

## **LTE-Advanced Rel 11 specific Enhancements**

### **Course Duration:**

- 2 days

### **Course Description:**

- This course addresses the needs of technical engineering staff who work on the design, test, integration and validation of LTE-Advanced equipment esp. UE-side.
- The course has been designed to meet specifically the requirements of UE-testers for chipset verification, integration and testing.

### **Prerequisites:**

- The student should possess detailed knowledge about LTE in Rel 8, 9 and 10, in particular about the physical layer.
- We recommend to book our course LTE from A-Z beforehand.

### **Course Target:**

- The student is enabled to design, integrate, test and validate LTE-Advanced equipment with focus on 3GPP Release 11

## Table of Content:

### Chapter 1: From LTE to LTE-Advanced Rel 10 (1 - 2 hours)

- **LTE History**  
Evolution Path of LTE / LTE Release 8/9 Performance / 4G Requirements / LTE, WiFi and WiMAX Evolution / LTE Advanced Features / Release 10 UE Categories
- **LTE in Release 8 and 9**  
LTE Architecture / LTE and EPC Protocols / Service Concept of LTE Networks
- **LTE PHY**  
FDD and TDD modes / Channels in LTE / Basic HARQ Operation / Random Access Procedures
- **Migration to LTE-Advanced: Features, Motivation and their Use Cases**  
Carrier Aggregation, enhanced MIMO, Relay Nodes, CoMP, HetNets, SON/MDT, H(e)NB, eMBMS

### Chapter 2: CA related changes with Rel 11 (2 - 3 hours)

- **The Concept of Carrier Aggregation with Rel 10**  
Primary and Secondary Serving Cell / Asymmetric Allocations / Frequency Bands and Use Cases / Signaling UE-Radio Access Capabilities / Cross-Carrier Scheduling
- **New UE categories 9 and 10 with Rel 11**
- **New CA-Combinations with Rel 11**
- **Improvements for non-contiguous intra-band CA with Rel 11**
- **Multiple Timing Advance for UL CA with Rel 11**
- **Special subframe configuration for LTE-TDD**

### Chapter 3: fICIC and ICIC related Improvements with Rel 11 (2 hours)

- **The new EPDCCH**  
Motivation, detailed permutation and configuration rules, EREG and ECCE, setup, coding and modulation, assignment
- **ABS and reduced power ABS**  
Operation / Anchor and Booster Carriers / Lean Carriers
- **Receiver based interference cancellation**
- **Transmitter based muting**

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## Chapter 4: Other Enhancements with Rel 11 (2 - 3 hours)

- **CoMP (Coordinated Multipoint Transmission / Case Study only)**  
Operation / CoMP in Uplink / CoMP in Downlink / implications for the network / implications for the UE / new TM 10
- **MDT (Minimization of Drive Tests)**
- **MTC (Machine Type Communication)**
- **VoLTE**  
architecture, protocol stack, general operation, new with Rel 11: vSRVCC and rSRVCC

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## Chapter 5: Outlook to Rel 12 (1 – 2 hours)

- **CSI related improvements**
- **Proximity Services (ProSe) also called D2D (Device to Device) communication**
- **UE receiver enhancements for interference cancellation**
- **EIMTA (Enhanced International Mobile Telecommunications Advanced)**  
Combine TDD-frequencies for duplex operation / aggregation of FDD and TDD
- **3D-MIMO**
- **Small Cells, WiFi-Interworking and HetNets**