

Course ID

**LTE-ADV**

Course Duration

**4 days**

Course Title

**3G LTE Advanced System Techniques**

**Related Courses**

- 3G LTE: Technology, Business, and Competitive Landscape (LTE-BIZ, 2 days)
- 3G LTE Air Interface Techniques (LTEAI, 3 days)
- 3G LTE Signaling and Functionality (LTESIG, 3 days)
- 3G LTE Planning Considerations (LTEPLAN, 4 days)
- HSDPA: Network Architecture, Operation, and Design (HSDPA, 2 days)
- HSUPA: Network Architecture, Operation, and Design (HSUPA, 2 days)

**Aimed At**

This course is aimed at technical audiences who have prior understanding of WCDMA and some exposure to 3G LTE who wish to expand their knowledge on the LTE technology based on 3GPP standards.

**Group Size**

5-25

**Prerequisites**

- 3G LTE/SAE: A Technology Overview (LTE-TECH, 3 days)
- UMTS-FDD: Network Architecture, Operation, and Design (UMTS-FDD, 3 days)

The 3G LTE overview course is strongly recommended, though not required.

**Course in a Nutshell**

This course is part of a series of our courses on 3G LTE, the term used for the ongoing evolution of the 3G UMTS networks to the 4G wireless system.

In this course, you will engage in an in-depth study of the evolved UMTS Radio Access Network (E-UTRAN), 3GPP Release 8. To help you understand the key new technology ideas that underlie the 3G LTE radio interface, we will give particular attention to the principles of OFDM (Orthogonal Frequency Division Multiplexing) and MIMO (Multiple Input Multiple Output) systems. The new access network architecture, with its different interfaces and protocol suites, is also covered along with an overview of the network entities and interfaces defined for the Evolved Packet Core (EPC) network (3GPP work item System Architecture Evolution or SAE).

**Customize It!**

- If you'd like to take this course but don't have the requisite understanding of WCDMA/LTE, we can extend the course to five days to include an up-front overview of WCDMA/LTE.
- If you are a manager, executive, or sales person involved with GSM/UMTS mobile networks or mobile handsets and you want to keep up with the evolution of 3G wireless to 4G, we can emphasize parts of the course that deal with the markets and applications pertinent to your project or product.

- If you are a Multimedia Engineer who would like to learn the LTE-SAE issues related to the transport of your services to the users, we can focus on the transmission principles and the supported data rates.
- Add a workshop day at the end of the course, for a total of five days for a deep dive into the MBMS system for multimedia services.

## Course Outline

- LTE/SAE Introduction
  - A brief look at the evolution of cellular systems
  - 3GPP Releases (Release 99 to Release 8)
  - EPS (E-UTRAN and EPC) logical architecture
  - EPS interfaces
  - EPC (Evolved Packet Core) architecture
  - SAE/LTE interfaces
- Radio Interface Principles
  - Channel models
  - BPSK, QPSK, 16QAM, 64QAM
  - Principles of OFDM
  - Overview of the MIMO system
  - Radio interface techniques: Uplink/downlink
  - Channel structure
  - Exercises
- Radio Interface Layers
  - Radio procedures
  - Radio Resource Control (RRC)
  - Packet Data Convergence Protocol (PDCP)
  - Radio Link Control (RLC)
  - Medium Access Control (MAC)
  - Packet data flow and multiplexing
  - Channel structure: Logical channels, transport channels, physical channels
  - 3GPP standards references
- LTE Idle Mode Functionality
  - Idle mode
  - RRC states on idle mode
  - PLMN selection
  - Cell selection process: Criteria, normal camping
  - Cell reselection evaluation process
  - System information
  - Paging: DRX for paging
  - SUBframe patterns
  - Network compatibility (2G measurements, RSSI, 3G measurements, WIMAX compatibility)

- Physical Layer Procedures
  - Radio link monitoring
  - Intercell synchronization
  - Downlink transmission
  - L1 and L2 control signaling
  - Physical layer
  - Power control: Timing adjustments
  - Link adaptation
  - Uplink transmission
  - Physical resources
  - Random access
  - Preamble selection
  - Channel Quality Indication (CQI)
  - Precoding Matrix Indicator (PMI)
  - Rank Indicator (RI)
- Radio Resource Management ( RRM)
  - Inter-frequency cell reselection
  - Intra-frequency cell reselection
  - Inter-RAT cell reselection
  - Paging: DRX for paging
  - SUBframe patterns
  - Network compatibility (2G measurements, RSSI, 3G measurements, WIMAX compatibility)
- LTE Cell Planning Principles
  - Frequency planning
    - Channel allocation
    - Basic schemes
    - Fractional loading
    - Multiple reuse patterns
    - Reuse partitioning
  - Capacity considerations
    - Theoretical overview
    - Capacity loss from interference
    - Resource allocation principles
    - Frequency-planned systems
    - Reuse-1 with prioritization
    - Soft frequency reuse
    - Reuse partitioning
    - Frequency planning and capacity parameters
    - Spectrum Utilization Factor (SUF)
    - Examples
- Course Wrap-up: Recap and Discussion

**How You  
Will Learn**

- A highly experienced wireless engineer/instructor, well-versed in a number of technologies, will present this course in interactive lecture format.
- Along with the lecture, we employ discussion, group activities, case studies, and exercises to clarify the content and make important points.
- If you already know something about the technology, we will build on that knowledge base. We'll compare and contrast what's already known to you with what's new, making the new material easier to learn.
- If your background is less technical, we will use appropriate examples and analogies to convey the complex material in a manner that makes sense.
- You will receive a printed Participant Handbook which will help you remember and retain what you learned in class and use it on the job.

*Revised*

*June 8, 2009f*