FDD Based Throughput Simulation of EPA-EVA Model for LTE downlink channel

Ajay kaushik[1], Shrishti khurana [2], Sangeeta[3]

[1]Assistant professor, ECE dept., SGI college, Haryana, India
[2]Assistant professor, ECE dept., SGI college, Haryana, India
[3]Assistant professor, ECE dept., SGI college, Haryana, India

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Abstract – Throughput analysis of wireless communication system is always a key parameter for increasing the performance of wireless network. 3GPP has evolved newly 4G LTE network for uplink and downlink channels. Throughput measurement is most important in the downlink channels as it is from base station to mobile station. Thus in this paper we are targeting to analyze and simulate throughput performance of EPA-EVA fading model based on FDD(frequency division duplexing) method. Simulation results are obtained from LTE system toolbox specified in MATLAB 2014a and also based on SNR values and no. of frames transmitted.

Key Words: SNR, Long term Evolution, Throughput, Duplexing, Simulation.

1. INTRODUCTION

4G LTE(long term evolution) is a revolution in wireless communication for providing better user based services in high mobile data rates, high speed, online voice calling etc. this technology has increased the working parameters for the network simulation[1]. 4G LTE network is divided into two channels i.e

1. Uplink channel(mobile station to base station)
2. Downlink channel(base station to mobile station)

In downlink channel from where data is transmitted from base station (BTS unit) to mobile unit and user gets benefits of services[3].
Wireless signals always varying for these two type of users as they are varying different modes of propagation and then throughput performance of network varies in these cases. Throughput performance also depends upon various factors like propagation fading channels, SNR, Doppler spreads, antenna correlations, and also which type of Tx scheme and duplexing method used for the system[2]. This paper suggests the performance of throughput simulation for EPA-EVA model which are duplexed by FDD method in downlink channel[2].

2. EPA-EVA Model

LTE System toolbox product provides a set of channel models(EPA & EVA) for the test and verification of UE & eNodeB and also throughput testing for those fading channel based upon various simulation parameters.

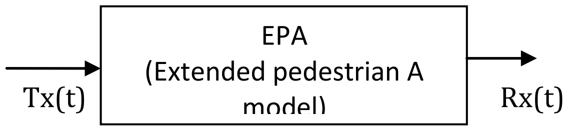

Figure 1: EPA model

A. EPA [4] specifies the condition for the users that are in stationary or slightly moving or walking condition. This channel calculates the throughput performance in that condition. As throughput is depends upon propagation of various paths so it fades out.

B. EVA[6] describes the user condition when they are vehicular, wireless signal is always varying very fast in mobile modes & the quality of signals also varies. So performance throughput of network never be same at every point of signal. EVA model estimate the throughput performance for these conditions.

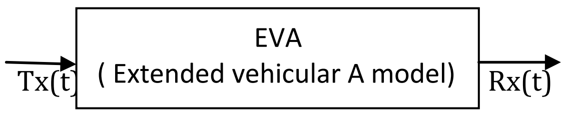

Figure 2: EVA model

3. FDD-LTE

LTE has been defined to accommodate paired spectrum for frequency division duplexing. Cellular communication system must be able to transmit in both directions simultaneously. This enables conversation to be made with either end being able to talk and listen as required. It enables simultaneously communication in both directions. FDD-LTE [7] uses different frequency in both direction. It used paired spectrum for communication with continuous transmission. There is a guard band benefit in isolation between uplink and downlink. Large band gap does not affect capacity of network.

