1.1 Preface

LTE is very attractive system that supports many services with very high quality. Which leads to system complexity, LTE supportsheterogeneous network which is a technique to enhance the user performance, it contains different cell tower sites workingseamlessly. The heterogeneous network includesmacrocells sites which cover a radius of up to 16.09344 kilometersin diameter, microcells sites which covers less than 1.609344 kilometers radius, picocells sites provides 0.2286 kilometers coverage area and thesmallest cell site are femtocells sites that can support up to 4 simultaneous mobile phone calls [1].

The heterogeneous network can be deployed in different scenarios containing macro cell sites and one or more small cell sites (micro, pico and femto).In this research the overall performance has been enhanced by using different techniques. An interference cancellation technique (sectorization using three sectors) has been introduced to mitigate the interference, and transmission strategy to perform the cooperation mechanism to make it possible to use the resources cooperatively between the higher and the lower cell levels.

1.2 Problem Statement

The users in small cells sites like femto or Pico in heterogeneous network exposed to high interference because the power of the macro cell is very high as compared to the power of the small cell.

The users in small cells sites like femto or pico in heterogeneous network compete for small amount of resources while there may be aplenty of resource in macro cell level.

1.3 Proposed Solution

In this research the following solutions are proposed:

- The sectorization technique(using three sectors) is used to reduce the interference to the users in femto or pico cell.
- In order to effectively utilize the available resources in both femto or pico cell and macro cell levels cooperation between multicell levels is used in this research.

1.4 Research Aim and Objectives

The aim of this research is to enhance the overall performance for users in femto or pico cellssites.

The detailed objectives of this research include:

- To study and investigate the performance of heterogeneous network with sectorization technique and cooperation between multicell levels.

- To develop a simulation to analyse the effectiveness of the proposed working scenarios used to mitigate interference from macro cell as well as the cooperation between different cell levels in order to :

    - Maximize the data rate.
    - Minimize the latency (delay).
    - Make small cells and macro cells operate cooperatively.
    - Efficiently utilize the available spectrum.

1.5 Methodology

The methodology used in the research process has been to start with a literature survey of the problem, analyses related problems and thereafter formulate a mathematical model of the problem. Then key performance parameters (metrics) has been defined and used to measure the improvement of the performance before and after applying the enhancement techniques. After that the proposed solutionsare further simulated over a MATLAB platform,System parameters are input in the simulator and the output has then been processed in MATLAB.The flow of the MATLAB code has been clarified bya flow chart in Appendix A, the results graphs from the simulation illustrates the amount of the improvement in each parameter. Then the enhancements has been recorded and used in writing this thesis. (More details in Chapter Three and Chapter Four).

1.6 Thesis Outlines

The thesis is divided into five chapters; Chapter One is an introduction facilitates briefly the purpose of this project.

Chapter Two is a literature review that gives a brief review ofLTE, LTE-Advanced and heterogeneous network,also it provides over view of different technologies that are used to enhancethe performance of the system.

Chapter Three discusses multicell cooperation for LTE-Advanced heterogeneous network and it covers how it can be deployed. Chapter Four presents a detailed discussion of the simulation results. Chapter Five provides the conclusion and recommendations.