

COURSE OUTLINE

LTE RF Design Process

- RF Planning workflow
- Inputs to and targets for the planning process; expected outputs
- Coverage and capacity requirements
- Planning constraints
- Significant differences in planning for GSM and UMTS

EPS Overview and E-UTRAN Consideration (tool-based)

- Evolved Packet System architecture
- E-UTRAN architecture: nodes and interfaces
- eNB and UE architecture
- Radio frame for E-UTRA FDD and TDD
- Reference signals and pilots: RS, P-SS, S-SS, DRS, SRS
- PHY channels in the downlink: PBCH, PDCCH, PCFICH, PHICH, PDSCH
- PHY channels in the uplink: PRACH, PUCCH, PUSCH
- Link-level radio interface simulations

Radio Propagation Principles (tool-based)

- Spectrum considerations and LTE frequency bands
- RF requirements imposed on UE and eNB transceivers
- Large-scale and small-scale propagation effects; path-loss, shadowing and fading
- Propagation models: statistical, empirical and deterministic
- Configuration and tuning of the propagation model

Antenna Considerations and MIMO

- Antenna properties – size, gain, beam-width, polarization, front-to-back ratio
- LTE diversity techniques
- Spatial multiplexing, single-user and multi-user MIMO
- Transmission modes and MIMO feedback signaling
- Impact on LTE link budget and capacity
- Antenna system sharing options

Coverage Planning and Link Budgets (tool-based)

- Link budgets, gains and losses
- Role of adaptive modulation and coding scheme
- Requirements for signal-to-noise-and-interference ratio (SNIR) and receiver sensitivity
- Thermal noise calculations and interference estimation
- Maximum allowed path loss
- Impact of normal and extended cyclic prefix
- Impact of antenna configuration
- Range determination and site-to-site distance estimation
- Signal level and best server coverage plots
- SNIR and spectrum efficiency coverage plots
- Key measurements: RSSI, RSRP and RSRQ

- Site sharing options
- Improving coverage with the use of repeaters
- LTE downlink and uplink link budget exercises
- Planning tool configuration and simulations

Frequency Reuse and Interference Management (tool-based)

- Interference avoidance, cancellation and coordination
- Considerations for Single Frequency Network (SFN)
- Frequency-parallel schemes (OFDMA, SC-FDMA) in SFN
- Classical frequency reuse concept (integer reuse)
- Fractional frequency reuse (FFR) methods including soft reuse and partial reuse
- Comparison of FDD and TDD co-channel interference scenarios
- Role of X2 interface between eNBs in coordination of interference and load balancing
- Frequency planning performance evaluations and simulations

LTE Capacity Planning (tool-based)

- EPS bearers and QoS concept
- Traffic types and device types
- Capacity planning with MIMO
- Influence of Modulation and Coding Scheme distribution on sector capacity
- Overview of backhaul network options and requirements
- Exercises in capacity calculations

RAN Procedures Configuration

- Self-Organizing Network (SON)
- Synchronization signals distribution (PHY cell ID planning)
- Random access preamble allocation and dimensioning of PRACH opportunities
- Cell reselection and handover parameters
- Uplink and downlink transmit power control
- Feedback reporting configuration (CQI, PMI, RI)

LTE Inter-working with 2G, 3G

- Roaming
- Inter-working with 3GPP and non-3GPP networks

Note: the course content is subject to minor changes and adaptations to the customer needs.