International Journal of Engineering Sciences Paradigms and Researches (IJESPR)
(Vol. 34, Issue 01) and (Publishing Month: September 2016)
(An Indexed, Referred and Impact Factor Journal)
ISSN: 2319-6564
www.ijesonline.com

Power Optimizations for LTE

Farha Omer Mohammed Omer[1], Dr. Khalid Hamid Bilal[2] and Dr. Mustafa Mohammed Alhassan[3]

[1,3]Department of Communication, Faculty of Engineering, Al-Neelain University, Khartoum, Sudan
[2]University of Science and Technology, Khartoum, Sudan

Publishing Date: September 18, 2016

Abstract

Long Term Evolution (LTE) is a beginning option for the 4th generation communications because of its higher data rates, lower latency and larger coverage. However, in multi user environment, number of users shares the same radio resources. The shared channels cause the signal intended for a certain user to reach other users and introduce interference in their path and degrade the signal quality. This paper addresses Power control needs to reduce inter-cell interference level and at the same time to estimated SNR level. To achieve this SNR level eNodeB sends Transmit Power Control (TPC) Command in Downlink in PDCCH and UE sends Power Head Room (PHR) stating how more it can transmit to reach maximum power.

Keywords: *LTE, OFDM, Power control, MISO***.**

1. Introduction

Long Term Evolution (LTE) is a 3GPP standard, designed to increase the capacity and improve the service performance [1]. LTE used for both FDD and TDD ,and supports IP (Internet Protocol) based packet switching communication system with OFDM multi-carrier transmission and other frequency domain schemes which offer high data transfer rates, which are further increased by using Antenna arrays for MIMO (Multiple Input Multiple Output) communication to avoid multi-path propagation losses[2]. LTE is an all IP based system, thus all the data including voice is sent as an IP packet. It gives high peak data rate due to flexibility of spectrum usage with low latency times. Efficient radio usage and optimization procedures ensure higher capacity per cell and Cost-efficient deployment .the LTE power control mechanism constitutes of a closed loop component operating around an open loop point of operation. Specifically, the open loop component has a parameterized fractional path loss compensation factor, enabling a trade-off between cell edge bit rate and cell capacity. [3]. After explaining the general idea of late we address some of the previous studies as follows: In this first paper the performance of 3GPP Long Term Evolution (LTE) closed loop power control combined with fractional path loss compensation factor is evaluated by simulating the effects of open loop error, Transmit Power Control (TPC) command delay and power headroom reporting [4].This paper presents the 3GPP long term evolution (LTE) power control mechanism, and compares its performance to two reference mechanisms. The LTE power control mechanism constitutes of a closed loop component operating around an open loop point of operation. Specifically, the open loop component has a parameterized fractional path loss compensation factor, enabling a trade-off between cell edge bit rate and cell capacity [5].In this paper, we propose an automated PC optimization scheme which jointly tunes PC parameters in relay deployments. The automated PC optimization can be based on either Taguchi's method or a meta-heuristic optimization technique such as simulated annealing. To attain a more homogeneous user experience, the automated PC optimization scheme applies novel performance metrics which can be adapted according to the operator's requirements. The evaluation of the optimization methods within the LTE-Advanced uplink framework is carried out in 3GPP-defined urban and suburban propagation scenarios by applying the standardized LTE Release 8 PC scheme. Comprehensive results show that the proposed automated PC optimization can provide similar performance compared to the reference manual optimization without requiring direct human intervention during the optimization process [6].In this paper we are going to discuss the relay technique to improve the throughput of the coverage area of base station. When comparing with the WIMAX scheduling our LTE power adaption improve the high data transmission of uplink[7].