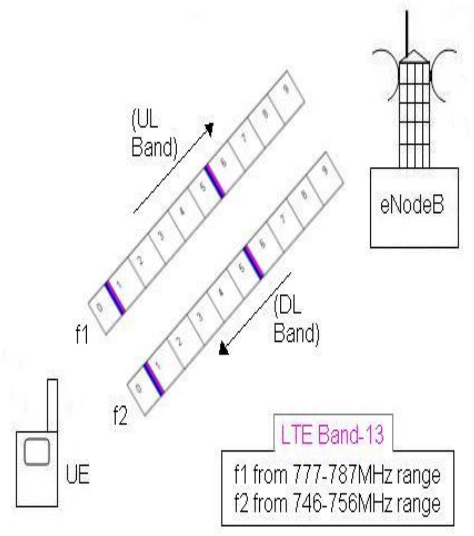

Figure 3: FDD-LTE system

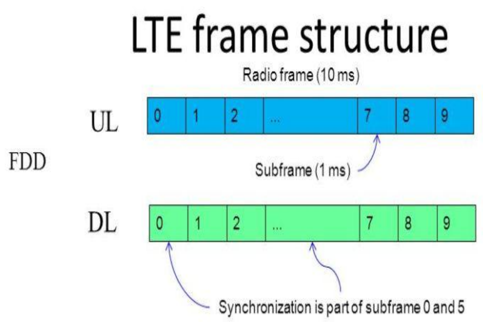

Figure 4: FDD- LTE frame structure

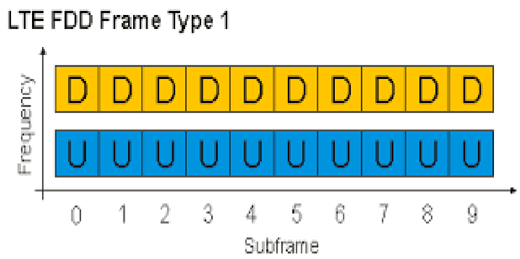

Figure 5: FDD guard band spacing Uplink/downlink channel

4. SIMUTION RESULT

Simulation results are shown in average running throughput for all SNR values with varying no. of frames.

Ref. channel	R.12
Duplex mode	FDD
Tx scheme	Tx diversity
PDSCH rho(db)	-3
Propagation model	EPA/EVA
Doppler(hz)	70 hz
Antenna correlation	Low/ medium
No. of Rx. Antenna	2
SNR(db)	3..0 -2.0 -1.0 0 1.0 2.0 3.0
Frame length	10/20
HARQ	8
Channel estimation	Yes
PMI mode	Wideband
Simulation result	Simresult

Table 1: Simulation parameter

Case 1-A: For EPA mode (low antenna correlation)

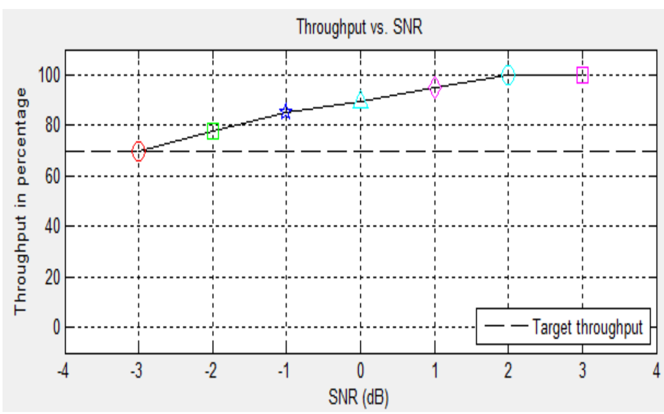

Figure 6: % throughput for SNR values(10 frames)

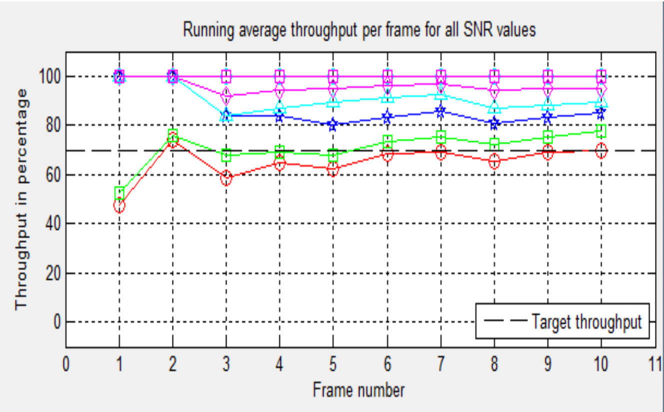

Figure 7: Running throuhput per frames per SNR(10 frames)

