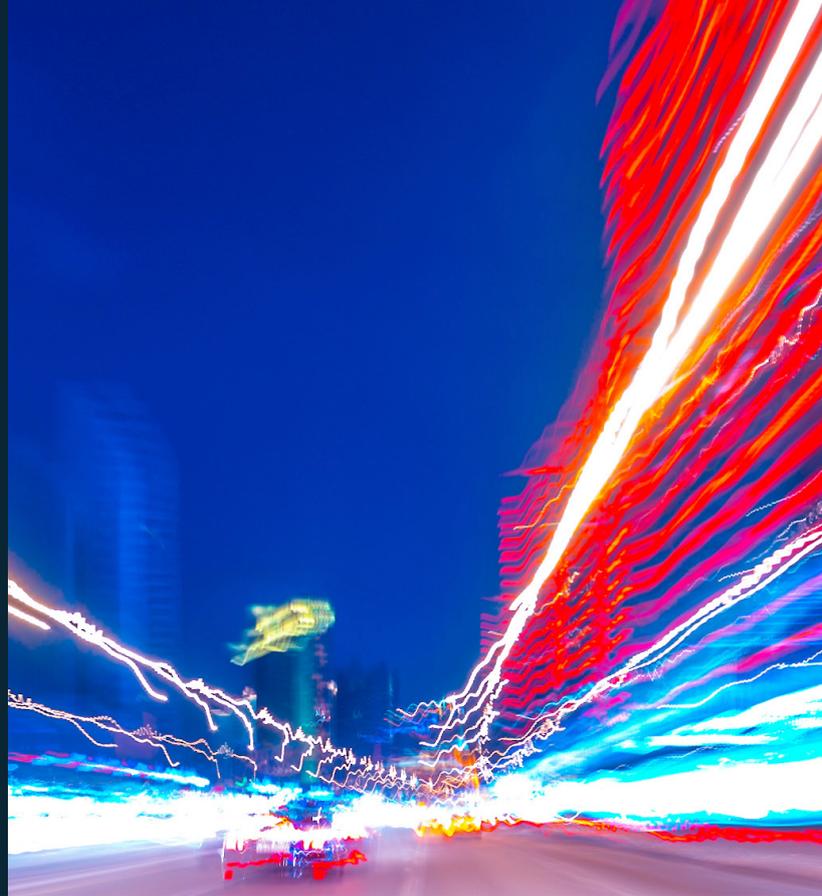




Very informative, instructor was engaging and knowledgeable!



Watch our course intro video.



LTE Air Interface

Course Description

With the introduction of LTE came the development of a new radio technology based on OFDMA / SC-FDMA. This course focuses on the LTE Air interface and provides a detailed analysis of the structure and features of the physical layer, as well as the layer 2 and 3 protocols, before explaining how these are used in the operation of the radio link from initial attach, through service delivery and finally mobility. In so doing, both LTE and LTE-Advanced are detailed. In addition, the operation of the X2 interface is also explored, as well as LTE Advanced Relays and Self Organizing Networks.

This course has no prerequisites.

3

days
(LiveOnsite, LiveOnline)

18

CPD Learning Credits



Level: 3
(Advanced)

This course will contain the following sections:

1. E-UTRA Introduction

Topic areas covered include:

- E-UTRA Features:
 - Radio Access.
 - Duplexing Techniques:
 - FDD, TDD.
 - Modulation and Coding.
 - Transmission Bandwidth.
 - LTE FFT Sizes.
 - Subcarriers and Reference Signals.
- Orthogonal Frequency Division Multiplexing:
 - OFDM Symbol Mapping.
 - Transmitted Signal.
 - Combating Interference in the Time Domain.
 - Cyclic Prefix.
- OFDMA:
 - OFDM.
- LTE Uplink - Single Carrier - Frequency Division Multiple Access.
 - The SC-FDMA Process.
- The E-UTRAN Protocols:
 - NAS, RRC, PDCP, RLC, MAC, S1AP and X2AP.
- Evolved Node B.
 - Home Evolved Node B.
- UE Capabilities.

2. E-UTRA Physical Layer

Topic areas covered include:

- LTE Generic Frame Structure:
 - Type 1 Radio Frames, Slots and Subframes.
 - Type 2 Radio Frames, Slots and Subframes.
- Resource Grid and Resource Blocks:
 - Downlink PRB Parameters.
 - Uplink PRB Parameters.
- Downlink Channel for Initial Access:
 - Downlink Synchronization Signals (FDD).
- Downlink Reference Signals:
 - Cell Specific Reference Signals.
 - UE Specific Reference Signals.
- The LTE Downlink Physical Channels:
 - Broadcast Information.
 - PCFICH:
 - CFI.
 - PDCCH:
 - REG, CCE.
 - PHICH.
 - PDSCH.
 - PDSCH Resource Allocation.
- The LTE Uplink Physical Channels:
 - Multiplexing of Control Signalling and UL-SCH Data.
 - Uplink Data Transmission.
 - PUCCH (Physical Uplink Control Channel).
- Uplink Reference Signals:
 - Demodulation Reference Signal.
 - Sounding Reference Signal.
 - PRACH.