2. Description Analysis

This model shows an end-to-end baseband model of the physical layer of a wireless metropolitan area network (WMAN), according to the IEEE® 802.16-2004 standard . More specifically, it models the OFDM-based physical layer, called Wireless

MAN-OFDM, supporting all of the mandatory coding and modulation options. It also illustrates Space-Time Block Coding (STBC), an optional transmit diversity scheme specified for use on the downlink. Finally, it illustrates the use of digital pre-distortion, a technique for extending the linear range of a nonlinear amplifier. Both models also use an adaptive-rate control scheme based on SNR estimates at the receiver to vary the data rate dynamically based on the channel conditions. The models use the standard-specified set of seven rates for OFDM-PHY, each corresponding to a specific modulation and RS-CC code rate as denoted by ID_Rate

Table 1: ID-Rate for Modulation

ID-Rate	Modulation RS-CC Rate
0	BPSK ½
1	QPSK ½
2	QPSK ¾
3	16-QAM ½
4	16-QAM ¾
5	64-QAM 2/3
6	64-QAM ¾

The following blocks display numerical results:

- The Bit Error Rate Display block shows the bit error rate, number of errors and the total number of bits processed.
- The Est. SNR (dB) display block at the top level shows an estimate of the SNR based on error vector magnitude. The SNR block in the Channel subsystem shows the SNR based on received signal power.
- The ID_ Rate display block shows the ID_ Rate that corresponds to the specific modulation RS-CC rate currently in use.

