

Essentials of UMTS

The third generation (3G) cellular system UMTS is advanced, optimised and complex. The many existing books on UMTS attempt to explain all the intricacies of the system, and as a result are large and equally complex. This book takes a different approach and explains UMTS in a concise, clear and readily understandable style.

Written by a professional technical trainer, and based on training courses delivered on UMTS to telecommunication companies worldwide, *Essentials of UMTS* will enable you to grasp the key concepts quickly. It assumes no previous knowledge of mobile telecommunication theory, and is structured around the operation of the system, clearly setting out how the different components interact with each other, and how the system as a whole behaves. Engineers, project managers and marketing executives working for equipment manufacturers and network operators will find this concise guide to UMTS invaluable.

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To my Mother and Father

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Preface

This book is about the Universal Mobile Telecommunication System (UMTS). UMTS is the most important of the third generation (3G) mobile phone systems, which are gradually replacing the older second generation systems such as the Global System for Mobile Communications (GSM). 3G systems provide much faster communications than their predecessors, and this allows them to offer the user a wider range of services than before, such as high speed Internet access, video and interactive games.

My aim in this book has been to write a technical introduction to UMTS. As an important part of this, I have tried to give the reader a system level understanding of what all the different parts of UMTS are, and how they relate to each other. Such an understanding is hard to gain from the UMTS specifications or from the more specialised books on the subject, but is precisely what the newcomer to the system needs.

At the same time, I have kept the book short enough that it can be read cover to cover in a weekend. To do this, I have consciously left out many of the details that can be found in the specifications or in some of the other technical books on the subject. Accordingly, you won't find in this book an exhaustive description of issues such as the bit layouts in the physical channels, the contents of the system information blocks or the different types of measurement event. Rather, you will get an understanding of what those concepts are, see some examples, and gain enough knowledge to approach one of the more detailed treatments with confidence.

The book is intended for people who are new to the system, such as engineers, managers and marketing executives; it will also be valuable for those who are experienced in one part of the system but want an appreciation of what is going on elsewhere. Although it's written as a graduate level book, it assumes no previous knowledge of mobile

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telecommunication theory or of particular systems such as UMTS or GSM. The mathematical treatment is kept at a basic level, although an understanding of complex numbers and decibel notation will be helpful in the parts that deal with radio communications. The material goes up to the end of release 7 of the UMTS specifications, with an initial look at the issues that are being addressed in release 8.

UMTS is riddled with terminology and abbreviations, which can be a barrier to a newcomer's understanding of the subject. Although they are unavoidable, I have tried to assist the reader by putting new terms and abbreviations in *italics*, and by drawing attention to the terms that are particularly important for this book.

Outline of the book

The first two chapters are introductory ones. Chapter 1 is an overview of mobile telecommunication technology, which provides the background information that will be needed by those who are new to the subject. The issues covered include radio transmission and reception, communication protocols, and the history of mobile telecommunication systems. Chapter 2 describes the system level architecture of UMTS, by looking at the hardware components that make up the system, and the software protocols that they use to communicate with each other. Its aim is to provide the reader with a framework for the later, more detailed aspects of the book.

Chapter 3 describes the techniques used for radio transmission and reception between the mobile phone and the network. The main focus is on the technology used by the air interface, which is known as wideband code division multiple access (W-CDMA). The chapter also discusses the data rates that can be reached using UMTS, and the more recent enhancements to the air interface such as high speed packet access (HSPA).

The next two chapters discuss the higher level operation of UMTS. Chapter 4 looks at the procedures that control the operation of the mobile phone, and the signalling messages that are exchanged between the mobile phone and the network. Chapter 5 then looks at the

implementation of services in UMTS. It covers voice and the general packet radio service (GPRS) in some detail, and then moves on to a higher level account of other services such as the short message service (SMS).

The book concludes in Chapter 6 with a look at two technologies that are likely to be added to UMTS in the next few years: the IP multimedia system and the long term evolution of the air interface. It also describes the expected process for the introduction of fourth generation (4G) systems.

Illustrations

Informa Telecoms & Media supplied the market research data underlying Figures 1.15 and 1.16 in Chapter 1. I am grateful to Alan Mayne and Mike Woolfrey for making the data available for use in this book.

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On a technical level, I am indebted to Andy Richardson for the knowledge he passed to me while delivering training courses on his behalf at Imagicom. My thanks are also due to the delegates on my training courses, for asking the questions that have stretched my understanding of the system, and for highlighting the gaps in my explanations.

Several people provided me with feedback and suggestions during the development of the book. I would particularly like to thank Stirling Essex, Julian Nolan, Mike Palmer, Rudi Tanner and William Webb, for taking time out from their Christmas holidays to review a draft of the manuscript, and for providing me with some invaluable advice on how the content and presentation could be improved. Nevertheless, the responsibility for any errors or omissions, or for any lack of clarity in the text, is entirely my own.