DURATION

2 Days

COURSE DESCRIPTION

This course will cover the major aspects of the LTE air interface in a manner that both technical and non-technical people will be able to fully appreciate. The course begins with a review of the LTE system architecture in order to fully establish the context of the radio interface operation and protocols. This initial section will also cover issues related to spectrum and deployment of LTE systems as well as comparing the 3 three main “evolutionary” radio technologies, LTE, WiMAX and UMB.

The central theme to LTE is the OFDMA and SC-FDMA radio multiplexing and modulation technique, the operation of this technology is explained and the choice of technologies used for LTE physical layer are justified. Layer 2 of the LTE protocol stack contains three sub-layers, MAC, RLC and PDCP as well as the control protocol RRC, and the main elements of each of these protocols is explained, showing how each relates to issues of mobility and mobility management with example of typical procedures given. Architectural and operational aspects of the Multicast Broadcast Multimedia Service are also covered.

PRE-REQUISITES

A working knowledge of 2G and 3G mobile network technologies would be beneficial but not essential.

COURSE OBJECTIVES:

At the end of the course, the delegate will be able to:

- Show how the new LTE architecture inter-works with existing UMTS systems
- Explain the function of the LTE Uu, X2 and S1 interfaces
- Explain the basic functions of the eUTRAN component, eNB
- Compare the 3 main technologies proposed for evolving current radio systems
- Draw and explain functions of the major layers of the LTE Protocol Stack
- Explain the operation of OFDMA and justify the use of the technology
- Show how SC-FDMA reduces some of the problems associated with OFDMA
- Show how the time and frequency domains are able to support a Resource Block
- List some of the principle functions of the MAC, RLC and PDCP protocols
- Describe the operation of the RLC layer for real time and non-real time services
- Explain the operation of LTE mobility in the 3 different mobility states
- Describe the operation of the eMBMS and how TV might be transmitted using the service
CONTENT

LTE Architectural Review
- LTE Development
- The E-UTRAN
  - eNB
  - LTE Uu and X2
- Evolved Packet Core (EPS)
  - Serving Gateway (SGW)
  - Mobility Management Entity (MME)
  - Packet Data Network Gateway (PDN GW)
- UMTS – LTE Inter-working
- Spectrum Requirements of LTE
- Comparing LTE, WiMAX, UMB
- LTE Status

LTE Protocol Stack Overview
- (OSI Reference Model)
- Control Plane Protocols
  - Radio Interface and NAS
- User Plane Protocol Stack

LTE Physical Layer
- Introduction to OFDM
  - Defeating Multipath ISI
  - Overcoming high PAR
  - Expected Performance
- Downlink OFDMA
- Uplink Single Carrier-FDMA
- LTE Channels
  - Logical
  - Transport
  - Mapping of Channels
- LTE Frame Timing
- UL/DL Resource Blocks, Symbols and Sub-Carriers
- Adaptive Modulation and Coding (AMC)
- MIMO and Beam-Forming Antenna Support in LTE
- Physical Layer Procedures
  - Cell Search
  - Time and Frequency Synchronisation
  - CQI/PMI/RI Measurements and Reporting

LTE MAC, RLC and RRC
- MAC/RLC Overview
- MAC Functions
  - QoS and Scheduling
- MAC Messages and PDU Structures
- RLC Modes
  - Ack Operation
  - Un-Ack Operation
- Resource Allocation and Control
  - ARQ and H-ARQ
  - SDU Sequencing

LTE PDCP
- Packet Data Protocol Functions
- PDCP Operation
  - Header Compression (ROHC)
  - PDCP Ciphering
- PDCP Messages

LTE Resource and Mobility Procedures
- LTE Mobility Modes
  - LTE Detached
  - LTE Idle
  - LTE Active
- Mobility in LTE Idle
  - Tracking Areas (TA)
  - Mobility in Multi RAT
- Connected Mode Mobility
  - Architecture for Mobility
  - Backwards Handover
  - RLC Context Transfer
- Connection Management
  - Resource Negotiation
  - Resource Allocation
- X2 and S1 interfaces

LTE Evolved Multicast Broadcast Multimedia Service (eMBMS)
- Architecture of eMBMS
  - eMBMS Gateway
  - MBMS Coordination Entity
- MBMS Protocol Structure
- Single Cell Broadcast
- Single Frequency Network (MBSFN)
- Delivering Mobile TV with MBMS