

Chapter I

INTRODUCTION

The growing popularity of mobile technologies and their applications is attracting day by day. People on the move with smart phones, wireless applications, internet etc. demand high speed data service, instance the voice and video communication, streaming service, file sharing, etc. that interweave their lives, their work, and the way they communicate and interact with their friends, family and colleagues. The wireless communication world has taken some giant leaps in past few decades by virtue of wireless communication. The development of cellular technology proved to be the foundation upon which present wireless technology would be laid upon. This popularity and new demands are simply the result and part of the impact that the development of the radio communication have had since the very moment when in the 1809s, Guglielmo Marconi and others invented the wireless telegraph. The history of the Mobile Communications started in 1947 when the idea of dividing the coverage areas into cell was born in the well-known Bell Labs. The concept was simple: Each cell with its own base station operating on a different frequency in order to avoid the co-channel interference and allowing a higher system capacity. Almost 100 years later in 1980s the development continued,

when the real commercial growth began when analog systems like NMT (Nordic Mobile Telephone), AMPS (Advanced Mobile Phone System) or TACS (Total Access Communication System) were developed. These systems became known as the First Generation systems [16].

The collaborative effort of numerous companies around the world made possible the appearance of the first massive used standard; Global system for Mobile Communication in 1990. The GSM is considered into the Second Generation systems, and the success of GSM inspired further collaborative development and the same approach was used in developing its successor, the Third Generation (3G) system WCDMA (Wideband Code Division Multiple Access). WCDMA has been gradually adopted around the world and the continuous evolution to provide higher data rates through 3G technology is in progress. Users want to use the better wireless access, voice, live streaming, video conference, higher speed of download and upload. All these requirements and expectations boost the evolution of the wireless communication system. The new system called Long Term Evolution (LTE) is designed to meet those targets.

1.1 Background

Phnom Penh (ភ្នំពេញ) has grown to become the nation's center of economic and industrial activities, as well as the center of security, politics, tourism, cultural heritage, and diplomacy of Cambodia. We need to use the better broadband wireless communication systems in central Phnom Penh. LTE technology is the best choices which can be serve high speed internet, good service for cell phone and so on. Other two systems were used in this topic as well. The first once is Global System for Mobile Communications, which appeared in most of the last telecommunication systems, explored and improved in all its parts. GSM has lasted much longer than what was earlier anticipated. Mobile voice accounts for 65-70% of mobile operators revenues. GSM adds today 40 million new subscribers every month and the voice traffic is still growing. Even mature markets see a voice traffic increase of 20-30% annually. It is now believed that GSM will continue well beyond 2020. And the second once is Universal Mobile Telecommunications System, UMTS is an umbrella term for the third generation radio technologies developed within 3GPP. UMTS is a 3G networking standard used throughout much of the world as an upgrade to existing GSM mobile networks. UMTS makes use of WCDMA, a technology that shares much with CDMA networks used throughout the world, though it is not compatible with them.

Base level UMTS networks are generally capable of downlink speeds as fast as 384kbps. Anyway the parameter and also the architecture of the LTE system is higher and better than those system.

1.2 Objective and Hypotheses

Global System for Mobile Communications and Universal Mobile Telecommunications System are completely are designed for the different goal, they work in difference scenarios. All of the wireless technologies target the users on the move aiming to provide their high Quality of Service (QoS) and customer satisfaction. Theoretical limits set the targets that are hard to achieve in real scenario as there are multiple factors to consider in the practical case; environment, fading, reflections, noise etc. Especially for the users whose position is mobile, situation becomes different. The purpose of the new concept is that, LTE system can implementation or access in the central Phnom Penh. This thesis studies and describes state of the art of design and simulation of LTE radio system for broadband wireless access in central Phnom Penh. And also include the radio planning in LTE including the network coverage and capacity, frequency planning, methods and the implementation to dimension the network. This work describes the dimensioning process of LTE

radio access network, its models, methods and the tool developed to dimension the network. The main objectives are listed here:

1. An introduction of the LTE features relevant for the dimensioning.
2. Define the model and methods for LTE capacity and coverage estimation.
3. LTE frequency planning evaluation.
4. Development and description of dimensioning tool.