Case 1 –B: EPA Model (medium correlation)

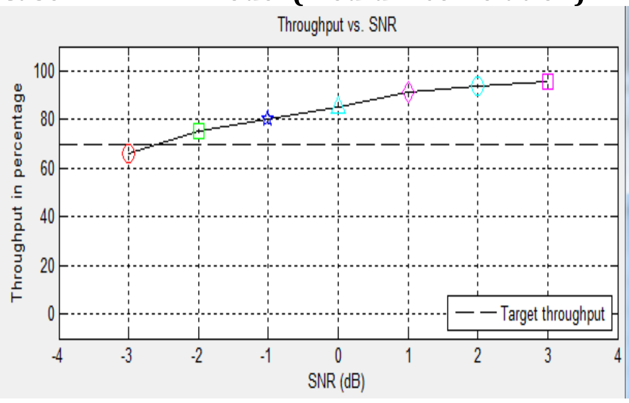

Figure 8: % throughput for SNR(20 frames)

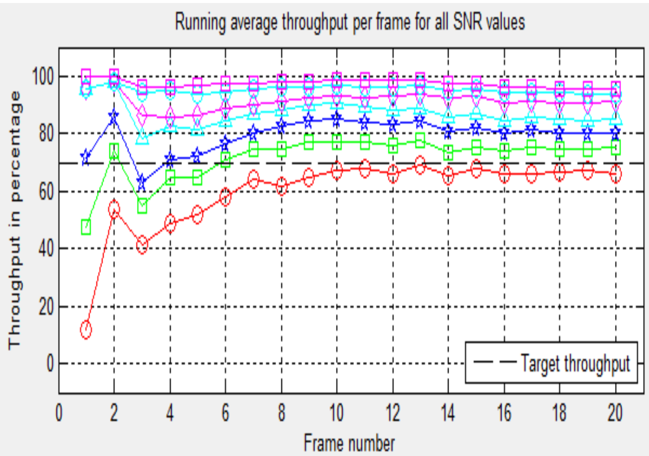

Figure 9: Running throughput per frame per SNR(20 frames)

Case 2-A: For EVA model (low correlation)

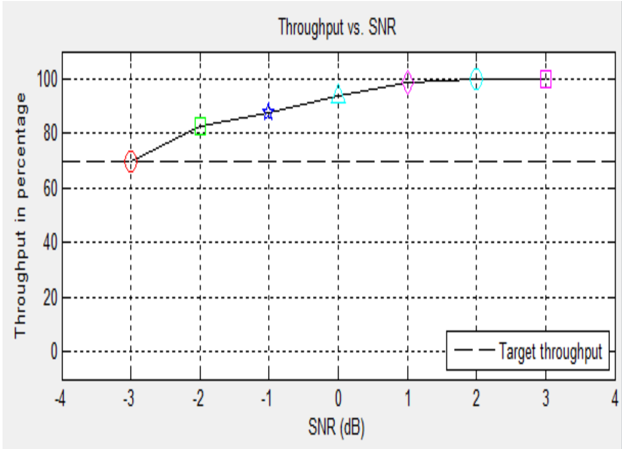

Figure 10: % Throughput for SNR(10 frames)

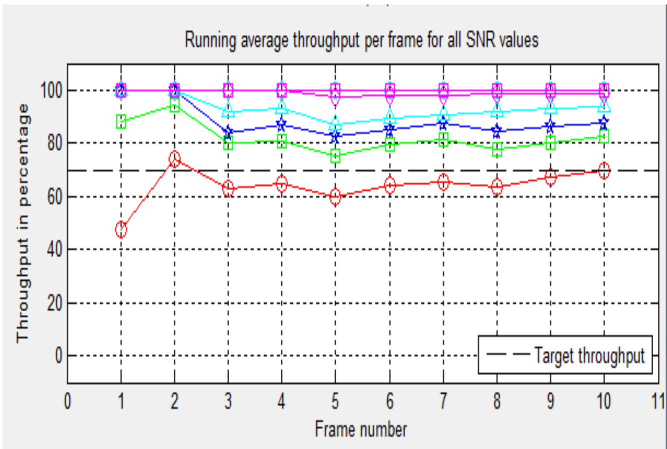

Figure 11:Running throughput per frame per SNR(10 frames)

