

# LTE ADVANCED WITH RADIO PLANNING PERSPECTIVES

"Since we launched our LTE service and got experience from the network, many questions emerged. The whole team had their questions answered and were taken to a higher level by Widermind's "LTE Advanced with Radio Planning Aspects"

- Tony Oldén, Manager Radio Network Planning, TeliaSonera Sweden

## Course Description

LTE Advanced introduces new features and functionalities to the networks. How will these impact the data rates, capacity and radio planning of the network? Related to WCDMA, other design principles for the radio planning are required. The spectrum flexibility and allocation alternatives contribute to the complexity. Relay Architecture is introduced as well as high orders of MIMO, Beam forming, Carrier Aggregation, Het-Net, Coordinated Multipoint and Self-Organized Network. The course "LTE Advanced with Radio Planning Perspectives" explores the new opportunities in the radio design field, illustrated by numerous examples.

## Content

### INTRODUCTION

- Evolution of 3G and network architecture
- E-UTRAN and EPC
- Comparing LTE to GSM/UMTS
- Hierarchical- vs flat architecture
- eNodeB, MME, S-GW, P-GW, HSS

### LTE AIR INTERFACE AND CHANNEL STRUCTURE

- Link LTE protocols and channels



- OFDM and SC-FDMA
- Link adaptation
- LTE FDD radio frame, resource blocks
- Channels and signals
- Automatic Neighbor Relations
- Physical Cell Identity
- Tracking Area
- Exercise and examples

## ENHANCEMENTS IN HSPA+ ADVANCED R8/R9

- LTE Advanced features
- LTE Capabilities vs IMT-2000 and IMT-advanced
- LTE-Advanced time-line
- New Frequency Bands for LTE-A
- Technical Performance and Test Environments
- Spectral Efficiency: Cell-, Peak-, Mean- and Cell Edge User-
- Spectrum, Bandwidth and Scalability
- Latency, Mobility and Handover
- VoIP Capacity
- Requirements Related with Capacity, Peak Data Rate and Latency
- LTE-Advanced Rel-10 and Rel-11

## RADIO PROPAGATION

- Review of key propagation mechanisms
- Propagation models and their applications
- eNB and UE transmitter and receiver requirements
- Exercises and examples

## ENHANCED MIMO SUPPORT

- Review of antenna principles
- Tx Diversity vs Spatial Multiplexing
- SU-MIMO, MU-MIMO, MIMO in LTE Advanced
- Practical antenna configurations
- MIMO influence on throughput and network capacity
- MIMO and Enhanced DL MIMO Support, 8x8 antenna configuration

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- Enhanced UL Transmission and multiple access
- TM9 8x8 MIMO
- Uplink Transmission Scheme
- Downlink Transmission Scheme Layer 5, 6, 7 and 8
- Enhanced multiple antenna transmission
- Designing enhanced MIMO systems
- Exercises and examples

## LTE LINK BUDGET CALCULATIONS

- Gains and losses for downlink and uplink
- SNIR, throughput, sensitivity
- Deployment scenarios and coverage calculations
- RSRP, RSRQ, RSSI
- Exercises and examples

## PLANNING OF FREQUENCY, INTERFERENCE AND NEIGHBOURS

- Fractional-, soft- and partial frequency reuse
- Physical Cell Identity and PCI planning
- Paging and Tracking Area (TA) planning

## LTE PROCEDURES

- Synchronization and random access
- Cell reselection and handover
- Power control
- Measurements reporting
- Exercises and examples

## CARRIER AGGREGATION (CA)

- Carrier Aggregation introduction and Options
- Carrier Aggregation at protocol layers
- Carrier aggregation example and Scenarios
- Creating carrier aggregation signals
- Architectural Alternatives Option 1, 2 and 3
- Downlink Control Channels and Impacts
- Achieving Carrier aggregation

## RELAY ARCHITECTURE

- Relay Architecture - Concept
- Classification
- Protocol Stacks
- Channel Mapping
- Multi-hop relaying
- Relaying summary

## HETEROGENEOUS NETWORK AND eICIC

- Introduction HetNet
- Enhancements for Home eNodeBs
- Mobility and RRC State Models
- H(e)NB
- HeNB/CSG operation
- Femtocells, standardization, Potential gains, Graph
- Femtocell – Users vs Data Volume
- Inter-Cell Interference Coordination in LTE

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- Improvements of Latency in the Control and User Plane
- HeNB mobility enhancements
- Fixed wireless customer premises equipment (CPE)
- ICIC and eICIC

## COORDINATED MULTIPOINT (CoMP)

- CoMP, Definition
- Coordinated Multipoint Transmission or Reception
- Transmission or Reception
- CoMP, geographically separated points
- Two possible situations of joint processing
- Uplink CoMP

## SELF ORGANIZED NETWORK (SON)

- SON introduction, graph
- SON Description
- SON network enhancements

## Target audience

The primary target audience is radio network planners.

## Pre-requisites

The participants should have good knowledge about UMTS Radio Network Planning.

## Course length

3 days