna Correlation	Medium
Propagation Channel	Extended Pedestrian A (EPA 5)
Number of Frames	10
Signal to Noise Ratio (SNR) Range	[0.0,0.2.0.4,0.6,0.8,1]

X.OUTPUT

ESTIMATION OF THROUGHPUT, BIT ERROR RATE, ERROR VECTOR MAGNITUDE, &OUTAGE PROBABILITY



(a)



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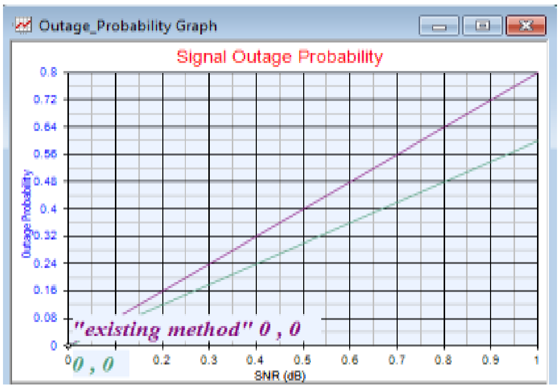

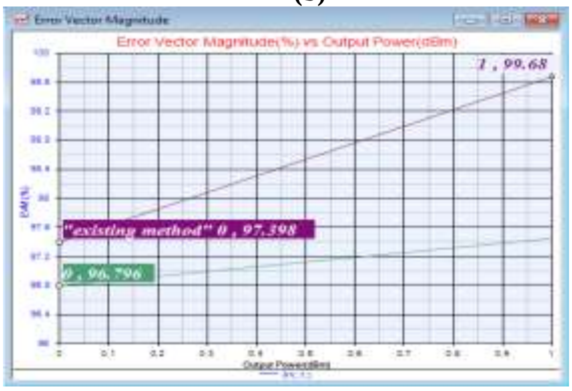

(c)

(d)

XI.SIMULATION RESULTS AND ANALYSIS

Simulation results are therefore performed by the KEYSIGHT SYSTEMVUE .thus the performance ofLTE-3GPP uplink and downlink transceiver results of Throughput, Bit Error Rate (BER), Error Vector Magnitude (EVM), and Outage-probability are analyzed.

XII.CONCLUSION

By designing the physical layer LTE-3GPP uplink and downlink transceiver in the KEYSIGHT SYSTEM VUE and analyzing the results of parameters such as Throughput, Bit Error Rate (BER), Error Vector Magnitude (EVM), Outage-probability achieving a high performance compared with the existing method .In future work different SNR values are carried out with various condition of uplink and downlink of the system.

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