

COURSE OUTLINE

Introduction to LTE Advanced

- Evolution path of 3GPP LTE systems (standardization time plan in 3GPP)
- Features of LTE releases
- Requirements and performance targets of LTE Advanced and its relation to requirements of IMT Advanced for 4G systems
- Identified IMT-Advanced spectrum allocations
- Release 8 and 9 air interface features
- Summary of LTE-Advanced enhancements on the radio interface
- LTE Bands, bandwidths, throughputs and UE categories
- Possible services for LTE-Advanced (e.g. positioning, internet of things, MBMS, broadband access, etc.)

EPS Network Architecture Improvements

- Release 8 nodes and interfaces (UE, eNB, MME, SGW, PGW)
- Release 9 scenarios (MBMS, Positioning)
- Release 10 enhancements in EPS (added Relays and enhanced Home eNodeB)

E-UTRA Rel. 9 Features

- Multimedia Broadcast Multicast Service (MBMS)
- MBMS architecture and PHY issues
- Self-organizing and self-optimizing networks (SON)
- SON architecture and functionalities
- LTE Positioning concept, architecture and possible location services

E-UTRA Rel. 10 PHY Enhancements

- Multicarrier transmission (OFDM/OFDMA/SCFDMA)
- Refreshment of the Rel. 8 E-UTRA (including protocol stacks, downlink and uplink radio frames, PHY channels and signals)
- Clustered SCFDMA for uplink in Rel. 10
- Bandwidth extension by carrier aggregation (use of component carriers)
- Processing of Component carriers
- Various scenarios of carrier aggregation
- RF aspects related to carrier aggregation
- Enhanced Downlink MIMO (for up to 8 antennas)
- Additional Downlink MIMO reference symbols for higher order MIMO (CSI-RS, DM-RS)
- Processing chain for DL MIMO (and comparison to Rel. 8 processing chain)
- New UL MIMO schemes (SU-MIMO for PUSCH and TX Diversity for PUCCH)
- Processing chain for UL MIMO (and comparison to Rel. 8 processing chain)

E-UTRA Rel. 10 Protocols and Procedures

- Protocol stack for Carrier Aggregation
- CA procedures (addition and release, activation and deactivation of component carrier)
- Primary and Secondary Component Carriers for Downlink OFDMA and Uplink SCFDMA

- Idle and Connected mode issues (System info acquisition and RRC signaling for CA usage, RRC idle-to-connected state change and HO timing requirements)
- CA challenges (scheduling and Handover aspects)
- MAC issues with relation to CA: user data allocation and signaling aspects (including cross carrier scheduling)
- Additional L1 signaling formats (PUCCH format 3 and DCI format 4)

E-UTRA Rel. 10 Relays

- Relay concept and roles for capacity and coverage enhancements
- Types of relays (Repeaters and Relay Nodes)
- L3-Relay Node (RN) in LTE-Advanced specifications (protocol stacks, architecture and roles of DeNB)
- RN procedures (activation and relaying operation)
- L1 issues (R-PDCCH & MBSFN sub-frame usage for relay link)
- Timing requirements for relay link

E-UTRA Rel. 10 Home eNBs, HetNets and SON

- LTE HeNB architecture possibilities (HeNB, HeNB GW and SeGW)
- Access control and CSG management (types of cells: open, hybrid and closed)
- Heterogeneous Network (HetNet) concept (Macro, Pico, Femto cells and relays)
- Interference scenarios
- LTE inter cell interference coordination (ICIC) in time and frequency

E-UTRA Release 11 and Beyond Features

- Cooperative Multipoint Transmission/Reception
- CoMP downlink and uplink scenarios
- Mobile Type Communications (MTC) concept and possible services
- Mobile Relays concept

LTE Advanced Deployment

- Backward compatibility to LTE Rel. 8 requirements
- Transparency of Relay nodes (and RNs deployment issues)
- Migration from LTE Rel. 8 to LTE Advanced Rel. 10
- HetNet deployment

LTE Advanced Demo and Experiments (tool-based)

- Usage of 8 antennas in the downlink for spatial multiplexing
- Spatial multiplexing in the uplink
- Bandwidth aggregation

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