3. Computer Modeling

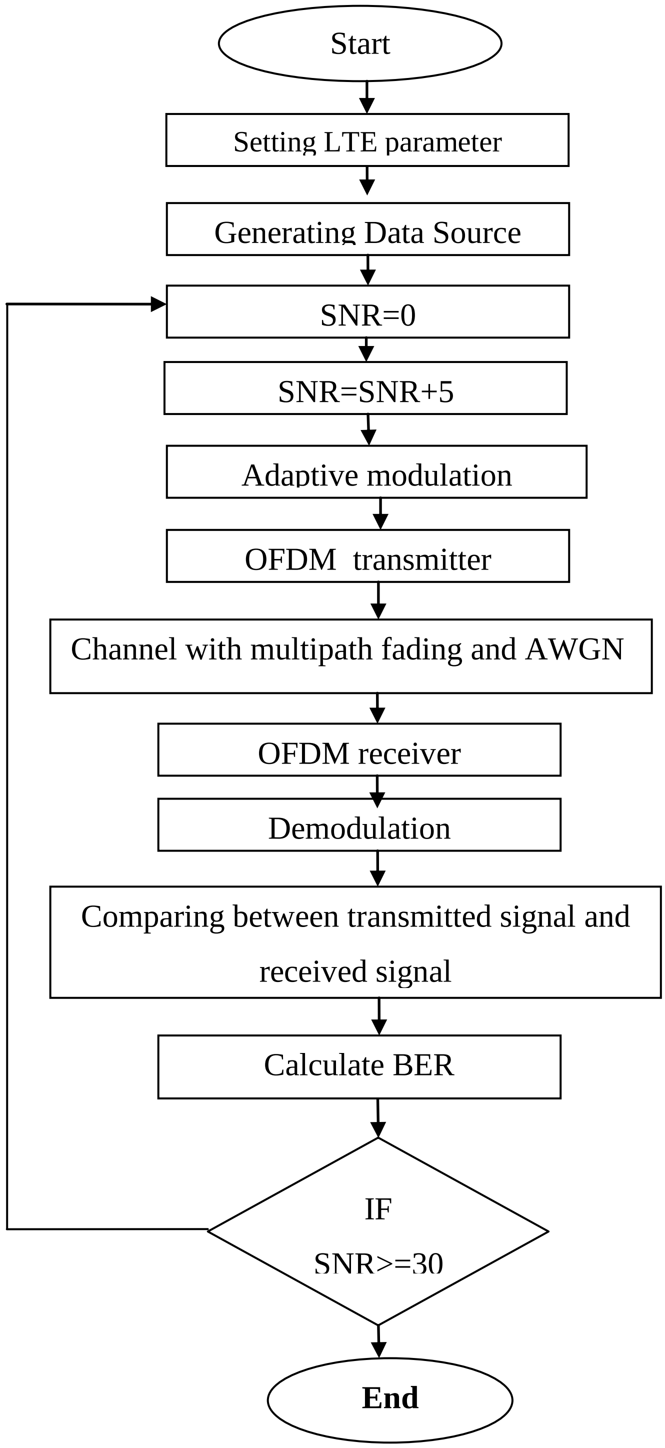

Figure 1: Computer Model

4. Simulation Parameter

Table 2: Simulation Environment

Parameter	Value
channel Bandwidth	1.4,5,10,20
SNR	(0 - 30)
Cycle prefix factor	(1/4),(1/8),(1/16),(1/32)
Low SNR threshold for rate control (dB)	[4 10 12 19 22 28]
Modulation technique	Adaptive modulation
Diversity	Multiple input single output
Noise	AWGN
Fading	Multi path fading