3

days
(LiveOnsite, LiveOnline)

18

**CPD Learning
Credits**



**LiveOnsite,
LiveOnline**

E-UTRA Physical Layer (cont.)

- Channel Coding.
- FDD/TDD Timing:
 - FDD Operation.
 - TDD Operation.
 - Timing Advance.
- HARQ Operation.
- RNTI Identities.
- Transmission Modes and MIMO:
 - MIMO and Transmission Options:
 - SU-MIMO, MU-MIMO.
 - Transmit Diversity.
 - MIMO.
 - Active Antenna Systems.
 - CoMP (Coordinated Multi Point).
 - CoMP Categories.
- Carrier Aggregation.

3. LTE RRC

Topic areas covered include:

- Radio Resource Control:
 - RRC Messages.
 - RRC States.
- System Information:
 - Acquisition of SI Messages.
 - RRC Connection.
- E-UTRA Radio Bearers:
 - Signalling Radio Bearers.
 - Dedicated Radio Bearers.
- UE Capabilities.

4. NAS in LTE

Topic areas covered include:

- NAS Control and User Plane:
 - Stratums.
 - NAS Messages.
- EMM and ECM States:
 - EPS Mobility Management States.
 - EPS Connection Management States.

5. PDCP in LTE

Topic areas covered include:

- Packet Data Convergence Protocol:
 - PDCP Services.
- PDCP Profiles:
 - Compression Standards:
 - ROHC.
- PDCP Headers:
 - Control Plane PDCP Data PDU for SRBs.
 - User Plane PDCP Data PDU - 12bit SN.
 - User Plane PDCP Data PDU - 7bit SN.
 - PDCP Control PDU - Feedback.
 - PDCP Control PDU - Status Report.
 - RN User Plane PDCP Data PDU - Integrity Protection.
- PDCP Status Exchange.

6. RLC in LTE

Topic areas covered include:

- Radio Link Control:
 - Transparent Mode.
 - Unacknowledged Mode.
 - Acknowledged Mode.
 - RLC PDUs.

7. MAC in LTE

Topic areas covered include:

- Medium Access Control:
 - Services expected from physical layer.
 - LTE Logical and Transport Channels.
 - RNTI Identities.
 - MAC Headers.
 - Random Access Process.
- Buffer Status Reporting:
 - BSR Types.
- Power Headroom Reporting:
 - PHR Types.

8. Operational Procedures

Topic areas covered include:

- Initial Procedures:
 - Cell Search.
 - Cell Selection.
 - PLMN Selection.
 - Cell Selection.
 - Random Access.
 - Initial Attach.
- LTE Capabilities.
- Discontinuous Reception (Paging).
- DRX in Active Mode:
 - Air Interface Scheduling (VoLTE).
 - Improving Coverage with TTI Bundling.
 - Voice Scheduling and SPS.
- Security:
 - EPS Authentication and Key Agreement.
 - Key Distribution in the EPS.
 - Security Procedures.
 - Algorithms.
 - IPSec - Encapsulating Security Payload.
- Power Control:
 - Downlink Power Control.
 - Uplink Power Control.
- E-UTRA Measurements:
 - Measurement Configuration Options.
 - Basics of Measurement Objects..
 - Basics of Report Configuration.
 - LTE Events.
 - RRC Measurement Configuration Example.
 - Gap Configuration.
 - Timing.
- ISR (Idle mode Signalling Reduction):
 - TIN Values.
 - ISR Activation.
- Feedback Mechanisms:
 - Feedback Types.

9. Air Interface Mobility

Topic areas covered include:

- Air Interface Mobility:
 - LTE Cell Planning.

Air Interface Mobility (cont.)

- LTE Measurements:
 - RSRP (Reference Signal Received Power).
 - RSSI (Received Signal Strength Indicator).
 - RSRQ (Reference Signal Received Quality).
- Mobility Functional Architecture:
 - eNB.
 - MME.
 - Tracking Area.
- LTE Idle Mode Mobility:
 - LTE Cell Reselection.
 - Priority Based Inter-RAT Cell Reselection.
 - E-UTRA System Information Messages.
 - Reselection to a Higher Priority Frequency or RAT cell.
 - Reselection to a Lower Priority Frequency or RAT cell.
 - Deleting E-UTRA Priorities.
- Mobility in the LTE Active State.
- Handover Process:
 - X2 Handover Request and Response.
 - RRC Connection Reconfiguration.
 - Random Access.
 - SN Status Transfer and Status Report.
- Data Forwarding:
 - RLC-AM DRBs.
 - RLC-UM DRBs.
 - SRB Handling.
- S1 Based Handover (Relocation).

10. X2 Interface Operation

Topic areas covered include:

- The X2 Interface.
- X2 Basic Mobility Procedures:
 - X2 Handover Request.
 - X2 Handover Request Acknowledge.
 - X2 Handover Preparation Failure.
 - X2 SN Status Transfer.
 - X2 UE Context Release.
 - X2 Handover Cancel.
 - X2 Load Indication.
 - X2 Resource Status Reporting.

