

# MCNS Training Program

## 5G SA Fixed Wireless Access (FWA)

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5G SA 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 Stand Alone (SA) design & deployment

### COURSE REVIEW

**This 5G FWA training course** leads the audience into the Fixed Wireless Access (FWA) principles over **5G NR Stand Alone (SA)** technology. A detailed analysis on basic procedures for FWA over 5G SA planning, design and network dimensioning principles is thoroughly explained and presented, both from technology understanding as well as configuration perspective. **FWA over 5G NR SA** solution prospective aspire is to provide broadband service with extremely high throughput and this course teaches the methodology to maximize **FWA RAN** network capacity and capacity, as well as to enhance data transmission considering 5G SA RAN optional features to improve FWA performance.

**Proper mathematical model** approaches to estimate 5G SA FWA throughput vs. SINR, RACH collision and RAN paging is fully explained. **The course is supported by proper excel dimensioning (calculator) files for practical exercises and case studies.**

### AIMED AT

**5G SA 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 SA.

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



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### Course Benefits for individuals (Professionals)

- Understanding **FWA over 5G SA RAN** requirements
- Explore FWA over 5G SA RAN coverage and capacity principles
- Learn how to plan for FWA 5G SA 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 and coverage (i.e. Paging, RACH planning & dimensioning)
- Learn how to configure FWA basic parameters for **5G NR SA**
- Practice on capacity and coverage planning tools (**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 SA RAN** plan, design and optimization.
- **Keep ahead of competitors** in offering well planned and high quality customers' FWA over 5G RAN SA services
- Identify new revenue streams to be enabled through **FWA over 5G RAN SA**
- 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: 5G Radio Technology Review

# Course Program Outline

## Module 1: 5G SA Technology Preview

- 5G SA Air interface overview
- 5G NR FR1 and FR2 bands
- Scalable numerology
- NR frame structure
- FDD-TDD modes
- NR SA signals and channels review
- Stand-Alone (SA) architecture
- 5G SA FR1 band Service requirements: eMBB
- 5G SA FR2 (mmW) service requirements: eMBB
- 5GC overview and slicing solution
- FWA over 5G SA using slicing examples

## Module 2: FWA MIMO & mMIMO Technology overview

- 5G MIMO review
- FWA 5G SA MIMO TM3-10 modes: gain and performance
- 5G massive MIMO (mMIMO) review
- 5G gNodeB mMIMO Beam-forming principles
- FWA gNodeB mMIMO panels and EIRP
- FWA 5G DL SSB & CSI-RS beam power & EIRP
- Massive MIMO Digital beamforming gain: FWA Practical approach

*See next box*

## Module 2: FWA MIMO & mMIMO Technology overview

### *Cont'd from previous box*

- Massive MIMO Analog/Hybrid beamforming gain: FWA Practical approach
- Customer Premise Equipment (CPE) in 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



## Course Program Outline

### **Module 3: 5G 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
- 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 Standalone (SA) Planning

**Module 4: FWA Uplink Planning**

- FWA FR1 & FR2 UL quality requirements
- CPE FR1 & FR2 UL requirements
- FWA 5G SA FR1 & FR2 Power control factor
- FWA 5G SA FR1 & FR2 Uplink Interference factor
- FWA 5G SA FR1 & FR2 Uplink Optional features
- Coverage planning for FR1 & FR2 UL channels (PUSCH, PUCCH, PRACH)
- Coverage Planning for 5G SA UL signals (SRS, DMRS)

*See next box*

## Course Program Outline

**Module 4: FWA Uplink Planning**

*Cont'd from previous box*

- 5G FWA FR1 & FR2 PUCCH capacity vs. 5G SA formats
- 5G FWA FR1 & FR2 PUCCH coverage vs. 5G SA formats
- FWA 5G SA FR1 & FR2 UL cell capacity estimations – eMBB service
- FWA 5G UL FR1 & FR2 Carrier Aggregation capacity
- FWA 5G UL FR1 & FR2 throughput estimation (average, cell edge, max) vs SINR
- Exercise: UL capacity estimations using Excel spread-sheet calculator





Section 2: FWA 5G Standalone (SA) Planning

**Module 5: FWA Downlink Planning**

- FWA FR1 & FR2 DL quality requirements
- CPE FR1 & FR2 DL requirements
- FWA 5G SA FR1 & FR2 DL Interference factor
- FWA 5G SA FR1 & FR2 DL Optional features
- FWA 5G DL SSB coverage planning
- FWA 5G DL SIB1 coverage planning
- FWA 5G DL CSI-RS coverage planning
- Coverage planning for FR1 & FR2 PDSCH

*See next box*

## Course Program Outline

**Module 5: FWA Downlink Planning**

*Cont'd from previous box*

- Coverage planning for FR1 & FR2 PDCCH vs. CCE aggregation levels
- Coverage Planning for 5G SA DL signals (DMRS, PTRS, TRS)
- 5G FWA FR1 & FR2 PDCCH capacity vs. CCE aggregation levels
- 5G FWA SA FR1 & FR2 DL cell capacity estimations – eMBB service
- 5G FWA SA DL FR1 & FR2 Carrier Aggregation capacity
- 5G FWA SA DL FR1 & FR2 throughput estimation (average, cell edge, max) vs SINR
- Exercise: UL capacity estimations using Excel spread-sheet calculator



Section 3: 5G SA FWA RAN Design

## Course Program Outline

### Module 6: FWA 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 7: FWA 5G NR SA Paging Dimensioning

- 5G NR Paging review
- 5G NR Paging intensity
- 5G NR SA Paging capacity estimation
- NG interface capacity estimation vs paging intensity
- 5G NR SA Paging Success rate estimation
- Exercise: Paging Capacity estimations Excel spread-sheet calculator
- Exercise: Paging decoding probability vs SINR Excel spread-sheet calculator

