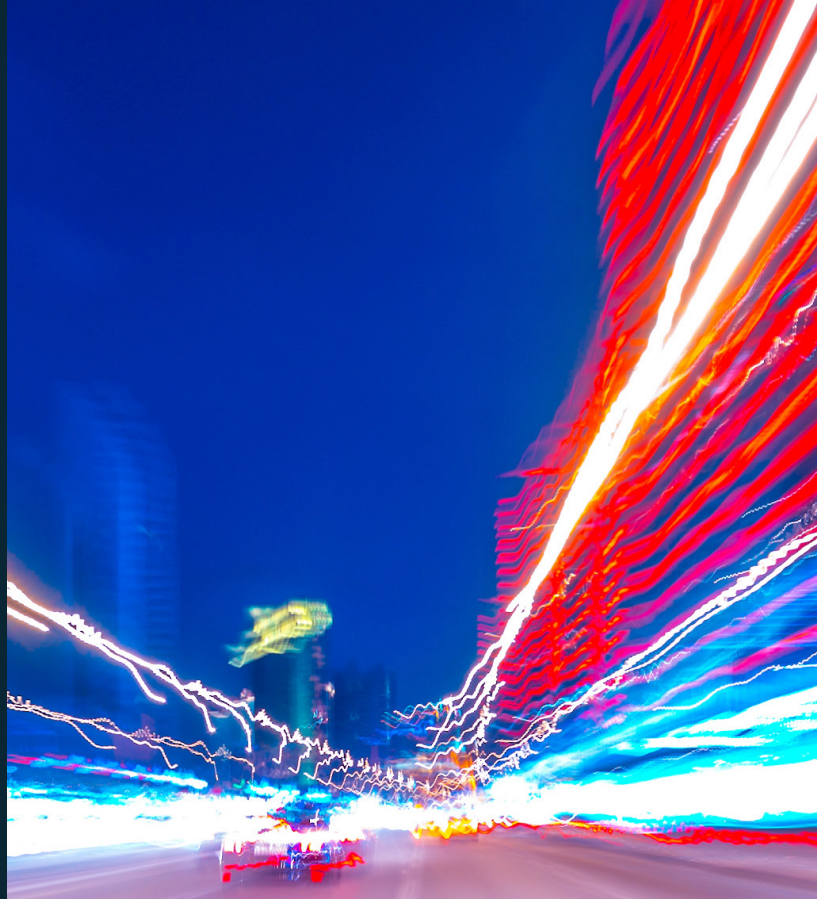# MPIRICAL

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▶ Watch our course intro video.

LTE Radio Planning

Course Description

As many service providers continue to enhance their 4G coverage, this course provides a fundamental understanding of the factors which must be considered as part of the planning process. Topic areas include the overall network design process, factoring in the QoS demands associated with different services. The basics of LTE radio propagation are also outlined, including considerations for LTE antenna design. Coverage and capacity planning are tracked in detail, before concluding with a synopsis of small cells and finally optimization.

Prerequisites: LTE Air Interface

2	12	Level: 3
Days (LiveOnsite, LiveOnline)	**CPD Learning Credits**	**(Advanced)**

This course will contain the following sections:

1. LTE Radio Network Design

Topic areas covered include:

- The LTE Radio Network.

- Planning Process:
    - Initial Planning.
    - Detailed Planning.
    - Optimization.

2. LTE Traffic Requirements

Topic areas covered include:

- LTE Traffic Types:
    - Default Bearer.
    - Dedicated Bearers.

- QoS in LTE Networks:
    - QoS Management.

- LTE Bearers:
    - EPS Bearer Service.
    - Bearer Manager.
    - QoS Attributes.

- Traffic Flow Templates:
    - Bearer Identities and Templates.

- Protocols used in Support of Various Traffic Types:
    - Real Time Services.
    - RTP Overhead.
    - Web Browsing.
    - File Transfer.

- Issues Surrounding Voice over LTE:
    - PDCP ROHC.

LTE Traffic Requirements (cont.)

- Packet Classification:
    - Packet Classification (DiffServ) - IPV4.
    - Packet Classification (DiffServ) - IPv6.
    - L2 Packet Classification.

- LTE Deployment Issues:
    - TDD and FDD Deployments.
    - Interworking between GSM/UMTS and LTE Services.

3. LTE Radio Propagation

Topic areas covered include:

- Radio Propagation.

