NR Radio Access Network 2019

Training Programs

Catalog of Course Descriptions

Catalog of Course Descriptions

Ericsson AB
Global Services
SE-164 80 Stockholm
Telephone: +46 10 719 0000
www.ericsson.com/ourportfolio/services/learning-services

Introduction

Ericsson has developed a comprehensive Training Programs service to satisfy the competence needs of our customers, from exploring new business opportunities to expertise required for operating a network. The Training Programs service is delineated into packages that have been developed to offer clearly defined, yet flexible training to target system and technology areas. Each package is divided into flows, to target specific functional areas within your organization for optimal benefits.

Service delivery is supported using various delivery methods including:

Delivery Method
Instructor Led Training (ILT)
Web-based Learning (WBL)
Blended Learning/Training (BLD)

Ericsson AB
Global Services
SE-164 80 Stockholm
Telephone: +46 10 719 0000
www.ericsson.com/ourportfolio/services/learning-services

5G Overview

LZU1082613 R4A

Description:

Do you want to know Ericsson's 2020 Vision for 5G and the Networked Society? In this course we give you an overview of the road to 5G, including LTE Evolution and the new Radio Access Technology planned for 5G. We also have a look at the use cases that drive the 5G development and the technology areas that will enable 5G.

Learning situation:

This is an Instructor-Led Training.

This course is based on theoretical instructor-led lessons.

Learning objectives:

On completion of this course the participants will be able to:

1 Give an overview of the 2020 vision for the Networked Society and 5G
1.1 Describe the Networked Society
1.2 Describe the NGMN use case categories
1.3 Describe Ericsson's engagement and involvement in standardization and 5G programs
1.4 List some of the industry and academic partners
1.5 Give an overview of 5G work within METIS, 5G PPP, ITU and 3GPP
1.6 Define the scope of 5G

2 Describe proposals, solutions and architecture of 5G Radio Access Network
2.1 Describe the Technology Areas that enable 5G
2.2 Describe the LTE Evolution and 5G Plug-ins
2.3 Give an overview of the NR radio access technology
2.4 Describe the flexible numerology
2.5 Describe the flexible infrastructure
2.6 Describe the concept of Cloud Infrastructure and the impact on hardware and RAN Management

3 Describe the proposals, solutions and architecture for 5G Core network
3.1 Give an overview of the core network solutions for 5G
3.2 Describe the different options for NR Non-Stand-Alone (NSA)
3.3 Explain on an overview level the NFV/SDN and management infrastructure

Target audience:

This course is suitable for anyone who is required to be familiar with 5G.

Prerequisites:

Successful completion of the following courses:

General telecom basics is required.
"LTE/SAE Overview" equivalent knowledge is desirable, but not mandatory.

Duration and class size:

The length of the course is 1 day and the maximum number of participants per session is 16.

Ericsson AB
Global Services
SE-164 80 Stockholm
Telephone: +46 10 719 0000
www.ericsson.com/ourportfolio/services/learning-services

5G RAN Concepts - WBL

LZU1082568 R1A

Description:

Are you aware of what 5G could mean and the fundamental radio concepts associated with the new radio access? What do the key terms like "flexible numerology" and "dynamic TDD" mean? Besides, how would the use case fixed wireless access work in a 5G network? Join the instructor as he guides you through these questions in a self-paced module 5G RAN Concepts.

Learning situation:

This is a Web-Based Learning.

This is a self-paced interactive learning with multimedia content, delivered online.

Learning objectives:

On completion of this course the participants will be able to:

1 Follow the evolution of technology and the requirements as we enter 5G
1.1 Recognize the current technology scenario driving the network evolution
1.2 Examine the requirements to fulfil the wide range of use cases enabled by the networks of the future
1.3 Identify the deployment scenarios and phases
1.4 Review the RAN evolution
1.5 List migration and architecture options
1.6 Clarify the architecture design principles: enablers and drivers
1.7 List NR architecture components
1.8 Illustrate the split architecture and the dual connectivity concepts

2 Describe the primary key technology areas of 5G RAN
2.1 Recall radio's man purpose and evolution milestones
2.2 Identify the key radio technology areas
2.3 Analyze key radio principles and concepts like Massive MIMO, beamforming, Ultra Lean Design & Dynamic TDD
2.4 Describe trials sample test areas
2.5 Demonstrate Radio concepts with trial results

3 Examine the Use Case Fixed Wireless Access
3.1 List Use Case families
3.2 Explain how use cases are mapped to network slice types
3.3 Review Fixed Wireless Access drivers, enablers and challenges
3.4 List key performance findings for FWA

Target audience:

This course is suitable for anyone who is required to have technical overview knowledge of 5G/NR RAN.