Coding technique	Fec (forward error coding)

5. Simulation

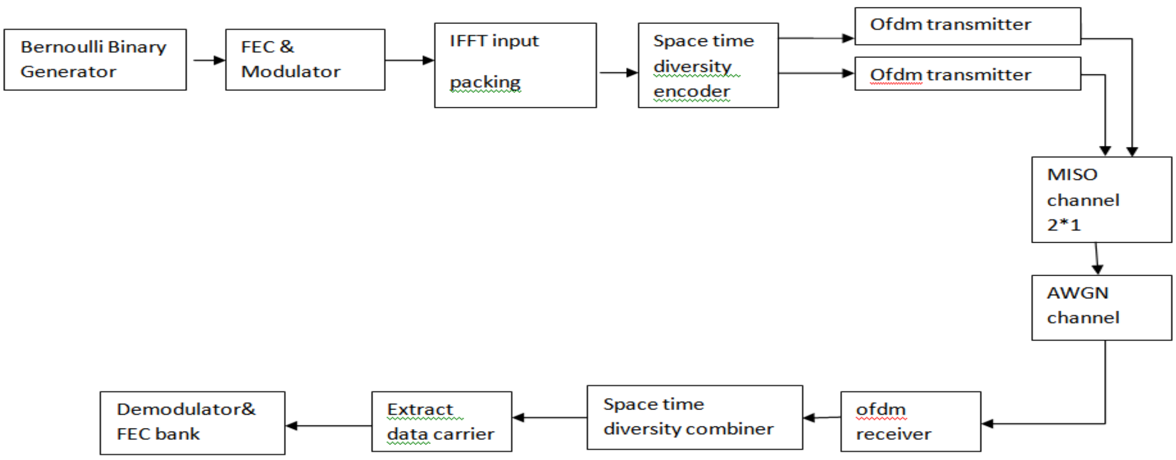

Figure 2: Model IEEE 802.16-2004 without MISO channel

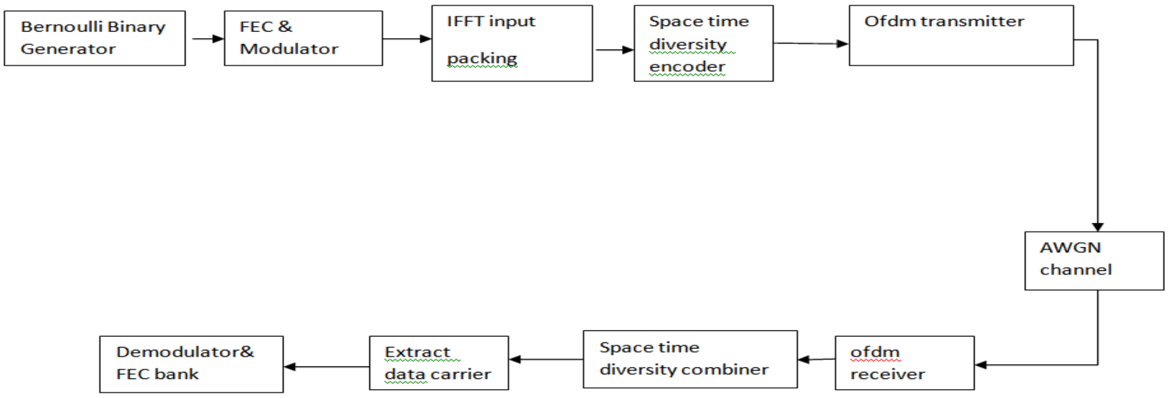

Figure 3: Model IEEE 802.16-2004 with multi path fading and space diversity

6. Result

After execution of the simulator using different scenario for the simulator parameter we get the following results in term of table & figure