Case 2-B: EVA model(medium Correlation)

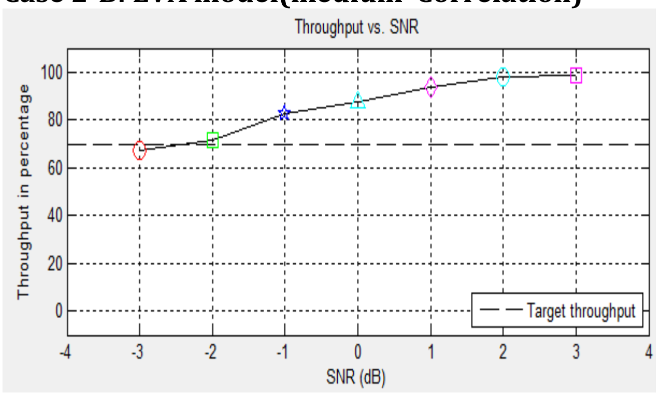

Figure 12: % throughput for SNR (20 frames)

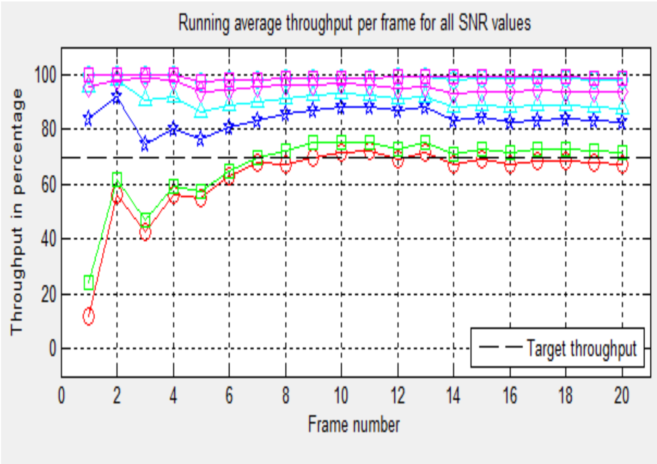

Figure 13: Running throughput per frame per SNR(20 frames)

5. CONCLUSION

Simulation results shows the throughput performance for both the EPA and EVA model for all SNR values as increase no. of frame transmitted. Result shows the relation between % of throughput versus SNR values and with the no. of frames. For the positive db SNR, average running throughput has better simulation results for low and medium antenna correlation.

Duplex mode		FDD			
Model		**EPA**		**EVA**	
Frame length		10	20	10	20
Antenna correlation		Low	Medium	Low	Medium
Doppler(hz)		70 hz	70 hz	70 hz	70 hz
Percentage of throughput in SNR(db)					
SNR(db)	-3.0	70	65.9	69.5	67.01
	-2.0	77.6	75.15	82.39	71.42
	-1.0	84.7	80.37	87.6	82.76
	0	89.5	85.10	93.5	87.76
	1.0	95.2	90.9	98.81	93.74
	2.0	100	93.9	100	97.99
	3.0	100	95.60	100	98.81

Table 2: Throughput simulation

6. FUTURE SCOPE

In future work for downlink channels, throughput performance can be estimated for other duplexing technique like as TDD with high Doppler spread, taken more no. of frames and also with changing no. of receiver antenna sectoring with using any other Tx scheme.

ACKNOWLEDGEMENT

We would like to thank our friends and colleagues who motivate to prepare this research paper.

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