

# MCNS Training Program

5G RAN NR Indoor Design

## 5G RAN NR Indoor Design

This course will introduce audience into a good understanding on 5G NR Indoor planning

### COURSE REVIEW

This training course leads the audience into 5G NR indoor planning and dimensioning principles. **It introduces the engineers on how to maximize RAN Indoor coverage, capacity and enhance data transmission.** The course is supported by excel files for practical exercises and case studies

### AIMED AT

This course is suitable for technical professionals, **RAN operators, Radio planning engineers, RAN optimization engineers, E2E System architects, RAN System Engineers.**

Prerequisites: Those wishing to take this course should have a good and solid understanding of 5G NR Air interface technology



## 5G RAN NR Indoor Design

This course will introduce audience into a good understanding on 5G NR Indoor planning

### Course Benefits for individuals (Professionals)

- Understanding 5G RAN requirements
- Explore 5G RAN indoor coverage and capacity principles
- Understand the indoor antennas and practice on their characteristics for the planning procedure
- Practice on capacity and coverage planning tools (i.e. excel calculators examples) through practical exercises

### Course Benefits for your Organization

- Keep ahead of competitors in offering well planned and high quality customers' 5G Indoor services
- Identify new revenue streams that can be enabled through 5G

### Training Format

Instructor-Led Training  
On-Site Classroom: 3 days  
Web delivered (Virtual): 3 days  
**Excellent and descriptive course material (pdf file) will be provided**

## Customer Tailored!

We can tailor the included topics, tech level, and duration of this course right to your team's technical requirements and needs



## Course Program Outline

### **Module 1: 5G RAN NR Preview**

- 5G Air interface overview
- 5G NR FR1 and FR2 bands
- Scalable numerology
- NR frame structure
- 5G NR signals and channels review
- 5G NSA architecture
- 5G SA architecture
- 5G NSA eMBB service
- 5G SA Services: eMBB, massive IoT, URLLC



Section 2: mMIMO and Beamforming Performance

## Course Program Outline

### Module 2: 5G Indoor Channel Modeling

- Mobile Physical Channel and Channel modeling
- Indoor channel modeling
- Indoor Multipath
- Indoor micro and pico architecture
- FR1 Pathloss models (below 3 GHz, C-Band, 5-6 GHz, 7 GHz)
- FR2 Pathloss models for mmW (24-30 GHz)

### Module 3: 5G Indoor MIMO Technology

- 5G Indoor antennas and types
- 5G Indoor DAS system
- 5G Indoor Active MIMO implementation
- 5G Indoor mMIMO Beam-forming principles
- 5G AAS mMIMO technology
- 5G Indoor mMIMO EIRP
- Example 5G special MIMO design – Ericsson Dot system

### Module 4: 5G Indoor Deployment

- 5G Indoor scenarios with Active Antenna systems
- 5G Indoor deployment using active antennas
- 5G Indoor gNB deployment requirements
- 5G Indoor capacity calculation
- 5G Indoor practical deployment examples
- Example: Indoor Link budget analysis overview (indoor)
- Exercise: Indoor Link Budget calculations using Excel



Section 3: 5G RAN Indoor Planning

## Course Program Outline

### Module 5: 5G Outdoor to Indoor (O2I) coverage

- 5G O2I losses
- 5G O2I capacity calculations
- 5G O2I interference
- 5G pico/micro cell features (HetNets)
- Example: O2I Link budget analysis overview
- Exercise: O2I Link Budget calculations using Excel

### Module 6: Indoor Uplink Planning

- Network quality requirements
- Vendor (equipment) UL requirements
- RACH Root Sequence planning
- RACH Preamble selection and cell size coordination
- RACH SINR requirements
- Exercise: RACH collision probability vs. SINR
- Power control factor

*See next box*

### Module 6: Indoor Uplink Planning

*Cont'd from previous box*

- Coverage planning for PUSCH channel
- Coverage planning for control channels (PUCCH, RACH)
- Coverage planning for signals (SRS, DMRS)
- 5G NR sector indoor UL capacity estimations – single service
- 5G NR UL indoor throughput estimation (average, cell edge, max)
- 5G NR Indoor Carrier Aggregation UL capacity
- Exercise: UL capacity estimations using Excel spread-sheet calculator



Section 3: 5G RAN Indoor Planning

## Course Program Outline

### Module 7: Indoor Downlink Planning

- Network quality requirements
- Vendor (equipment) DL requirements
- Power gain calculation
- Indoor Interference factor: Optional features for Interference mitigation
- Indoor Coverage planning for PDSCH channel

*See next box*

### Module 7: Indoor Uplink Planning

#### *Cont'd from previous box*

- Indoor Coverage planning (including aggregation level) for control channel PDCCH
- Coverage planning for signals (PSS, SSS, PBCH, SIB1, SIBx, CSI-RS, DMRS, PTRS, TRS)
- 5G NR sector DL capacity estimations – single service
- 5G NR indoor DL throughput estimation (average, cell edge, max)
- 5G NR Indoor Carrier Aggregation DL capacity
- Exercise: DL capacity estimations using Excel spread-sheet calculator



## Course Program Outline

### *Module 8: Indoor Transport network capacity deployment*

- Front-haul indoor transport requirements
- Back-haul indoor transport network requirements
- Indoor Transport throughput and capacity
- Exercise: capacity estimations using Excel spread-sheet calculator