Prerequisites:

Successful completion of the following courses:

5G Overview (LZU1082613)

Duration and class size:

The length of the course is approximately 2 hours.

Ericsson AB

Global Services

SE-164 80 Stockholm

Telephone: +46 10 719 0000

www.ericsson.com/ourportfolio/services/learning-services

5G RAN NR - System Techniques

LZU1082802 R1A

Description:

Are you interested in Ericsson's view on the new radio (NR) technology for 5G? If so, this course will give you a technical overview of the NR radio interface details and signaling flows, as well as the architecture and mobility management for NR stand-alone (SA) and non-standalone (NSA). This course will definitely boost your competence and understanding of Ericsson 5G solution.

Learning situation:

This is a Web-Based Learning.

This is a self-paced interactive learning with multimedia content, delivered online.

Learning objectives:

On completion of this course the participants will be able to:

1 Give an overview of the concepts of 5G
1.1 Describe the 3GPP standardization for NR
1.2 Explain the 5G use cases
1.3 Explain the overall 5G Architecture and terminology

2 Explain Ericsson’s view on the 5G RAN Architecture
2.1 Describe nodes and interfaces
2.2 Describe the Dual Connectivity architecture and options

3 Describe the higher layers of NR
3.1 Describe the L3 signaling basics (RRC, signaling flows)
3.2 Explain the NR cell concept
3.3 Explain the functions of SDAP, PDCP, RLC and MAC such as Scheduling, Fast HARQ
3.4 Explain QoS in 5G

4 Describe the physical layer procedures and key principles
4.1 Describe the Time domain structure, FDD, Dynamic TDD, OFDM, CP and Flexible Numerology
4.2 Explain the concept of Ultra Lean Design
4.3 Describe Physical layer procedures for control, e.g SSB transmission, initial access and signaling
4.4 Describe Physical layer procedures for data, e.g. resource allocation in frequency and time domains, scheduling, link adaptation and reference signals

4.5 Describe Massive MIMO, spatial multiplexing, SU-MIMO, MU-MIMO, high gain beamforming, CSI Acquisition, Grid of Beams and beam management

5 Explain Mobility Management
5.1 Explain the L3 mobility for Idle, Dormant and Connected mode
5.2 Explain multi-connectivity and interworking with LTE

Target audience:

This course is suitable for anyone who is required to have a technical overview of NR radio access network, also referred to as '5G RAN' .

Prerequisites:

Successful completion of the following courses:

Successful completion of the following courses:
LTE Foundation for 5G - LZU1082648 (or equivalent strong LTE knowledge)
5G Overview - LZU1082613

Duration and class size:

The length of the course is approximately 12 hours.

Ericsson AB
Global Services
SE-164 80 Stockholm
Telephone: +46 10 719 0000
www.ericsson.com/ourportfolio/services/learning-services

5G RAN NR Air Interface

LZU1082750 R2A

Description:

The "5G RAN NR Air Interface" course explores the radio technology involved in 5G RAN New Radio (NR) and the physical layers procedures, from initial access to resource allocation and beamforming for data transmissions. It provides detailed descriptions and explanations of the radio interface channel structure, the concepts of OFDM (Orthogonal Frequency Division Multiplexing), resource allocation, control signaling, channel coding, frame structure, slot structure, FDD, TDD, system information, Massive MIMO (Multiple Input Multiple Output) are detailed.

This course requires solid LTE radio interface knowledge (see pre-requisites).

Learning situation:

This is a Blended Learning.

The WBL component(s) is self-paced interactive learning with multimedia content, delivered online and the ILT component is based on theoretical instructor-led lessons.

