
MCNS
Mobile | Cloud | Network Services
MCNS Training Program
NB-IoT RAN Design & Dimensioning
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NB-IoT RAN Design & Dimensioning

NB-IoT RAN Design & Dimensioning will offer delegates a good and deep understanding on NB-IoT Radio Access Network (RAN) Design considering LTE and NB-IoT inband coexistence including transport network S1 and X2 interfaces, spanning from physical layer parameters up to network TA, PCI, RACH and Paging Dimensioning

COURSE REVIEW

This NB-IoT training course leads the audience into a deep dive towards NB-IoT RAN planning, design and network dimensioning principles, both from the essential understanding as well as configuration perspective. It presents in details the opportunities, challenges, and risks that's needed to exploit and deploy the **NB-IoT RAN network** as inband, guardband and standalone deployment.

Course content explains in details how to maximize NB-IoT RAN network connected **IoT devices** capacity and enhance data transmission, evaluate service quality, optimize usage of radio network resources, design the **RACH channel**, plan for paging capacity, dimension TAs and consider quality requirements for RAN reference signals and channels. Finally it also considers some NB-IoT RAN optional features to improve performance. **The course is supported by proper excel dimensioning (calculator) files for practical exercises and case studies.**

AIMED AT

NB-IoT RAN Design & Dimensioning is mainly aimed at a technical audience. It is suitable for **technical professionals**, **RAN operators**, **Radio planning engineers**, **RAN optimization engineers**, **IoT service providers**, **Research Institutes, defense sector**, who currently are or will be involved in NB-IoT RAN planning and NB-IoT network dimensioning with emphasis on coverage extension, number of IoT connected devices capacity and NB-IoT coverage deployments.

Prerequisites: Those wishing to take this course should have a good and solid understanding of **NB-IoT radio physical layer**, with emphasis on **NB-IoT air interface** and physical layer procedures.

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Course Benefits for individuals (Professionals)

- Understanding **NB-IoT RAN planning and dimensioning** requirements
- Explore **NB-IoT RAN coverage** and capacity principles
- Learn how NB-IoT planning will affect LTE coverage and capacity
- Learn how to plan for cell edge users as well as average cell performance conditions
- Understand the principles behind the control channels and reference signals capacity and coverage requirements
- Learn how to complete special topics on capacity and coverage (**e. Paging, RACH planning & dimensioning, RACH Root sequence, PCI &TA planning)**
- Practice on capacity and coverage planning tools (i**.e. excel calculators examples)** through practical exercises

Course Benefits for your Organization

- Equip organization engineers with the necessary knowledge to accomplish difficult and complex tasks related to **NB-IoT RAN planning and dimensioning.**
- Understand how NB-IoT deployment will affect LTE capacity and coverage.
- Decide about the parameter configuration for paging capacity
- Decide about RACH capacity and coverage, including the collision probability estimations
- **Keep ahead of competitors** in offering well planned network, maximizing coverage, capacity (throughput) and number of IoT devices targeting to good quality customers'IoT services
- Identify new revenue streams that can be enabled through **NB-IoT network**
- Prepare for future network expansions and quality performance optimization

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

Section 1 : NB-IoT Radio Technology Review

Course Program Outline

Module 1: NB-IoT Air Interface Overview

- NB-IoT Air interface overview
- NB-IoT physical layer
- NB-IoT OFDM/OFDMA principles
- NB-IoT Frequency domain physical layer structure
- NB-IoT Frequency bands and supported Channel Bandwidth
- NB-IoT TDD and FDD deployments
- NB-IoT Time Domain physical layer structure and slot structure details
- NB-IoT coding principles
- NB-IoT Modulation schemes
- NB-IoT Physical layer OFDM mapping

Module 2: NB-IoT Channel Modeling

- What is a Mobile Channel model ?– general principles
- Non-Line of Sight and Rayleigh modeling
- LoS and Rice modeling
- nLoS and Shadowing modeling
- NB-IoT Coverage modeling : Coverage extension solution
- Doppler effects and channel models
- Sub 3GHz Pathloss models (400 MHz -2.6 GHz)
- C-Band Pathloss models (3.4-3.8 GHz)
- Example: Link budget analysis overview; various cases (rural, urban, dense urban, O2I)
- Exercise: Link Budget calculations using Excel

Section 2: NB-IoT Basic Planning

Course Program Outline

Module 3: NB-IoT RAN deployment

- NB-IoT inband requirements and restrictions
- NB-IoT inbandanchor PRB
- NB-IoT inband PRB extra capacity
- NB-IoT inband interference
- NB-IoT inband power leakage and filter requirements
- NB-IoT stand-alone requirements and restrictions
- NB-IoT guardband requirements and restrictions
- NB-IoT Coverage extension principles

Section 2 : NB-IoT Basic Planning

Course Program Outline

Module 4: NB-IoT Uplink Planning

- NB-IoT UL quality requirements
- Vendor (equipment) UL requirements
- Power control factor
- NB-IoT Coverage Extension in UL
- NB-IoT FEC repetition coding for UL Interference mitigation
- Coverage planning for NB-IoT PUSCH channel

See next box

Module 4: NB-IoT Uplink Planning

Cont'd from previous box

- Coverage planning for NB-IoT PUCCH channel
- Coverage planning for NB-IoT UL reference signals
- NB-IoT UL cell capacity estimations
- NB-IoT UL throughput estimation (average, cell edge, max) vs SINR
- NB-IoT UL optional features
- Exercise: UL capacity estimations using Excel spread-sheet calculator

Section 2 : LTE RAN Architecture

Course Program Outline

Module 5: NB-IoT Downlink Planning

- NB-IoT quality requirements
- Vendor (equipment) DL requirements
- NB-IoT Coverage Extension in DL
- NB-IoT FEC repetition coding for DL Interference mitigation
- Coverage planning for NB-IoT PDSCH channel
- Coverage planning NB-IoT PDCCH

See next box

Module 5: NB-IoT Downlink Planning

Cont'd from previous box

- Coverage planning for DL reference signals
- NB-IoT DL cell capacity estimations
- NB-IoT DL throughput calculation (average, cell edge, max) vs SINR
- NB-IoT DL optional features
- Exercise: DL capacity estimations using Excel spread-sheet calculator

Section 3 : NB-IoT RAN Design & Dimensioning

Course Program Outline

Module 6: NB-IoT RACH Design

- RACH Root Sequence planning
- RSI and sectorization
- NB-IoT RACH Preamble vs. cell size coordination
- NB-IoT RACH SINR requirements
- NB-IoT RACH collision probability vs connected users capacity
- NB-IoT RACH capacity vs. coverage
- Exercise: RACH collision probability and RACH decoding vs. SINR using Excel spread-sheet calculator

Module 7: NB-IoT Accessibility Design

- RACH msg1 success rate estimation
- RACH msg2 success rate estimation
- RACH msg3 success rate estimation
- RACH msg4 success rate estimation
- Overall NB-IoT RACH accessibility assessment
- Exercise: RACH Accessibility Success Rate estimation using mathematical models over Excel spread-sheet calculator

Module 8: NB-IoTPaging Dimensioning

- NB-IoT Paging review
- NB-IoT Paging intensity
- NB-IoT Paging capacity estimation
- NB-IoT and DRX
- S1 interface capacity estimation vs paging intensity
- NB-IoT Paging Success Rate estimation
- Exercise: Paging Capacity estimations and Paging decoding probability vs SINR SINR using Excel spread-sheet calculator