MCNS
Mobile | Cloud | Network Services

MCNS Training Program

5G NSA Fixed Wireless Access (FWA)

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5G NSA Fixed Wireless Access FWA will offer delegates a good and deep understanding on FWA over 5G NR Radio Access Network (RAN) planning and dimensioning procedures with focus on non-Stand Alone (NSA) design & deployment

COURSE REVIEW

This 5G FWA training course introduces participants into the Fixed Wireless Access (FWA) principles over **5G NR non-Stand Alone (NSA**) technology. A detailed analysis on basic procedures for **FWA over 5G NSA** planning, design and network dimensioning principles is thoroughly explained and presented, both from initial **LTE Master Node (MeNB)** service provisioning as well as the subsequent NR Secondary node addition (SCG addition).

FWA over 5G NR NSA aspire is to provide broadband service with high throughput combining the split bearer solution, hence this course teaches the methodology to maximize FWA RAN network capacity and capacity, as well as to enhance data transmission considering 5G NSA RAN optional features to improve FWA performance. Proper mathematical model to estimate 5G NSA FWA throughput vs. SINR is thoroughly explained. **The course is supported by proper excel dimensioning (calculator) files for practical exercises and case studies**

AIMED AT

5G NSA Fixed Wireless Access (FWA) is mainly aimed at a technical audience. It is suitable for **technical professionals**, **RAN operators**, **Radio planning engineers**, **RAN optimization engineers**, **Research Institutes**, **defense sector**, who currently are or will be involved in deploying and designing FWA over 5G NSA.

Prerequisites: Those wishing to take this course should have a good and solid understanding of 5G NSA technology, with emphasis on **5G NR air interface** and **LTE air interface**.

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Course Benefits for individuals (Professionals)

- Understanding **FWA over 5G NSA RAN** requirements
- Explore FWA over 5G NSA RAN coverage and capacity principles, considering both **LTE** and **5G NR technology**
- Learn how to plan for FWA 5G NSA cell edge users as well as average cell performance conditions
- Understand the principles behind the control channels and reference signals FWA capacity and coverage requirements
- Learn how to complete special topics on **FWA over 5G SA** capacity, coverage and mobility (i.e. Radio Link Failure, A2 and B1 events)
- Learn how to configure FWA basic parameters for 5G NR SA
- 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 **FWA over 5G NR NSA RAN** plan, design and optimization.
- **Keep ahead of competitors** in offering well planned and high quality customers' FWA over 5G RAN NSA services, including LTE/NR collocation or NR hotspot architectures
- Identify new revenue streams to be enabled through FWA over 5G RAN NSA
- Prepare for future network expansions and quality performance optimization, including also **Dynamic Spectrum Sharing (DSS**) for FWA NSA

Training Format

Instructor-Led Training
On-Site Classroom: 4 days
Web delivered (Virtual): 4 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

Section 1: Radio Technology Review

Module 1: LTE Technology Review

- LTE Air interface overview
- LTE frame structure
- FDD – TDD modes
- LTE frequency bands
- LTE signals and channels review

Module 2: L 5G NSA NR Technology Preview

- 5G Air interface overview
- 5G NR FR1 and FR2 bands
- Scalable numerology
- NR frame structure
- FDD – TDD modes
- NR signals and channels review
- Non-Stand-Alone (NSA) architecture
- NSA SCG addition
- NSA SCG release
- 5G NSA FR1 band Service requirements: eMBB
- 5G NSA FR2 (mmW) service requirements: eMBB

Section 1: Radio Technology Review

Course Program Outline

Module 3: FWA MIMO & mMIMO Technology overview

•3GPP Rel.8-14 MIMO standardization

• eNodeB MIMO TM4 CLSM and Beam-forming transmission scheme

• eNodeB MIMO 2x2, 4x4 Performance Gains

• eNodeB MIMO TM8-TM10 modes

• eNodeB MIMO 8x8 Performance Gains

• 5G MIMO review

• 5G massive MIMO (mMIMO) review

• 5G gNodeB mMIMO Beam-forming principles

• FWA gNodeB mMIMO panels and EiRP

See next box

Module 3: FWA MIMO & mMIMO Technology overview

Cont'd from previous box

•FWA 5G DL SSB & CSI-RS beam power & EiRP

• Massive MIMO Digital beamforming gain: FWA Practical approach

• Massive MIMO Analog/Hybrid beamforming gain: FWA Practical approach

• Customer Premise Equipment (CPE) in LTE and 5G RAN

• CPE 5G FR1 technical characteristics

• CPE 5G FR2 technical characteristics (beamforming)

• CPE 5G FR1 antenna characteristics

• CPE 5G FR2 mMIMO antenna characteristics

• CPE FR1 MIMO performance

• CPE FR2 mMIMO performance

Section 1: Radio Technology Review

Course Program Outline

Module 4: FWA Channel Modeling

•FWA Point-to-Point Link

• Non-Line of Sight (nLoS) and Rayleigh modeling

• LoS and Rice modeling

• nLoS and Shadowing modeling

• Fresnel zones and Diffraction Losses

• Special Case: Doppler Shift and channel models

• FWA Outdoor vs. Indoor losses

• FR1 Pathloss models (below 3 GHz, C-Band, 5-6 GHz)

• FR2 Pathloss models for mmW (24-30 GHz, 30-40 GHz, 50-60 GHz)

• Example: Link budget analysis overview; various cases (rural, urban, dense urban, O2I)