- **With space diversity and MISO channel:**

1\Bandwidth: 1.4 Cycle prefix: ¼

Table 3: BER, Power

Sr. No.	EST.SNR	BER	POWER
0	0.850	0.265	-141.6
5	2.809	0.190	-139.641
10	4.1789	0.000916	-138.271
15	4.490	0.0033	-137.96
20	4.62	0.000004597	-137.83
25	4.651	0	-137.799
30	4.657	0	-137.793

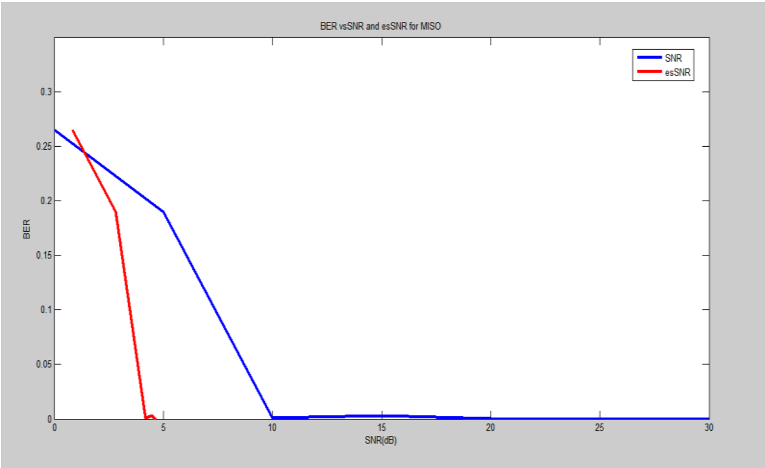

Figure 4: SNR and esSNR respective to BER

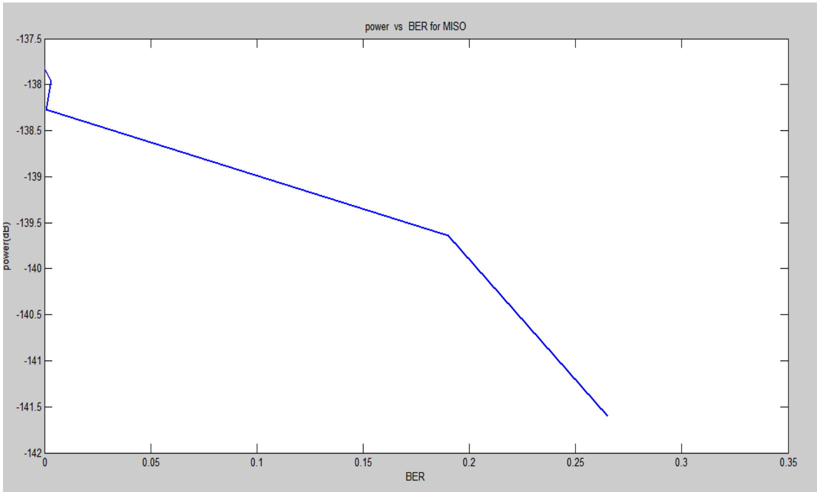

Figure 5: POWER versus BER

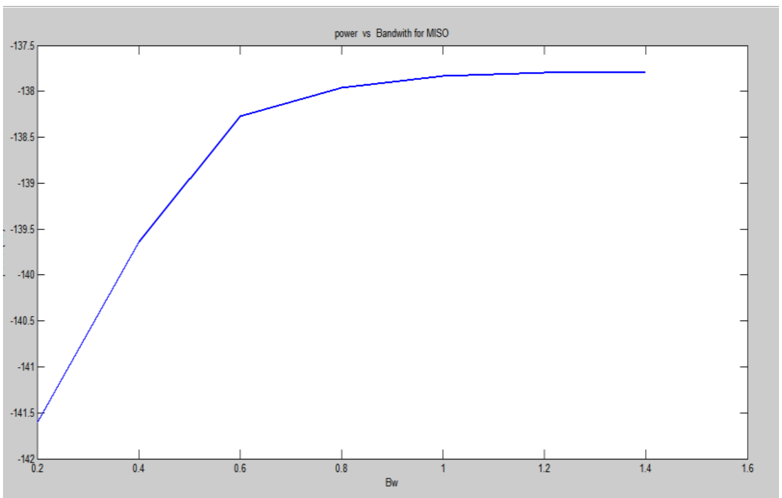

Figure 6: POWER versus BANDWIDTH

- **Without space diversity and MISO channel:**

1/ Bandwidth: 1.4 Cycle prefix: ¼

Table 4: BER, Es SNR and Power

SNR	BER	Es SNR	Power
0	0.4857	-8.223	-150.763
5	0.3341	-0.4253	-142.965
10	0.09924	5.609	-136.931
15	0.01114	10.03	-132.51
20	0.004217	15.38	-127.16
25	0.004612	20.27	-122.27
30	0.0007943	24.76	-117.78

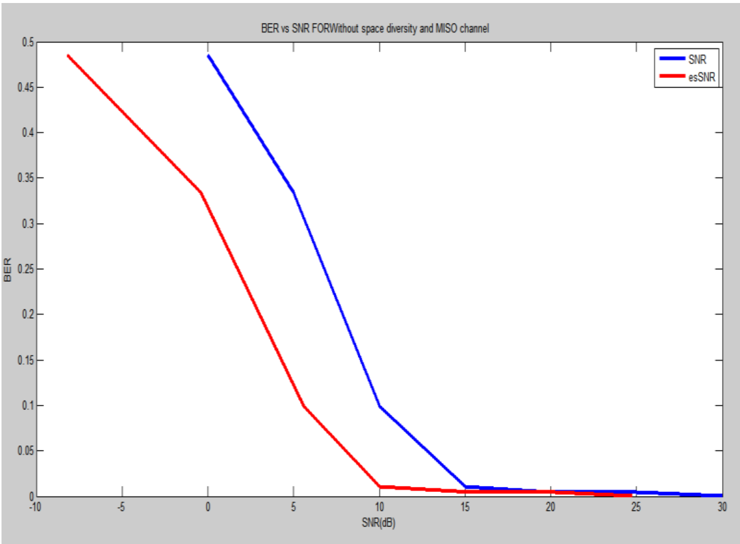

Figure 7: SNR and esSNR respective to BER

International Journal of Engineering Sciences Paradigms and Researches (IJESPR)
(Vol. 34, Issue 01) and (Publishing Month: September 2016)
(An Indexed, Referred and Impact Factor Journal)
ISSN: 2319-6564
www.ijesonline.com

