



## 4G - Long Term Evolution (LTE) Air Interface

Long Term Evolution (LTE) is the new 3GPP standard for wireless broad band data services. It comprises E-UTRA network, which uses OFDMA technology and EPC (Evolved Packet Core), an all-IP core network. This framework allows the migration of 3GPP system towards packet-optimized system that supports multiple RATs (Radio Access Technologies), higher-data-rates and lower-latencies. Also it provides an evolutionary path for 3GPP and non-3GPP legacy technologies.

This course provides an in-depth discussion of LTE air interface. It begins with an overview of LTE/E-UTRAN network architecture and protocols and introduces OFDMA, the key technology of LTE, and then discusses the DL and UL channels, signals and operations. This is followed by a comprehensive discussion of MAC, RLC and PHY layers of the LTE air interface.

### Expected Accomplishments

- Describe network architecture evolution
- OFDM Basics
- Explain OFDM Concepts
- Understand in details the physical layer and operations in mobility and idle mode
- Describe MIMO in LTE
- Understand MAC and RLC in details
- Study LTE Packet Data Convergence Protocol (PDCP) Layer
- Explain the details of RRC layer and operations

### Course Outline

- Evolved Packet System Network Architecture & Protocols
  - Describe network architecture evolution
  - Explain Evolved Packet System (EPS) network entities and interfaces
  - Describe EPS user and control plane protocol stacks
  - Identify basic EPS Security aspects
  - Explain mobility management, session management, and IP connectivity aspects
  - Explain EPS QoS architecture and principles
- OFDM basics
  - Explain OFDM basic concepts
  - OFDMA, multipath and cyclic prefix
  - Understand OFDM and SC-FDMA
- E-UTRA Essentials
  - Identify the main E-UTRA Air Interface capabilities
  - Air Interface peak data rates and UE categories
  - Understand E-UTRA Downlink and Uplink time and frequency organization
  - Define the components of the E-UTRA UL/DL resource grid
  - DL/UL scheduling and interference management
- E-UTRA Downlink (DL) Channels, signals & operation
  - Discuss E-UTRA DL physical channels and signals
  - Discuss the initial acquisition procedure
  - Describe DL shared channel operation
  - Describe the role of DL control channels in DL operation
  - Understand how channel feedback information is reported by the UE in the UL
  - Describe DL HARQ operation
  - Describe DL data transfer modes
  - MIMO in LTE
- E-UTRA Uplink (UL) Channels, signals and operation
  - Describe E-UTRA UL channels and channel mapping onto time/frequency resources
  - Describe E-UTRA UL operations
  - Comparison between LTE and HSPA operations





- LTE Physical Layer
  - Describe frame, subframe, and slot structure in Downlink and Uplink
  - Describe resource block and resource elements
  - Describe physical layer processing for Downlink and Uplink channels
  - Describe reference signals used in Downlink and Uplink
- LTE Medium Access Control (MAC) Layer
  - Describe key MAC functions
  - Explain channel mapping and multiplexing
  - Describe MAC PDU formats for different transport channels
  - Describe RACH procedure
  - Explain timing alignment and (DRX) procedures
- LTE Radio Link Control (RLC) Layer
  - List the functions of RLC
  - Describe the different RLC modes in LTE
  - Compare RLC implementations in LTE and HSPA
  - Describe the re-segmentation process for retransmissions
- LTE PDCP Layer
  - Provide an overview of PDCP
  - Describe PDCP data and control PDU formats
  - Describe PDCP functions
  - LTE and HSPA comparison
- LTE RRC Layer
  - Provide an overview of RRC in LTE
  - Describe idle mode procedure
  - Show what RRC signaling is used in Connected mode
  - Describe Radio Link Failure (RLF) Handling in UE

### Who Can Benefit

Personnel involved in mobile operation, maintenance and planning.

### Related Training

- 4G – Long Term Evolution (LTE) Fundamentals
- 4G – Long Term Evolution (LTE) Technical Overview
- 4G – Long Term Evolution (LTE) Network Planning

### Duration

4 days

### Mode

Consultant led classes

### Prerequisites

- 4G – Long Term Evolution (LTE) Technical Overview

**Course Code: TRC-807**

