

eUTRAN Protocols Tracing and Optimization

SYNOPSIS

- **Hands-on Seminar:** LTE air interface technology, physical layer, radio channel structure, physical layer procedures and radio parameters tuning.
- Focus on tracing LTE-FDD radio technology, access protocols, radio access network configuration and parameters optimization.
- Recognize **radio parameters** that influence service performance and QoS.
- Discuss EUTRAN Radio Resource Management.

DURATION

- 5 Days

PREREQUISITES

- Familiarity with LTE and/or UMTS terminology.

TARGET AUDIENCE

- Test planers and Testing Engineers, Field Engineers and troubleshooters.
- Radio Optimization engineers, Network planer, technical staff being responsible for O&M, Drive Test Engineers.
- System architects, software engineers.

COURSE TARGETS

- The participants would be able to develop, deploy, test, optimize and troubleshoot eUTRAN equipment and LTE protocol software.
- They would gain insight to LTE radio channels, bearers, measurements, resource allocation scenarios and handover scenarios.
- The participants would gain insight to eUTRAN architecture and protocols, understand the message flows and recognize important parameters.
- They would experience analyzing S1AP, X2AP, and GTPv1-U/GTPv2-C traces as well as mobile radio protocol logs, including systematic trace investigation, mapping between trace and standard specification, correlating between different interface views and issuing fault/performance investigation.

LTE Radio Optimization

1. LTE-EPC Architecture and Protocols

- | | |
|---|-----------------------------|
| a. LTE Release Evolution | Core and Radio Capabilities |
| b. LTE Architecture and Protocol principles | Mobile Identities |
| c. Releases and Mobile Capabilities, | USIM Enhancements, Roaming |
| d. Basic Service Scenarios | (Registration, Packet Data) |

2. LTE Radio Technology and Radio Channels

- | | |
|---|---|
| a. Radio Propagation and Principles | Modulation, Multiple-Access |
| b. LTE Technology Enablers | OFDMA/SC-FDMA, MIMO, MC |
| c. LTE Radio Technology
(modulation, channel estimation, channel coding, time/frequency mapping) | |
| d. LTE Radio Channels organization | physical, transport, logical |
| e. LTE Physical Layer Procedures | Cell Search/Synchronization, TA,
UL/DL Power Control, RL Failure |
| f. PRACH Operation | |
| g. Measurements for Resource Allocation | (UE+eNB) |
| h. Location Techniques and Measurements | (UE+eNB) |
| i. LTE Cell Configuration | (small cells, eICIC) |
| j. LTE Cell Coverage and Link Budget | (Voice/Data, Coverage/Capacity) |
| k. Drive Testing and MDT | |
| l. LTE-Advanced features Overview | |

3. eUTRAN Transport and Scheduling

- | | |
|---|--|
| a. eUTRAN Architecture | RAN Sharing, S1, X2, S1-Flex,
GTP-U Tunnels |
| b. Shared Channel Scheduling | PD-CCH, DRX, SPS |
| c. MAC Protocol + Hands-On | |
| d. RLC Protocol + Hands-On | |
| e. PDCP Protocol | |
| f. eUTRAN Bearer Transport | GTPv1-U |
| g. Traffic Quality Monitoring Hands-On | |

eUTRAN Control Protocols Optimization

4. Radio Resource Management Scenarios

- a. **RRC Protocol**
- b. RRC State Model (Multi-RAT) State Transition Scenarios
- c. Idle Selection/Reselection Parameters Intra/Inter Frequency/RAT
- d. SIB Structure and Parameters **+ Hands-On**
- e. RRC Message structure
- f. Measurements for Mobility Events and Parameters
- g. RRC Connection Scenarios Bearer Setup, Mobility
- h. Radio Bearer Configuration
- i. **RRC Procedures Hands-On**
- j. Radio Protocol Parameters Optimization
- k. Optional: eMBMS Technology and Parameters
- l. Optional: Wi-Fi Offloading and ANDSF
- m. Optional: Femtocell-Infrastructure and Femto Specific Scenarios

5. eUTRAN Protocols and Parameters Optimization

- a. IP fundamentals for eUTRAN IPv4/IPv6, Sigtran, DiffServ,
- b. eUTRAN Bearer Model
- c. **Sigtran Hands-On**
- d. **S1AP Protocol**
- e. eUTRAN Bearer and Mobility Procedures Intra/Inter Frequency/RAT
- f. **S1AP Bearer Allocation & Mobility Hands-On**
- g. **X2AP Protocol** X2 Handover
- h. Cell Configuration Parameters eNB O&M
- i. SON scenarios and protocols ANR, RLF

LTE NAS Protocols and End-to-end Scenarios

6. ePS-Core Registration Scenarios

- a. EPC Architecture and Protocols
- b. PS-Core and EPC migration
- c. NAS Messages Structure
- d. **NAS eMM Protocol**
- e. S6a/Diameter Basic Procedures
- f. Registration and Roaming Scenarios
- g. LTE Security contexts and continuity upon Handover
- h. **Registration Scenario Hands-On**

7. ePS-Core Bearer Allocation

- a. PDN Connectivity and ePS Bearers
- b. **NAS eSM Protocol**
- c. GTPv2-C Protocol and Basic Procedures
- d. Bearer Allocation and Service Scenarios
- e. **Bearer Setup and Mobility Hands-On**
- f. Inter-3GPP Bearer Mobility Scenarios and Parameters

8. Service Scenarios over LTE

- a. CSFB Parameters and Service Scenarios
- b. LTE Messaging alternatives and RCS
- c. IMS Services over LTE-EPC bearer
- d. IMS VoIP Service Scenarios (MMTel, SRVCC)