

## COURSE OUTLINE

### Introduction to WiMAX

- WiMAX network architecture
- Nodes and domains: MS, BS, ASN-GW, ASN, CSN
- Interfaces: R1, R8, R6, R4, R3, R2
- ASN Profiles
- WiMAX bandwidths and bit rates
- Summary of radio access techniques used in WiMAX air interface

### Overview of OFDM and OFDMA

- Fundamentals of multipath propagation (selectivity in time, frequency and space)
- Basics of OFDM transmission, subcarriers, cyclic prefix, IFFT/FFT processing
- OFDMA as an extension of OFDM
- Multiple access with OFDMA
- Advantages and disadvantages of OFDM and OFDMA

### WiMAX Air Interface Protocol Structure

- WiMAX air interface protocol stack
- Control information and user data organization
- Information mapping: bursts, sub-channels and slots

### WiMAX PHY Layer

- RF channel definitions
- MS and BS transmitter power parameters
- PHY interface options: WirelessMAN-SC, WirelessMAN-SCa, WirelessMAN-OFDM, WirelessMAN-OFDMA, WirelessHUMAN
- OFDMA parameters for WirelessMAN-OFDMA
- TDD and FDD radio frame organizations
- Radio frame elements (sub-frames, sub-channels, slots, data regions, bursts, TTG, RTG)
- Channels and signals (preambles, DL-MAP, UL-MAP, DCD, UCD, FCH, Ranging, fast feedback channel)
- Subcarrier allocation schemes and pilot assignment
- Pseudo random permutations: FUSC, PUSC and Optional PUSC
- Adaptive permutation: Adaptive Modulation and Coding (AMC)
- MIMO scenarios in WiMAX for downlink and uplink
- Adaptive MIMO switch
- Space-Time Coding and Spatial Multiplexing
- Beamforming
- Uplink Collaborative MIMO
- MIMO allocations in the frame

- Downlink and uplink processing chain including channel coding, modulation, subcarrier mapping, Space-Time Coding and OFDMA signal generation

### WiMAX PHY Layer Demo and Experiments (tool-based)

- OFDMA waveforms
- Chosen BS and MS signals and PHY channels shown in the time and frequency domain
- Complete downlink and uplink radio frame shown as time-frequency grid

### WiMAX MAC Layer

- MAC overall architecture and functions
- MAC sub-layers: Security, Common Part, Convergence
- Logical connections, service flows and QoS
- Link adaptation mechanism, Adaptive Modulation and Coding
- MAC security processing
- Power saving
- MAC packet processing
- Hybrid ARQ
- Timing Relationship and Timing Advance

### WiMAX Radio Interface Procedures

- Synchronization
- Cell selection, reselection
- System info acquisition
- Ranging procedure and allocations
- Initial and periodic ranging
- Handover ranging
- Bandwidth request
- Power control for uplink and downlink, closed loop and open loop
- Measurements and reporting
- RSSI, CINR, relative delay, round trip delay
- WiMAX reporting events

### WiMAX Deployment

- Planning for coverage and capacity
- Site sharing options
- Tools used in the planning process
- Self-organizing networks (SON) concept

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