LTE Radio Network Planning & Optimization

Introduction:
RF Planning & Optimization is a course providing a solid understanding of how to design /plan and optimize a high quality LTE radio network. The course also covers how to expand the network, techniques to boost capacity, how to lower interference and increase quality in the network. Macro cell planning is emphasised in the course, however planning with micro- and pico-cells is also featured. Furthermore it is discussed how cell-planning tools can enhance the cell planning process and how problems can be solved regarding coexistence with other systems.

Prerequisites:
In order to get full benefit from this course, it is recommended that the participants should have understanding of 2G and 3G base mobile system and basic knowledge of electromagnetism.

Who Should Attend:
Engineers from Radio Frequency Planning / Optimization, managers, or other personnel responsible for RF systems whether wireless, cellular/mobile, microwave, or other, will benefit from a comprehensive understanding of Radio Network Planning and Optimization Course for LTE network.

About Organizer:
ETS is Pakistan’s leading Telecom Training provider. With 60+ Consultants from all over the world make it possible to deliver trainings, workshops and conferences around the world covering up to date technologies.

Through our dedication to customer-centric innovation and strong partnerships, we have established end-to-end advantages in telecom services, solutions and Trainings. ETS is committed to create maximum value for telecom companies, enterprises and consumers by providing competitive solutions and services.

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Course Outline

- Understand LTE Air Interface and basic Spectrum Planning
- List main LTE radio interface parameters
- Describe LTE Air Interface applied to RF Planning, Design and Optimization
- Understand the LTE RF planning, design and optimization principals
- Understand basics of Frequency Reuse for LTE
- Describe the impact of MIMO on LTE and its planning
- Calculate Link Budgets for LTE
- List Timing and Synchronization for LTE
- List LTE RF planning and design tools
- Describe the impact of the LTE backhaul in the planning and design process

Introduction to the RF Planning, Design and Optimization Processes

- What is RF Planning?
- Planning for Capacity and/or Coverage
- Nominal Cell Size
- Radio Propagation 101
- Propagation Models
- Link Budgets 101
- The Power Law
- Using a Planning Tool
- Site Acquisition and Selection
- Mast Options
- Nominal Areas for Sites
- Feedback Loop
- Detailed Site Design
- Concrete Canyons
- High Sites
- Drive Testing
- Flat Earth Modeling
- RF Planning and Tools

LTE Air Interface Overview

- S-OFDMA (LTE downlink)
- SC-FDMA (LTE uplink)
- Number of Subcarriers
- Symbol Size
- Subcarrier Types
- Frames
- Resource Blocks (RB)
- UL Allocation
Modulation Techniques
Error Correction
Basic Spectrum Planning in LTE
Operating Bands
Channel Bandwidths
Channel Spacing
Guard Band Considerations

LTE RF Link Budget

- Effective Radiated Power
- Thermal Noise
- Noise Figure
- Ambient Noise
- SNR
- Implementation Margin
- Fast Fading
- Receive Diversity Gain
- System Gain and Losses
- Typical Parameter Values
- Base Station Antenna Gain
- Uplink Budget
- Downlink Budget
- Data rate (Mbps)
- Receiver sensitivity (dBm)
- Interference Margin (dB)
- Control Channel Overhead (dB)
- Maximum path loss
- Propagation (Path Loss) Models
- Environment: urban, rural, dense urban, suburban, open, forest, water
- Estimated Number of Sites
- Neighbor Cell Lists for each site
- Detailed Coverage Predictions (e.g. Signal Strength (RSRP), Signal Quality (RSRQ) Best CINR, Best Server Areas, Uplink and Downlink Throughput)
- Sites Coverage by Signal Strength
- Fine Tuning and Optimization

RF Propagation Models

- Free Space
- HATA
- Okumura Model
- COST-HATA
- COST-231 Walfisch-Ikegami Model
- ERCEG-GREENSTEIN
- Stanford University Interim (SUI) model
- SEMI-DETERMINISTIC Models
- Ray Tracing Model
- Factors Impacting Propagation Models

**Mapping of Path Losses to Cell Sizes**

- Okumura–Hata parameter
- Urban Indoor
- Suburban Indoor
- Rural Indoor
- Rural outdoor fixed
- Base station antenna height (m)
- Mobile antenna height (m)
- Mobile antenna gain (dBi) 0
- Slow fading standard deviation (dB)
- Location probability (%)
- Correction factor (dB)
- Indoor loss (dB)
- Slow fading margin (dB)
- Cell Size in Km

**LTE Capacity Planning**

- Uplink Throughput
- Capacity and MPR Distributions
- CINR Distributions
- MAC Scheduler
- Antenna Schemas
- LTE System Spectral Efficiency
- TDD Capacity
- Workload Modeling
- LTE Traffic Planning and Calculations

**Practical LTE Planning Considerations**

- Coverage vs. Capacity Planning
- Coverage in Noise-Limited Cases
- Definition of average SINR
- Optimizing LTE system bandwidth for coverage
- LTE in Interference-Limited Cases
- Link budget with non-negligible interference: Interference Margin
- Trade-off between cell range, network load and cell edge throughput
- Cell range vs. network load, fixed cell edge throughput
- Network load vs. cell edge throughput, fixed cell range
- Antenna Systems MIMO Transmission Schemes in LTE
- Frequency Reuse
- Timing and Synchronization for LTE
- Carrier to Interference
- Noise ratio
- Inter System Interference
- Inter technology Antenna Sharing
- Cell range versus cell edge throughput, fixed network load
- Frequency-Aware UL/DL Scheduling
- Example of Measured MIMO Radio Channel
- Backhaul Capacity Planning

**LTE RF Optimization**

- Understand existing LTE network
- Deployment site locations
- Site readiness
- Backhaul
- Propagation models for LTE
- LTE Link budget analysis
- LTE coverage maps
- Site acquisition process in LTE engineering
- RF optimization planning
- RF optimization execution
- RF planning and optimization tools
- LTE Network Resource Management
- Quality of Service (QoS)
- Quality of Experience (QoE)
- Service Quality Architectures
- Scheduling Algorithms
- Test cases
- Physical layer throughput tests peak
- RLC throughput tests peak
- Physical layer throughput tests median
- Radio Bearer Control (RBC)
- Radio Admission Control (RAC)
- Connection Mobility Control (CMC)
- Dynamic Resource Allocation (DRA) - Packet Scheduling (PS)
- Inter-cell Interference Coordination (ICIC)
- RSRP, RSRQ, RSSI and SINR to get Good Data Rate
- LTE Femtocell