CHAPTER ONE

INTRODUCTION

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1.1 Preface:

Mobile broadband traffic has surpassed voice and is continuing to grow rapidly. This trend asset to continue, with global traffic figures expected to double annually over the next five years. [9][10]

By 2009, it had become clear that, at some point, 3G networks would be overwhelmed by the growth of bandwidth-intensive applications like streaming media Consequently, the industry began looking to data-optimized fourth-generation technologies (LTE), with the promise of speed improvements up to 10-fold over existing 3G technologies.

The motivation for LTE included the desire for a reduction in the cost per bit, the addition of lower cost services with better user experience, the flexible use of new and existing frequency bands, a simplified and lower cost network with open interfaces, and a reduction in terminal complexity with an allowance for reasonable power consumption. [4]

Ever since LTE technology has been established in 2009, the work on its enhancements and requirements had begun and these have been fulfilled successfully by LTE-Advanced. LTE-Advanced architecture has two types of technologies, homogeneous networks and heterogeneous networks. [2]

Traditionally wireless cellular networks are typically deployed as homogeneous networks composed of all the base stations belong to the same type and power class.

With ever increasing demand for mobile radio communication services, Wireless cellular systems have evolved to the point where an

isolated system (with just one base-station) achieves near optimal performance, as determined by information theoretic capacity limits. [12][11]

Heterogeneous networks technology was adapted to coup with the increasing demand for services and resources,

Heterogeneous cellular networks for a very compelling approach for cellular networks to provide the coverage and capacity needed to move forwards. These heterogeneous networks typically composed of a variety of formats of base station, radio access networks, transmission solutions and power levels.

1.2 Problem Statement:

In heterogeneous network even with targeted deployment where the small base-stations are placed in high traffic zones, most users will still be served by the macro cell base station, this result in small amount of resources dedicated to each user in macro cell, while they may be twenty of resources available in Pico cell.

1.3 Proposed Solution:

As a solution to pre-discussed problem is to actively push more users into the small base-station by performing Cell Range Expansion to the small base-station to balance the load among high and low power base-station, Range Expansion will allow attract more users and thus achieving performance improvement. Range expansion is achieved by performing user association based on biased measured signal.

1.4 Aim and Objective:

The aim of the thesis is to evaluate the performance of a heterogeneous network with performing Cell range expansion and without performing Cell range expansion and determine how the cell range expansion will improve the network in concern with the:

- Data rate.
- Throughput.
- Spectral Efficiency.
- Bandwidth Utilization.

1.5 Methodology:

In order to fulfill the aim of the thesis a research background were obtained in heterogeneous network architecture, small cells deployment and its challenges , Pico cell range expansion and how to apply it by adding a positive bias value to the power received from the Pico the to the end user. To evaluate the performance of a heterogeneous network with performing Cell range expansion and without, four performance metrics were measured and evaluated (throughput, data rate, spectral efficiency and bandwidth utilization).

By using Matlab software to simulate the performance of a network consisting of one macro cell and one Pico cell, the performance metrics were evaluated for a congestion macro cell and reevaluated after expansion Pico cell range and offloading users from the macro cell.

The results were obtained and the system enhancement percentage was calculated.

1.6 Thesis Outline:

This thesis consists of five chapters presented as follow:

- Chapter two: Presents the literature review of LTE-Advance and its key features, heterogonous networks (motivation, design options, low power nodes type, advantages and disadvantages) and small cells (deployment, selection, access polices) also present related work on Pico cell range expansion.
- Chapter three: Presents the cell range expansion method (motivation, limitation, cell selection strategy) also provides the performance mathematical model and the simulation scenario used to measure the performance of the network.
- Chapter four: Provide the simulation parameters and discussion of the results obtained from each simulation scenario also provide a comparison for the gradually system enhancement percentage.
- Chapter five: Provide the conclusion of the work done and the recommendation.