Performance Enhancement of Multiple Cell Users using Coordinated Multipoint in LTE

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Abstract— LTE (Long Term Evolution) was started as a project by telecommunication body known as 3GPP. Main goal of LTE is to provide high data rate, low latency, packet optimized radio access technology and supporting flexible bandwidth. LTE is important because it will bring up to 50 times performance improvement and much better spectral efficiency to cellular networks, but due to one frequency reuse factor in LTE there is a high interference between the cells. so to enhance the performance CoMP (Coordinated Multipoint) is used.

Key words: LTE, CoMP

I. INTRODUCTION

LTE is basically started as a project by 3rd generation partnership project to fulfill all the requirement for today's explosive intrnet growth. It is name of technology standard for cellular network beyond 3G. LTE uses MIMO (Multiple input Multiple Output) and OFDM (Orthogonal Frequency division Multiplexing) technology both. LTE uses OFDMA (Orthogonal Frequence division Multiple Access) in its downlink and SC-FDMA (Single Carrier Frequency Division Multiple Access) in its uplink. It supports flexible bandwidth operation upto 20MHz. it provides peak data rate upto 300 Mb/s for downlink and 75Mb/s for uplink. LTE provides TDD and FDD at same platform. It provides low latency to connect to the network. LTE also provides seamless connection to existing network like GSM, CDMA. It support 4x4 antenna configuration for transmission as well as for reception. These all parameters are supported bt early version of Long Term Evolution that is known as LTE Release 8. To fulfill the requirements of IMT-A (International Mobile Telecommunications), there is a new version called LTE Release 10 or LTE-A (Long Term Evolution Advanced). LTE-A supports flexible bandwidth upto 100MHz via Carrier Aggregation. It supports upto 8x8 antenna configuration in uplink and downlink. It uses Coordinated Multipoint for performance enhancement. It provides peak data rate of 1Gb/s for downlink and 500Mb/s for uplink. With the use of Coordinated Multipoint technique, wich is basically coordination between different basestation performance in terms of Bit Error Rate (BER), throughput, data rate will increase.

II. LTE FRAME STRUCTURE

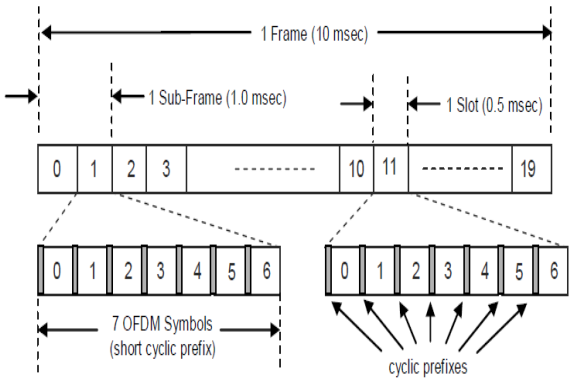

Fig. 1: LTE Time Domain Structure

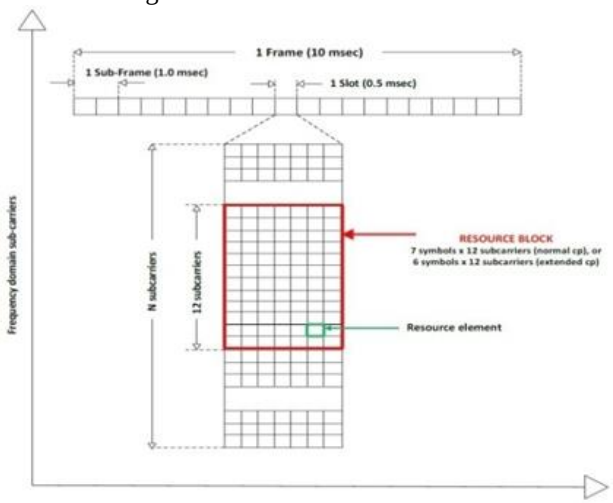

Fig. 2: LTE Time-Frequency Resource Grid

As can be seen in the Figure 1 and 2 LTE frame is of 10 millisecond (msec) duration which is divided into 10 Subframes of 1msec duration. Each Subframe is further divided into two slots each has a length of 0.5msec. Each slot comprise either 6 or 7 OFDM symbols depending upon normal or extended cyclic prefix that is used.

A PRB is the smallest unit that Base Station can allocate to the user. Subcarrier Bandwidth and PRBs Bandwidths are 15 KHz and 180 KHz respectively for all system Bandwidths.

A Resource Element is the smallest physical Resource and it consists of one subcarrier during one OFDM symbol. A group of Resource Element s are referred as physical Resource Blocks i.e. PRBs. A PRB has a seven OFDM symbols having duration of one time slot 0.5ms and 12 subcarriers having a Bandwidth of 180 KHz (15 KHz * 12 = 180 KHz), so each Resource Block in the case of normal cyclic prefix has of 84 Resource Element s (12 Subcarrier * 7 OFDM Symbols = 84 Resource Element s) whereas in the case of extended cyclic prefix.

