

SA and NSA RAN Protocols and Radio Scenarios

SYNOPSIS

- **Hands-On Seminar:** 5G RAN Protocols, Scenarios, Security and Parameters.
- **Hands-on Seminar:** NR air interface features, radio channel structure, physical layer procedures, RAN Protocols and Scenarios, Security and Parameters..
- Focus on End-to-End Scenarios and Session Correlation between different Interfaces.
- Focus on NR radio resource measurements, understanding parameters that impact performance and fault detection.
- Focus on understanding the difference between LTE, SA, NG-RAN and NSA in terms of protocol stacks, topology and scenario management roles.
- Discuss performance tuning parameters and KPI.
- Discuss Location Estimation.

DURATION

- 3 Days.

PREREQUISITES

- NR Essentials seminar, LTE Essentials seminar or equivalent knowledge.

TARGET AUDIENCE

- Software and hardware engineers, tester, system architects, electronic warfare and interception engineers.
- Field engineers, troubleshooters, technical staff being responsible for O&M.

COURSE TARGETS

- The participants will become familiar with NR radio, including radio channels, radio procedures, antenna technologies and important parameters,
- The participants would become familiar with 5G end-to-end service scenarios and role players in SA and NSA networks.
- The participants would understand the various cases of mobility and correlating session contexts and security contexts between the involved nodes.
- The participants would discuss RAN optimization techniques and RAN trouble shooting (coverage shortages, performance tuning, dimensioning).
- Hands-On and deep dive in all RAN protocols, identifying and correlating identity, location, security, session and performance impacting parameters.
- Deep dive into Measurement parameters.

SA and NSA RAN Protocols and Radio Scenarios

1. 5G RAN Protocols - hands-on

- a. RRM Introduction - Connection States and Basic Scenarios
- b. Identities and Relations
- c. 5RRC - Protocol, Procedures, and Parameters
- d. XnAp vs X2AP - Protocol, Procedures, Contexts and Parameters
- e. F1AP - Protocol, Procedures, Contexts and Parameters
- f. NGAP vs S1AP - radio and security relevant aspects
- g. **Principles of Call/Session cross-interface correlation**

2. SA NR RAN Mobility Scenarios & Security Context Continuity

- a. Idle RAN Scenarios – Cross-AMF Security Continuation
- b. Connection Setup & Bearer Allocation – security context activation
- c. Xn/N2 HO Scenarios – parameters& thresholds, cross node session correlation (Cross AMF/SMF/UPF – intra/inter gNB/ng_eNB/DU)
- d. VoNR-VoLTE Handover, CSFB, EPS Fallback & SRVCC Handover
- e. Security Context Derivation and Activation Cases
- f. **NR-5GC Cross Interface Correlation Hands-On**
between Contexts & Identities(correlate from/to IMSI)

3. EN-DC Operation and Mobility Scenarios & Context Continuity

- a. EN-DC Idle and Connected Mode – relevance of NR Channels
- b. EN-DC Dual-Protocol Topology and Security
- c. EN-DC Connection Setup and Secondary Node Activation
- d. **X2/S1 Handover and Re-Establish Scenarios**
- e. **NSA Cross Interface Correlation Hands-On** - Contexts & Identities

NR Radio Operation

4. NR Radio Operation

- a. Radio Coverage, Load and Performance Principles
- b. Interference and Fading (SNR, SINR, Pathloss)
- c. LTE and NR Radio Channels and Ref-Signals
- d. LTE and NR Multi-Carrier Operation (CA, MR-DC)
- e. Neighbor Cell Measurements (intra/inter definition, inter-RAT)
- f. Radio Channel Measurements – deep dive
- g. Scheduling related Reports
- h. QoS based Scheduling and User-Plane Transport Protocols
- i. **CU-UP Split and Monitoring Scenarios**

5. Radio Procedures and Optimization Overview

- a. Radio Optimization Items and Performance Reports (KPI)
- b. Connection Setup and Handover success tuning parameters
- c. SSB and Cell Search
- d. NR Multi-Beam Operation and related Mobility Measurements
- e. RACH Access Optimization Cycle
- f. Timing Advance and Power Control parameters
- g. Radio Link Failure and Connection Robustness
- h. Paging Optimization cycle
- i. Location based Architecture in 3GPP
- j. Enhanced Cell ID and gaining Location Information from Logs
- k. Drive Tests and MDT Reports