1

Introduction

Over the last few decades, mobile radio communications have become ubiquitous throughout the world. People have become accustomed to the technology through commercial mobile phones. The mobile network infrastructure that enables communications has become a normal part of urban environment in which people live.

There is also great number of other mobile radio applications essential in the modern world that are used in navigation, transportation, machine-to-machine communications (M2M), robotics, emergency and low enforcement services, broadcasting, space exploration, the military and so on. Mobile radio is, in fact, a part of more a widely defined wireless technology that, of course, includes wireless LANs (WiFi) with fixed and nomadic access.

Each application was developed on the basis of specific needs and, in some aspects, the mobile radio networks for emergency services and commercial mobile services are different. Nonetheless, the underlying principles in mobile communications, such as radio link design given performance constraints, separation of control and traffic channels, mobility support, principles of the channel allocation in the cell, radio network management and so on, have lots in common in many applications. Moreover, some of the commercial technologies, such as LTE, now appeared to support land mobile radio applications for emergency and public safety services.

This book is written as a modified and expanded set of lectures on the wireless engineering course I had privilege to teach at the University of Sydney, Australia for a couple of years. Most of the concepts of these lectures were adopted from published standards and also based on personal experience in the field as well as from some works of other authors. The course was delivered as post-graduate study. The assumption was made that the fundamentals of digital communications were already known to attendees and the objective was to explain the subject using mathematical arguments as little as possible; that is, close to common practice in the commercial communications industry. The target audience are engineers who are involved in either network operations or technical pre-sale. The content is limited to major three mobile communication technologies: GSM, 3G-Wideband Code Division Multiple-Access (WCDMA) and LTE with the major focus on radio access network (RAN) technology. The core part of the network is a complex subject on its own and is described only to discuss its role in e2e procedures and interfaces with the radio network.