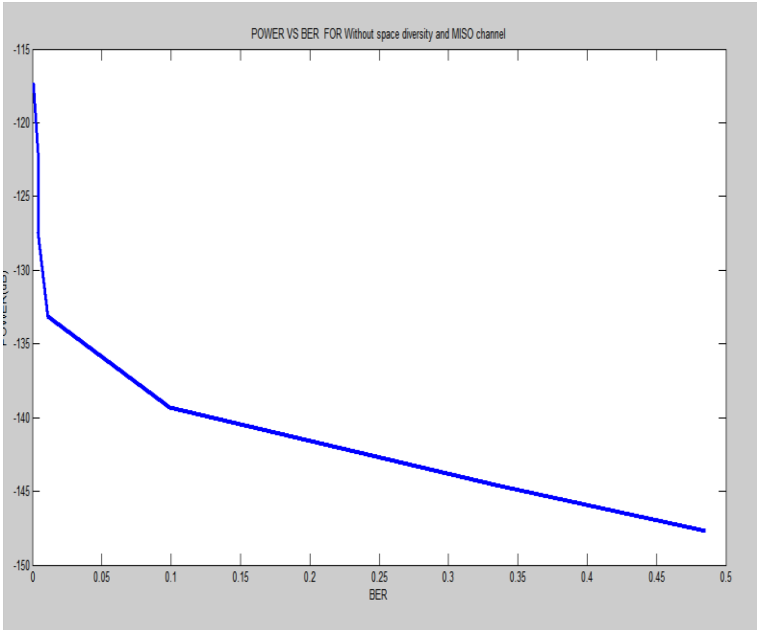

Figure 8: POWER versus BER

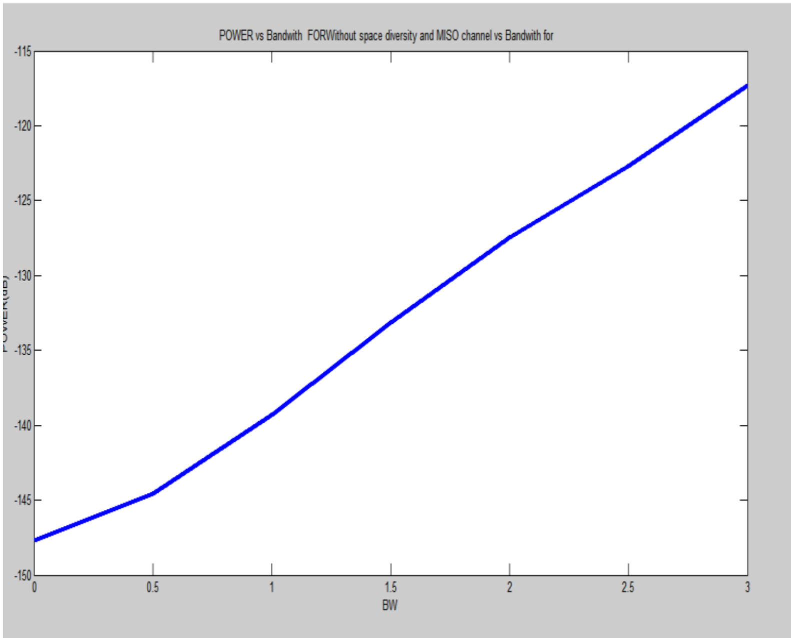

Figure 9: POWER versus BANDWIDTH

7. Conclusion

This paper is study and analyzed the power control and estimated perfect power in LTE. First, parameters have been analysed and simulated by different scenario. Simulation result achieve that the power control by estimating SNR is enhanced the quality of service, system capacity, enhance cell edge performance by reducing interference level. The result where obtained in terms of tables and graphs after execution of simulation. It was obtained whenever increase bit error rate (BER), the esSNR and SNR Where decrease. Whenever increase the power, BER will decrease and Bandwidth decrease for that we can adjust to the optimal situation for power. After getting the results that are listed earlier.

References

[1] Sajid Hussain, “Dynamic Radio Resource Management in 3GPP LTE”, Master’s Thesis Report, Blekinge Institute of Technology,2009.

[2] Warabino, T.; Kaneko, S.; Nanba, S.; Kishi, Y., "Advanced load balancing in LTE/LTE-A cellular network," Personal Indoor and Mobile Radio Communications (PIMRC), 2012 IEEE 23rdInternational Symposium on , vol., no., pp.530,535, 9-12 Sept. 2012

[3] Jiajia Liu; Kawamoto, Y.; Nishiyama, H.; Kato, N.; Kadowaki, N., "Device-to-device communications achieve efficient load balancing in LTE-advanced networks," Wireless Communications, IEEE , vol.21, no.2, pp.57,65, April 2014.

[4]Bilal Muhammad, Abbas Mohammed,” Uplink closed loop power control for LTE system”, IEEE, November 2010.

[5] Arne Simonsson, Anders Furuskar,” Uplink Power Control in LTE - Overview and Performance, Subtitle: Principles and Benefits of Utilizing rather than Compensating for SINR Variations”, IEEE, October 2008.

[6]Ömer BulakciEmaauthor,Ahmad Awada,Abdallah Bou Saleh,Simone Redana,Jyri Hämäläinen, ” Automated uplink power control optimization in LTE-Advanced relay networks”, Springer 2013.

[7] D. Gururaj, P. Pandiaraj,” Power Control Optimization for Lte-Advanced Relay Networks” IEEE Journal, December 2012.