



**5G NR E2E Essentials**

**24 + Hours**



**LEARNING OBJECTIVE:**

Upon completing the course, the participant will be able to:

- Understand in detail about the 5G Technology
- Look at the concept of mm waves, Spectrum allocations in FR 1 and FR 2 ranges
- Discuss the 5G network Architecture, roaming scenarios and interworking.
- Understand the process of registration, PDU connection 5G NR voice signaling
- Discuss the 5G planning concepts and also discuss the radio Resource Management procedure
- Discuss basic 5G KPI's

**COURSE OBJECTIVE:**

This Course covers the 5G technology starting from the basics to Intermediate to advanced level. The student will learn about the standardization, Air interface, Planning, Different interworking Procedures, KPI and much more. This course bring you an end to end.

**WHO SHOULD ATTEND:**

This course is designed to provide a in-depth knowledge about the 5G procedures so telecommunications professionals, network professionals and others who plan to work and gain knowledge in 5G wireless network can come on board.

**TARGET AUDIENCE:**

RF/RAN/Core Engineers, Cloud Admin., 5G Planners and Optimizers.

**INSTRUCTIONAL METHODS:**

Lectures in Classroom, Virtual Classroom trainings, discussion, Questions & Answers. All participants will also receive comprehensive course materials.

**COURSE OUTLINE :**

**1. 5G : The Next Generation Wireless Technology**

**1.1 Introduction to the Evolution of Generations.**

**1.2 5G Use Cases**

**1.3 IMT- 2020 Mission**

**1.4 Key features of the 5G**

1.4 a) Peak data rates





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- 1.4 b) URLLC and MTC
- 1.4 c) Wider bandwidths
- 1.4 d) Network capacity expansion

### 1.5 Air interface Technological evolution

### 1.6 Future Wireless challenges

### 1.7 New Applications – IoT

## 2. 5G NR – Architecture and Protocols

### 2.1 Radio spectrum

### 2.2 Architecture of 5G

### 2.3 5G NR Functions

### 2.4 Protocol Layers

### 2.5 5G Numerology

## 3. Understanding 5G Spectrum Allocation by ITU

### 3.1 5G Spectrum

### 3.2 5G standardization

### 3.3 5G NR frequency bands and bandwidth

### 3.4 Spectrum sharing and flexible spectrum use

### 3.5 Bandwidth Part configuration

## 4. High Speed Downlink Packet Access

### 4.1 Radio spectrum

### 4.2 Architecture of 5G

### 4.3 5G NR Functions

### 4.4 Protocol Layers

### 4.5 5G Numerology

## 5. Beamforming Concepts in 5G

### 5.1 G Beamforming principles

### 5.2 Multi-user MIMO

### 5.3 Beamforming Types (Digital, analog, and hybrid) and difference

### 5.4 Beam management procedure

## 6. 5G NR Initial Access Procedure

### 6.1 PRACH - Preambles and their formats

### 6.2 UE Synchronization process in Uplink

### 6.3 Cell search & PLMN Selection Procedure

### 6.4 Downlink Synchronization process

## 7. 5G NR Radio Resource Management

### 7.1 5G Bearer Configuration & Admission Control

### 7.2 NR Power Control

### 7.3 5G Adaptive Modulation and Coding

### 7.4 NR Scheduling Parameters

## 8. Introduction to 5G Planning

### 8.1 5G planning basics

### 8.2 Link budget Analysis

### 8.3 Initial Parameter Planning

## 9. 5G NR Channel foundation and parameters

### 9.1 Overview Logical, Transport and Physical Channels

### 9.2 Downlink Channels

### 9.3 Uplink Channels

### 9.4 Reference Signals

### 9.5 Channel Processing

#### 9.5 a) Cell Search

#### 9.5 b) Random Access Procedures





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**10. VoNR Fundamentals**

**10.1 Registration and connection management**

**10.2 RM state Model in AMF**

**10.3 5GS Connection management States**

10.3 a) CM-idle

10.3 b) CM-Connected State

10.3 c) CM- Connected state with RRC Inactive State

**10.4 SMS over NAS**

**10.5 Emergency services**

**11. 5G Interworking Principles**

**11.1 4G – 5G Interworking**

**11.2 RAN Level Interworking**

**11.3 Core level Interworking**

**11.4 Interworking with EPC**

**11.5 Inter working with EPC with N26**

**Interface**

**11.6 Inter working with EPC without N26**

**Interface**

11.6 a) Interworking with WLAN

**12. 5G NR KPI (3GPP)**

**12.1 Introduction**

**12.2 5G Use case**

**12.3 5G IMT 2020 vs IMT Advance**

**12.4 User Requirements**

**12.5 5G Key Performance Indicators**

12.5 a) Accessibility

12.5 b) Integrity

12.5 c) Utilization

12.5 d) Availability

12.5 e) Retainability

12.5 f) Reliability

**13. 5G NR E2E Signaling**

**13.1 5G NR Layer 2 Air interface between UE and GNB**

**13.2 5G L2 Channels - RRC Signaling**

**13.3 SDAP Sublayer**

**13.4 PDCP Sublayer**

**13.5 RLC Sublayer**

**13.6 MAC Sublayer**

**13.7 Physical Layer**

**13.8 5G Protocol Layers**

**13.9 CP &UP Traffic with 5GC Traffic**

**14. 5G Network Virtualization**

**14.1 NFV Overview**

**14.2 Virtualization Concepts**

**14.3 NFV Architecture**

**14.4 NFV as a service**

**14.5 NFV Application in 5G**

**14.4 Case study**

**15. 5G NR Drive Test Optimization**

**15.1 Introduction to Drive test**

**15.2 Type of Drive test**

**15.3 Drive test process Steps**

**15.4 5G NR DT parameters**

**15.5 Typical Optimization Solution**

**15.6 Initial KPI Check**

**15.7 Case study**





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**Evaluation and feedback  
of the participants**

Maximum number of participants: N/A

Duration: 24 + Hours



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