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# UMTS Air Interface

## Course Description

This course provides a comprehensive and detailed explanation of the UMTS Air Interface. In so doing, the architecture of the radio interface, 6 channel structures, the CDMA physical layer, the protocols, procedures and operation will all be discussed. For a complete picture, the course also includes focus on enhancements to the air interface through HSPA.

**Prerequisites:** UMTS System Engineering.

9

**Hours learning**  
(OnlineAnytime)

9

**CPD Learning Credits**



**Level: 3**  
(Advanced)

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

## 1. The UMTS Air Interface

**Topic areas covered include:**

- Frequency Bands:
  - ITU Regions.
  - Mobile Frequencies.
  - UMTS Bands.
- CDMA Basics:
  - Codes.
  - User Channel.
  - Spreading and De-spreading.
  - Code Requirements.
- 4 Modulation Techniques and Coding:
  - Basic Modulation Techniques.
  - UMTS Modulation.
  - Adaptive Modulation and Coding.
- Cell Planning for UMTS:
  - UMTS Cells and Sectors.
  - Scrambling Codes.
  - Cell Footprint.
  - Adjusting a Cell to Provide Coverage.
  - Frequency Layers.

## 2. UMTS Structure & Channels

**Topic areas covered include:**

- UMTS Air Interface Architecture:
  - The Non Access Stratum.
  - The Access Stratum.
  - UMTS Channels.
- UMTS Channel Types.

## UMTS Structure & Channels (cont.)

- Logical Channel Architecture:
  - Logical Channels - Control:
  - Logical Channels - Traffic.
  - MBMS Channels.
- Transport Channel Architecture.
  - UMTS Transport Channels.
- Physical Channels:
  - Downlink Physical Channels.
  - Uplink Physical Channels.
- Channel Mapping:
  - Logical to Transport Mapping.
  - Downlink Transport to Physical Channel Mapping.
  - FDD Uplink Transport to Physical Channel Mapping

## 3. UMTS Physical Layers

**Topic areas covered include:**

- UMTS Spread Spectrum:
  - Channel Rates.
  - Spreading.
  - Direct Sequence Spread Spectrum.
  - De-spreading.
  - UMTS Code.
- Synchronization Codes:
  - P-SCH and S-SCH.
- Scrambling Codes:
  - Downlink Scrambling Codes.
  - Uplink Scrambling Codes.

9

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9

**CPD Learning**  
**Credits**



**OnlineAnytime**

## UMTS Physical Layers (cont.)

- Spreading Codes:
  - OVSF Codes.
  - Code Allocation.
  - Static Codes.
  - Processing Gain.
- Basic DSSS System:
  - Transmission.
  - Reception.
  - Rake Receiver.
- Uplink Code Processing:
  - Dedicated Uplink Channels.
  - Common Uplink Channels.
- Downlink Code Processing:
  - Channel Combining.
- Frame Timing:
  - Node B Timing.
  - Cell Timing.
  - UE Timing.

## 4. UMTS Physical Channels

### Topic areas covered include:

- Downlink Physical Channels:
  - CPICH.
  - CPICH Measurements.
  - Example CPICH Measurements.
  - Primary Common Control Physical Channel:
    - P-CCPCH.
  - Primary and Secondary Synchronization Channel:
    - P-SCH and S-SCH.
  - S-CCPCH.
  - DPCH.
  - PICH.
- Uplink Physical Channels:
  - DPCH.
  - PRACH:
    - AICH.
  - Physical Channel Timing.
- Compressed Mode:
  - Transmission Gap Position.
  - Compressed Mode Pattern Parameters.

## 5. UMTS Radio Resource Control

### Topic areas covered include:

- RRC Functions:
  - RRC Architecture.
  - RRC Procedures.
- Radio Bearers.
- Idle Mode Procedures:
  - Broadcast System Information.
  - System Information Blocks.
  - Paging.
- Connected Mode:
  - Identities:
  - RRC Connection.
  - Direct Transfer.
  - Paging.
  - UE Capability.
  - Security.
  - Radio Bearer Procedures.

## 6. UMTS Operational Procedures

### Topic areas covered include:

- UMTS Initial Procedures:
  - PLMN Selection.
  - Cell Selection.
  - UMTS Attach.
  - Initial Direct Transfer.
- Power Control:
  - Uplink Power Control.
  - Downlink Power Control.
- Circuit Switched Operation:
  - Radio Bearer Setup.
  - Speech Transport Format Combinations.
  - RRC Connection Release.
- Packet Switched Operation:
  - Activating the Packet Switched RAB.
  - Packet Switched RAB.
  - Transport Format Combination for Packet Data.
  - Volume Triggers.
  - Data Sub-states.

## 7. UMTS Mobility and Interworking

### Topic areas covered include:

- Idle Mode Mobility:
  - Cell Reselection.
  - Cell Reselection Criteria.
- Connected Mode Mobility:
  - Periodic Measurements.
  - Event Measurements.
  - Intra-Frequency Measurement Reporting.
  - Measurement Control.
  - Measurement Report.
- Soft Handovers:
  - Rake Receiver.
  - Rake Receiver in Soft Handover.
  - Soft Handover Regions.
  - Soft Handover Triggers.
  - Active Set Update.
  - Hard Handover.
- Common State Mobility:
  - Cell Update Procedure.
  - URA Update Procedure.
- Interworking with GERAN:
  - Inter-RAT Mobility Messages.
  - Inter-RAT Measurements.



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