

# UMTS System Overview - 3 days

## COURSE OBJECTIVES:

Upon completion of this course, the participant will:

- Be familiar with the UMTS Terrestrial Radio Access Network (UTRAN) including WCDMA
- Be familiar with the UMTS Core Network in R99, R4 (Split Architecture) and R5 (IMS)
- Understand how circuit switched calls and packet switched sessions are set up
- Understand how UMTS handles mobility within UMTS and between UMTS and GSM
- Understand the service architectures in UMTS, including providers, bearers and QoS

## SUITABLE FOR:

Those who require an overview of the UMTS system architecture and functionality.

## PREREQUISITES:

GSM and GPRS knowledge on an overview level is highly recommended but not compulsory.

## CONTENTS:

The course presents an overview of the UMTS system, including the User Equipment (UE), the UMTS Terrestrial Radio Access Network (UTRAN) and the Core Network (CN). Bearer services and QoS in UMTS are introduced. The UTRAN access method, WCDMA, is examined. Benefits, problems (e.g. interference) and solutions (e.g. fast power control) are discussed.

The course also describes the functions of UTRAN and its protocol and channel structure. Mobility management is discussed, both from a Core Network perspective (MM states) and a UTRAN perspective (RRC states). Traffic cases for speech call and web-browsing session summarises the setup of bearers in how UE, UTRAN and CN. Also, 2G/3G interoperability issues are presented.

The final part of the course focuses on the evolution of the core network. Release 4 is presented with its split architecture of the circuit switched CN with ATM or IP in the backbone. The IP Multimedia Subsystem (IMS), enabling packet switched multimedia, is also introduced as well as general Service Architecture.

### System Introduction

- Network architecture of GSM, GPRS and UMTS
- The evolution of UMTS

### UE and Bearer Services

- Introduction to the bearer concept
- Introduction to Quality of Service (QoS)

### Spreading

- Comparison of FDMA, CDMA and WCDMA
- The general principles of spreading
- Requirements on codes used for WCDMA

### UMTS Codes

- Scrambling Codes (SC) and Channelisation Codes (CC)
- Usage of codes in uplink and downlink

### Radio Theory

- Characteristics and problems on the radio interface
- Joint prediction of coverage and capacity
- Soft handover, softer handover, power control

### Power Control

- Power control mechanisms in UMTS: open loop, inner loop (fast loop) and outer loop

### UTRAN Functionality

- RRC Connection, Iu Connection, Signalling Connection
- Radio Bearer, Iu Bearer, Radio Access Bearer
- Signalling within UTRAN: NBAP and RNSAP
- Signalling with Core Network: RANAP

### UTRAN Protocols and Channels

- RRC, RLC, MAC, PHY
- Logical channels, transport channels and physical channels

### UE States

- Mobility Management states (Detached, Idle and Connected)
- RRC states (cell\_FACH, cell\_DCH, cell\_PCH and URA\_PCH)
- UE activities in different states

### Speech Call setup and Web Browsing

- Mobile terminated call setup, including RRC Connection establishment and RAB allocation
- Set-up of web browsing session, including RRC Connection, PDP Context Activation and RAB allocation

### UMTS/GSM Interoperability

- Prerequisites for interoperability
- PLMN/RAT Selection
- Cell reselection 3G ↔ 2G
- Handover 3G ↔ 2G

### Split Architecture

- Introduction of (G)MSC server and MGW
- IP or ATM in the circuit switched domain

### Service Architectures

- Different service providers: Core Network, Service network, 3<sup>rd</sup> party networks

### IP Multimedia Subsystem (IMS)

- Why IMS?
- New nodes (CSCF, HSS, MGCF)
- The ISC interface
- Other features in R5, e.g. HSDPA