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Resource Block has 72 Resource Elements (12 Subcarrier * 6 OFDM Symbols = 72 Resource Element)

III. LTE ARCHITECTURE

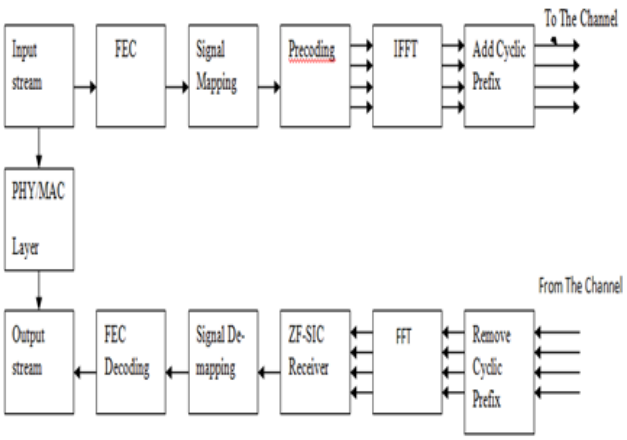

Fig. 3: LTE Physical Layer Architecture

The figure shown above is considered for simulation in this paper. Precoding is used that is spatial multiplexing scheme in wich channel gain is multiplied with each symbol that is transmitted by antenna. FEC (forward Error Coorection) is basically channel coding technique to detect & correct error. Signal mapping maps the output of channel coding to the particular symbol according to symbol mapping technique. IFFT and Cyclic prefix is basically OFDM block that is used in LTE as a modulation scheme.

ZF-SIC (Zero Forcing Successive Intereference Cancellation) receiver or decoding scheme is used for MIMO decoding

IV. COORDINATED MULTIPOINT

Multiple base station cooperation is very attracting approach now a days for better user experience. So coordinated Multipoint (CoMP) is used by LTE. CoMP is a process of coordinating and combining signals from multiple antennas and hence we will get better system coverage, cell-edge throughput, system efficiency and interference suppression. It can be classified into coordinated scheduling/ beam-forming

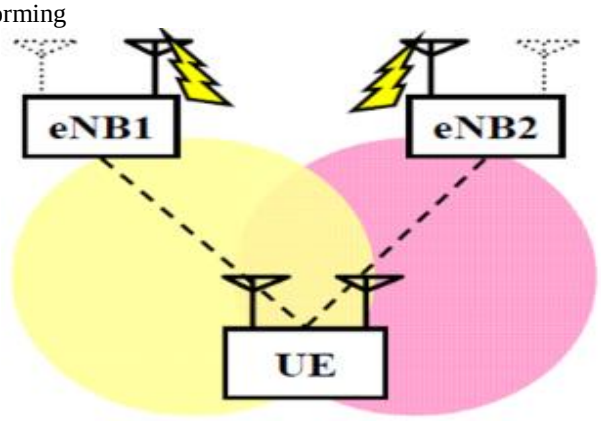

Fig. 4: CoMP Joint Transmission

V. SIMULATION PARAMETERS AND RESULTS

A. *Parameters*

Parameters	Value
Antenna configuration	4x4
Cellular layout	Hexagonal grid, 7 cell layout
System bandwidth	10MHz
No. of physical resource block	50
Pilot ratio	1/12
IFFT	128
Guard type	Cyclic extension
Guard length	32
Data rate of sample	1 Mbps
Signal mapping	BPSK
channel	Rayleigh fading channel
Receiver structure	ZF-SIC

Fig. 4: Parameters

B. *Result*

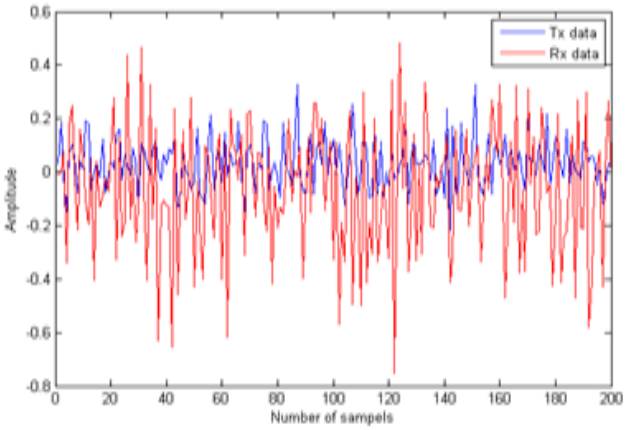

Fig. 5: Amplitude vs no of sample graph for transmitted and received signal

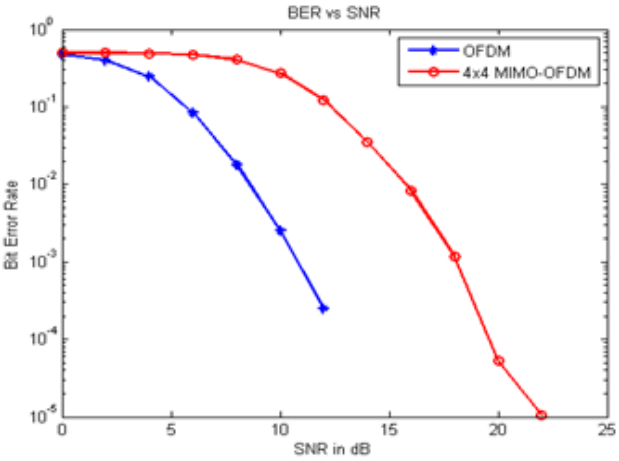

Fig. 6: BER Comparision Of OFDM and MIMO-OFDM (LTE)

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VI. CONCLUSION

- Study of basic concept of LTE, LTE-A and CoMP technique.
- BER is higher for MIMO-OFDM, that is LTE than OFDM network alone because no of antenna increased. So by use of ZF-SIC we get better performance for LTE in terms of BER.

VII. FUTURE WORK

I will use another receiver to LTE and compares the results with this results. Then I will implement CoMP technique to LTE.

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