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# UMTS System Engineering

## Course Description

Building upon the success of the second generation technologies of GSM and GPRS, the third generation network UMTS brought about significant enhancements and network efficiencies. This course explains the principles behind this network technology and in so doing, provides detailed analysis of the key signalling procedures in terms of call setup, data transfer and mobility.

This course has no prerequisites.

**2** days (LiveOnsite, LiveOnline)

**12** hours learning (OnlineAnytime)

**12** CPD Learning Credits

Level: 2 (Intermediate)

**This course will contain the following sections:**

## 1. UMTS Architecture

### Topic areas covered include:

- The UMTS Network Architecture:
    - Terminal Equipment.
    - The Universal Terrestrial Radio Access Network:
        - UE, Node B and RNC.
    - Femto Cells.
    - The Core Network - Circuit Switched:
        - MSC Server and MGW.
    - The Core Network - Packet Switched:
        - SGSN and GGSN.
    - Databases:
        - VLR, HLR, EIR and AuC.
    - Intelligent Networks and CAMEL:
        - gsmSSF, gsmSRF, gsmSCF and gprsSSF.

- Protocols and Interfaces:
    - Lower Layers.
    - The UTRAN Interfaces.
        - Uu, Iub, Iur, IuCS and IuPS Interfaces.
    - The CS Core Network Interfaces.
    - The PS Core Network Interfaces.
        - Gn/Gp Interfaces.
    - The Database Interfaces.
        - D and Gr Interfaces.

## 2. UMTS Air Interface

### Topic areas covered include:

- Frequency Bands:
    - UARFCN.

- Modulation Techniques and Coding:
    - Power Control.
    - Adaptive Modulation and Coding:
        - QPSK, 16QAM and 64QAM.

## UMTS Air Interface (cont.)

- CDMA Basics:
    - Code Division Multiple Access:
        - WB-CDMA.
    - Code Requirements.
    - Spreading.
    - De-spreading.

- UMTS Frame Structure.

- HSPA+:
    - Downlink 64QAM (Added in Release 7).
    - Multiple Input Multiple Output (Added in Release 7).
    - Multi-Antenna Systems.
    - Dual Cell Operation (Added in Release 8).
    - HSPA+ Evolution.

## 3. UMTS Initial Procedures

### Topic areas covered include:

- 3G Mobility Management:
    - Location Areas and Routing Areas:
        - LAC, RAC and CGI.
    - UMTS Mobility Management States.
        - Detached.
        - Connected.
        - Idle.
    - Connected Mode Sub-states:
        - Cell_DCH, Cell_FACH, Cell_PCH and URA_PCH.

- 3G Initial Procedures:
    - Power On.
        - PSCH and SSCH.
        - Scrambling Codes.
        - CPICH and BCH.
    - Cell Selection.

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**ITP**
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**LiveOnsite, LiveOnline, OnlineAnytime**

# UMTS Initial Procedures (cont.)

- UMTS Attach:

    - Radio Resource Control Connection.
    - UMTS Circuit Switched Attach.
    - UMTS Packet Switched Attach.
    - Cell Re-Selection.
    - Location Area and Routing Area Updates.
    - Iu Flex.

## 4. UMTS Security

### Topic areas covered include:

- USIM Based Security:

    - Authentication:
        - AV (Authentication Vector).
        - RAND, XRES, CK, IK and AUTN.
    - Encryption.
    - Integrity.

## 5. UMTS Circuit Switched Operation

### Topic areas covered include:

- 3G Mobile Originated Call Setup:

    - Core Network Signalling - ISUP.
    - Disconnect.
    - Core Network Signalling - BICC.

- 3G Mobile Terminated Call Setup.

- Text Messaging:

    - Mobile Originated Text Messaging:
        - SMS Submit.
    - Mobile Terminated Text Messaging:
        - SMS Deliver.
    - Text Messaging Failures.

## 6. UMTS Packet Switched Operation

### Topic areas covered include:

- Session Management.

- 3G PDP Context Activation:

    - Secondary PDP Context Activation.

# UMTS Packet Switched Operation (cont.)

- 3G Data Transfer:

    - Uplink Data Transfer.
        - Gi, Gn/Gp, Iu-PS and Uu.
    - Downlink Data Transfer.
    - Direct Tunnel Mode.
    - 3G Modes of Operation.

## 7. UMTS Mobility

### Topic areas covered include:

- System Information.

- Cell Reselection.

- Idle Mode Mobility:

    - Location Area Update.
    - Routing Area Update.
    - Combined Location and Routing Area Update.

- 3G Circuit Switched Mobility.

- The Soft Handover:

    - Rake Receiver.
    - Rake Receiver in Soft Handover.
    - Soft Handover Regions.
    - Active Set Update.

- The Hard Handover.

- Relocation.

## 8. Interworking with GSM and GPRS

### Topic areas covered include:

- Interworking in Idle Mode:

    - Cell Selection.
    - Cell Re-Selection.

- Interworking - CS Connected:

    - UMTS to GSM Circuit Switched Handover.
    - GSM to UMTS Circuit Switched Handover.

- Interworking - PS Connected:

    - UMTS to GPRS Packet Switched Handover.
    - GPRS to UMTS Packet Switched Handover.

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