

**Course Outline for the Training Course on
LTE Fundamentals and Interworking
Duration: 3 Days**

Title: LTE Fundamentals and Interworking

Duration: 3 days

Course Code: NSE-WLS-604

Course Description:

This Course is designed to give an introduction to the Long Term Evolution – LTE system and its relative Interworking with other technologies. This course helps participants understand the line of evolution of mobile systems due to the data explosion and the role of LTE to provide for the data explosion foreseen in the market. This course continues to explain LTE by describing the network architecture and technologies that were introduced with LTE to meet the performance parameters suitable for delay-sensitive real-time applications and services. After describing the characteristics of the LTE system, this course shall help participants understand the procedures of interworking between LTE and prior 2G/3G systems to ensure backward compatibility. The building blocks that support interworking are discussed in detail.

Course Objective and key benefits:

- ✓ Describe the features and Benefits of LTE
- ✓ Identify LTE Network Components and Describe respective functions
- ✓ Understand LTE Air Interface Methods
- ✓ Understand and sketch the LTE Architecture with respective interfaces
- ✓ Understand the LTE-2G/3G Interworking requirements

Pre Requisite

- ✓ Knowledge of 2G/3G
- ✓ Basic Understanding of LTE

Who Should Attend?

Engineers / Technicians /Network Designers & Planners / Design & Deployment Engineers/ Network Integration & operations Engineers

Course Outline:

I. 4G Technology: Drivers and Comparison

A. LTE Drivers

1. Access to data via Mobile
2. 3GPP 4G Requirements
3. All-IP based network background and evolution

B. LTE Goals and Comparisons

1. LTE Performance Objectives
2. LTE Deployment Requirements
3. Architecture Migration and backward compatibility Requirements
4. LTE comparison with HSPA+ and WiMAX
 - i. Speed, Latency, Scalability

C. Evolution of UMTS

1. UMTS Network Architecture
2. HSPA and room for enhancement (Antennas, Modulation, Channels)
3. UMTS Problems and Limitations

D. LTE Basics Overview

1. LTE Air Interface basics
2. LTE Evolved System Architecture
3. LTE Nodes and Respective Functions
4. LTE Channels – Physical, Logical and Transport
5. Understanding LTE Interfaces

II. LTE Explained

A. EPS Network Components and Interfaces

1. Evolved Packet Core (EPC)
2. Evolved base station – e-NodeB
3. LTE Air Interface E-UTRAN
4. Radio Network Interfaces

- 5. Evolved Core Interfaces
- 6. Control plane, User plane Interfaces
- B. LTE Air Interface and RAN
 - 1. Physical Layer Downlink – OFDMA Technology
 - i. Modulation Changes
 - ii. Turbo Coding Refresher
 - 2. Physical Layer Uplink – SC-FDMA
 - 3. Flexible Spectrum allocation
 - 4. MIMO Concepts
- C. Protocol Stacks
 - 1. Non- Access Stratum – NAS
 - 2. Radio Resource Control (RRC)
 - 3. E-UTRAN Entities
 - 4. Packet Data Convergence Protocol –PDCP
 - 5. Radio Link Control Sublayer
 - 5. Medium Access Control –MAC Sublayer Technology
 - i. Error Control – ARQ, HARQ
 - ii. Mobility Management
 - iii. Rate control and Scheduling
- D. LTE Evolved Core Network
 - 1. Handover
 - 2. Mobility to Non-3GPP Networks
- III. LTE System Interworking
 - A. LTE Interworking architecture
 - 1. UMTS Releases GERAN Architecture
 - 2. Pre-Rel. 8 and Rel. 8 Interworking Architecture
 - 3. Non-Roaming and Roaming Architecture
 - 4. Interfaces: GERAN and EPC Networks
 - 5. Network Entities
 - 6. GPRS Tunneling Protocol and Versions
 - B. LTE Connections: Initial Session Setup

1. LTE Attach procedure in Evolved Packet System (EPS)
2. UMTS PDP Context Activation
3. QoS for UMTS
4. QoS for LTE EPS
- C. Connected Mode Interworking
 1. IRAT Handover
 2. LTE and UMTS measurements
 3. LTE Inter-Mobility
 - i. LTE-UTRAN handover and UTRAN à LTE handover with S4-SGSN
 - ii. LTE-UTRAN handover and UTRAN à LTE handover with Gn-SGSN
 4. LTE-GERAN interworking
- D. IDLE Mode Interworking
 1. cell reselection
 2. measurements
 3. System Information Blocks
 4. PLMN selection
- E. Circuit-Switched Interworking
 1. IMS overview
 2. Voice in LTE using IMS
 3. CS fallback
 4. Single Radio Voice Call Continuity SRVCC
 5. IMS service centralization and continuity
- F. Interworking Security
 1. Security Features and Mechanisms