The real condition in Phnom Penh now is operated by two wireless communication systems such as GSM and UMTS. Unfortunately, both systems still work separately in different technique and also different environment. So the speed, data rate and service still not good for the newer technology device. The future system will support many demanding applications such as interactive TV, mobile video blogging, and advanced gaming. Moreover, LTE works on scalable bandwidth starting from 1.4MHz up to 20 MHz which makes it flexible for telecommunication operators to deploy this system. The LTE system will be exist in the city. Therefore, the wireless communication in Phnom Penh will be smoothly and higher quality.

Coverage estimation is one of the fundamental factors of network planning for all modern wireless technologies. Regardless of this, a provider needs to make sure that sufficient

QoS is maintained. Of many frequency bands in LTE, this research focuses mainly on the 1800 MHz band test network installed by Smart Mobile. Hence, motive behind this thesis and project is to study the coverage performance and limitation of LTE network on this particular band with respect to other bands. Following problem statements have been outlined as the scope of the thesis such as LTE 1800 MHz band coverage, calculation coverage area and capacity for LTE radio system and simulation in Atoll Software and Google Earth

The thesis will design new LTE radio systems in Phnom Penh city. The new broadband wireless communication system will help business and economic growing up faster and faster because of the better quality of broadband wireless communication system. Blueprint of design is the goal of this thesis. The design is LTE system map planning Phnom Penh city which covers an area of 678.46 square kilometers (262 sq mi), with some 11,401 hectares (28,172 acres) in the municipality and 26,106 hectares (64,509 acres) of roads. The agricultural land in the municipality amounts to 34.685 square kilometers (13 sq mi) with some 1.476 square kilometers (365 acres) under irrigation.

1.3 Thesis Structure

This thesis consists of five chapters, the contents of each chapter are outlined in this section.

Chapter 1

Defines the objective and approach and a short introduction is presented to the company where the thesis was made. And also introduces the reader to the problem being addressed in this thesis, along with previous work, contributions made in this thesis and difference between current and previous work.

Chapter 2

Presents the theoretical fundamentals of LTE and it includes some of the key technologies in LTE which are related in this thesis. Background knowledge relating to the research work will be given in this chapter. The history and development of Long Term Evolution will be shown. Then MIMO technology will also be described in this chapter.

Chapter 3

The purpose of this chapter is to give a brief introduction to simulation techniques and calculation. Firstly, a description of the system scenario model and related knowledge of modeling are shown. Then the appropriate measure and performance verification are presented, and then the simulation tools that have been used to generate the results shown in this thesis, to generate the results shown in this thesis, and then a description of the system scenario model and related knowledge of modeling are

shown. Then the appropriate measures and performance verification are presented. Finally, the performance evaluation and parameters are also discussed. And also describes the capacity and coverage planning in the LTE system in both downlink and uplink directions with the consideration of MIMO capacity enhancement and the effects of system bandwidth. Peak data rate and maximum subscribers' number are also calculated on the base of LTE.

Chapter 4

The system simulator is described in details. The assumptions made for reducing the simulator's complexity are also listed together with the common simulation parameters. Presents the frequency planning for LTE network including the frequency allocation scheme and related methods. LTE coverage and capacity planning will be presented. This chapter covers the Radio Link Budget and the related methods and factors with the text explaining the method to calculate the number of sites based on the coverage and capacity. The simulation and methods are designed on the base of the software platform and the results are illustrated.

Chapter 5

Summary and conclusions of the entire thesis and discusses possibilities of future research. Additionally, some suggestions and recommendations for future work are also included.

Exhaustive list of material which was referred in this study is listed out in references section. Quite substantial amount results were obtained while performing this study.