- Decibels:
    - dBs used as a Reference.
    - Radio Channel.
    - Path Loss.
    - Fading and Shadowing.
    - Multipath/Delay Spread.
    - Doppler Shift.

- Propagation Models:
    - Okumura-Hata Model.
    - COST 231 Extension to Hata Model.
    - CrossWave Propagation Model.
    - Topographical Data.

- Model Tuning Process:
    - CW Measurements.

- Interference in OFDMA and SC-FDMA Systems.

2
Days
(LiveOnsite, LiveOnline)

12
CPD Learning Credits

LiveOnsite, LiveOnline

LTE Radio Propagation (cont.)

- UE and eNB Transmitter and Receiver Requirements:
    - Frequency Bands.
    - UE Requirements.
    - UE Receiver Sensitivity.
    - eNB Requirements.
    - Output Power.

- Impact of Modulation and Coding on the Performance:
    - Example Simulations.

- LTE Frequency Re-use Options:
    - Benefits of Soft Frequency Reuse.

4. Antenna Considerations

Topic areas covered include:

- Antenna Selection:
    - Antenna Configuration.
    - Antenna Characteristics.
    - Cable Losses.
    - Tower Mounted Amplifier / Low Noise Amplifier.
    - Combining Systems.

- Sectorization:
    - Antenna Beam Width.
    - Sectoring and Beam Width Simulation.

- Antenna Implementation:
    - Antenna Height.
    - Antenna Down Tilt.

- LTE Diversity Options, MIMO and Beamforming:
    - LTE Transmission Modes.
    - Transmit Diversity.
    - MIMO.
    - Beamforming.

- Indoor Antenna Solutions:
    - Indoor Coverage using Repeaters.

5. LTE Capacity Planning

Topic areas covered include:

- LTE Data Rates:
    - Bandwidth Options.
    - Downlink LTE Peak Rates.
    - Uplink LTE Peak Rates.
    - Impact of Cyclic Prefix Size.
    - Downlink Overheads.

LTE Capacity Planning (cont.)

- - Control Region.
    - Uplink Overhead.
    - Total Physical Overhead.

- Capacity Sites:
    - Capacity Dimensioning.

- Factors Affecting Cell Capacity:
    - Impact of Cell Load on Cell Capacity.

- Capacity Planning with MIMO Systems:
    - Total Capacity.

6. LTE Coverage Planning

Topic areas covered include:

- Coverage Dimensioning:
    - LTE Link Budget.
    - Typical LTE Link Budget and Cell Range Assumptions.

- Cell Range and Coverage.

- LTE verses GSM and UMTS.

- Planning Tool Configuration:
    - LTE Equipment.
    - Station Templates.
    - Propagation Models.
    - Configuring Services.
    - Terminals.
    - User Profiles.
    - Environments.
    - Cartography.
    - Placing Sites.
    - Coverage Predictions.
    - Overlapping Zones.
    - Computation Zones.
    - Comparing Results.
    - PCI Planning.
    - Services and Simulation.
    - Traffic Map.

- Indoor Coverage.

- Coverage Improvements.
    - Impact of Power Control.
    - Downlink Power Control.
    - Uplink Power Control.
    - Random Access Channel Planning.

7. Site Selection and Integration

Topic areas covered include:

- LTE Site Planning:
    - Site Sector Orientation.
    - Repeaters.
    - Hot Spots.

- Site Integration:
    - High Sites.

- LTE Planning Guide:
    - Site Selection Priorities.
    - Site & Antenna Positioning.
    - Re-using Sites.
    - Nominal Plan.
    - Acquisition Issues.
    - Site to Site Distance.
    - Railway Lines and Roads.
    - Antenna Guidelines.

- Self Organizing Networks:
    - Automatic Neighbour Relation.

- The X2 Interface:
    - Functions of the X2 Application Protocol.
    - X2 Handover.
    - X2 Load Indication.
    - X2 Resource Status Reporting Initiation.

8. RAN Configuration and Interworking

Topic areas covered include:

- Cell Selection and Reselection:
    - RRC States.
    - Cell Search.
    - Cell Selection.
    - Random Access.

- RRC Connection.

- Idle Mode:
    - Cell Reselection.

- Measurements:
    - Timing.

- 3GPP Interworking.
    - Inter-RAT Reselection Process.

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