• Exercise: Link Budget calculations using Excel

Section 2: FWA 5G non-Standalone (NSA) Planning

Course Program Outline

Module 5: FWA NSA Uplink Planning

•FWA FR1 & FR2 UL quality requirements

• CPE FR1 & FR2 UL requirements

• FWA LTE UL Power control factor

• FWA 5G FR1 & FR2 UL Power control factor

• FWA LTE Uplink Interference factor

• FWA LTE Uplink Optional features

• FWA 5G FR1 & FR2 Uplink Interference factor

• FWA 5G FR1 & FR2 Uplink Optional features

See next box

Module 5: FWA NSA Uplink Planning

cont'd from previous box

•Coverage planning for FR1 & FR2 UL channels (PUSCH, PUCCH, PRACH)

• Coverage Planning for LTE UL signals (SRS, UE-RS)

• Coverage Planning for 5G UL signals (SRS, DMRS)

• LTE PUCCH capacity vs. formats

• LTE PUCCH coverage vs. formats

• 5G FWA FR1 & FR2 PUCCH capacity vs. formats

• 5G FWA FR1 & FR2 PUCCH coverage vs. formats

• FWA NSA LTE UL Leg throughput estimations – eMBB service

• FWA NSA FR1 UL NR Leg throughput estimations – eMBB service

See next box

Module 5: FWA NSA Uplink Planning

cont'd from previous box

•FWA NSA FR2 UL NR LEG throughput estimations – eMBB service

• FWA NSA FR1 UL ENDC aggregation throughput estimations – eMBB service

• FWA NSA FR2 UL ENDC aggregation throughput estimations – eMBB service

• FWA NSA UL FR1 & FR2 Carrier Aggregation capacity

• FWA NSA UL FR1 & FR2 cell capacity estimation (average, cell edge, max) vs SINR

• Exercise: UL capacity estimations using Excel spread-sheet calculator

Section 2: FWA 5G non-Standalone (NSA) Planning

Course Program Outline

Module 6: FWA NSA Downlink Planning

- FWA FR1 & FR2 DL quality requirements
- CPE FR1 & FR2 DL requirements
- FWA LTE DL Interference factor
- FWA LTE DL Optional features
- FWA 5G FR1 & FR2 DL Interference factor
- FWA 5G FR1 & FR2 DL Optional features
- FWA LTE DL coverage planning
- FWA LTE DL BCCH & SIB1, SIB2 coverage planning
- FWA 5G DL SSB coverage planning
- FWA 5G DL SIB1 coverage planning

See next box

Module 6: FWA NSA Downlink Planning

cont'd from previous box

- FWA LTE DL CRS coverage planning
- FWA 5G DL CSI-RS coverage planning
- Coverage planning for LTE PDSCH
- Coverage planning for 5G FR1 & FR2 PDSCH
- Coverage planning for LTE PDCCH vs. CCE aggregation levels
- Coverage planning for FR1 & FR2 PDCCH vs. CCE aggregation levels
- Coverage planning for LTE PHICH & PCFICH
- Coverage Planning for 5G SA DL signals (DMRS, PTRS, TRS)
- LTE PDCCH capacity vs. CCE aggregation levels
- 5G FR1 & FR2 PDCCH capacity vs. CCE aggregation levels

See next box

Module 6: FWA NSA Downlink Planning

cont'd from previous box

- FWA NSA LTE DL Leg throughput estimations – eMBB service
- FWA NSA FR1 DL NR Leg throughput estimations – eMBB service
- FWA NSA FR2 DL NR LEG throughput estimations – eMBB service
- FWA NSA FR1 DL ENDC aggregation throughput estimations – eMBB service
- FWA NSA FR2 DL ENDC aggregation throughput estimations – eMBB service
- FWA NSA DL FR1 & FR2 Carrier Aggregation capacity
- FWA NSA DL FR1 & FR2 cell capacity estimation (average, cell edge, max) vs SINR
- Exercise: UL capacity estimations using Excel spread-sheet calculator

Section 3: FWA NSA Special Design Requirements

Course Program Outline

Module 7: FWA NSA mobility planning

•NSA Collocation deployment and mobility scenarios

• NSA Hotspot deployment and mobility scenarios

• NSA Outdoor-Indoor deployment and mobility scenarios

• NSA LTE mobility review and coverage areas

• NSA NR mobility review and coverage areas

• NSA events (A2, A3) and parameter recommendations for mobility planning

• 5G NSA Radio Link Failure coverage estimation

• Special case I: FWA NSA for Railway coverage

• Special case II: FWA NSA for Ship Vessel coverage

• Special case II: FWA NSA over satellite coverage

Module 8: FWA NSA RACH Design

• RACH Root Sequence planning

• RSI and sectorization

• RACH Preamble selection and cell size coordination

• RACH SINR requirements (mathematical model)

• RACH collision probability vs capacity (mathematical model)

• Exercise: RACH collision probability Excel spread-sheet calculator

• Exercise: RACH decoding vs. SINR Excel spread-sheet calculator

Module 9 : FWA over Dynamic Spectrum Sharing (DSS)

•Introduction to spectrum sharing

• Available technical solutions

• DSS MBSFN deployment (optional vendor specific)

• DSS scheduler and priorities

• Analyze LTE attach procedure logs for EN-DC DSS setup

• Describe how UE indicates DSS related features

• DSS LTE/5G coverage estimations

• DSS LTE/5G overhead and capacity estimations

• Exercise: capacity & coverage estimations using Excel spread-sheet calculator