Learning objectives:

On completion of this course the participants will be able to:

1 Describe the general 5G concepts and use cases (Covered through the WBL.)
1.1 Describe the evolution of cellular networks
1.2 Summarize the evolution of 3GPP releases, from Rel 99 to Rel 15
1.3 Describe the flexible spectrum usage

2 Explain the NR general physical layer structure
2.1 Detail the channel structure of the radio interface and relate to LTE
2.2 Explain the NR Cell concept and relate to LTE
2.3 Have a good understanding of the OFDM principle, signal generation and processing
2.4 Explain the flexible numerology and the reasons behind it
2.5 Explain the concepts of channel coding and FEC (Forward Error Correction)
2.6 Detail the slot structure
2.7 Explain the bandwidth part (BWP) concept

3 Detail the physical layer procedures for control signaling
3.1 Detail the structure of sync signals and reference signals related to control plane
3.2 Explain the cell search procedure and SS/PBCH block sweeping
3.3 Explain the random access preamble formats and initial beam establishment
3.4 Detail the downlink control signaling and DCI formats

3.5 Detail the uplink control signaling and the PUCCH formats
3.6 Describe power control and transmit timing control

4 Detail the physical procedures for user data transmissions
4.1 Detail the reference signals related to user plane transmissions (DMRS, CSI-RS, TRS, PTRS, SRS)
4.2 Explain Type A and Type B transmissions
4.3 Explain HARQ codebook principles and Code Block Group (CBG) based retransmissions
4.4 Describe UL and DL scheduling principles and resource allocation in frequency and time domains
4.5 Explain link adaptation principles
4.6 Describe LDPC channel coding

5 Describe the general concepts of Massive MIMO beamforming and spatial multiplexing
5.1 Describe the concepts of channel rank, transmission rank, precoding and layers as well as codebook-based vs non-codebook based transmissions
5.2 Explain SU-MIMO and MU-MIMO and relate it to different CSI acquisition methods
5.3 Describe Grid of Beams (GoB) concept
5.4 Compare analog and digital beamforming
5.5 Explain beam management

Target audience:

This course is suitable for anyone who is required to have detailed knowledge of NR radio interface.

Prerequisites:

Successful completion of the following courses:

LTE Foundation for 5G, LZU1082648
5G Overview, LZU1082613

Duration and class size:

The length of the course is 2 days (ILT) and 1 hour (WBL) and the maximum number of participants is 16.

Ericsson AB
Global Services
SE-164 80 Stockholm
Telephone: +46 10 719 0000
www.ericsson.com/ourportfolio/services/learning-services

5G RAN NR Coverage and Capacity Dimensioning

LZU1082803 R1A

Description:

How is coverage and capacity dimensioning performed for the 5G RAN New Radio (NR) network? What are the concepts that determine the coverage and capacity of a NR cell? How does dimensioning with Advanced Antenna Systems (AAS) differ from Conventional panel antennas? This 5G RAN NR Coverage and Capacity Dimensioning course explains the NR coverage and capacity dimensioning process used by Ericsson. The attendees will be guided through this process with the aid of an example calculation for a Mobile Broadband service.

Learning situation:

This is an Instructor-Led Training.

This course is based on theoretical instructor-led lessons.

Learning objectives:

On completion of this course the participants will be able to:

1 Give and overview of the Ericsson 5G RAN NR Coverage and Capacity dimensioning process
1.1 Explain the 5G RAN NR dimensioning concepts and terminology
1.2 Describe the factors that contribute to signal attenuation in the 5G RAN
1.3 Explain the basic time and frequency domain structure of the 5G RAN Air Interface

2 Perform 5G RAN NR coverage and capacity dimensioning
2.1 Perform a simple 5G RAN NR uplink calculation
2.2 Describe the Ericsson 5G RAN NR downlink dimensioning process
2.3 Perform a simple 5G RAN NR downlink calculation
2.4 Explain the 5G RAN NR Control Channel coverage is evaluated
2.5 Perform a simple 5G RAN NR Control Channel coverage calculation
2.6 Describe the Ericsson 5G RAN NR uplink dimensioning process

3 Explain the Ericsson 5G RAN NR hardware
3.1 Describe the 5G Non Stand Alone Deployment options
3.2 Explain the capacities of the Baseband and radio Hardware used for 5G NR

Target audience:

This course is suitable for anyone who is required to have detailed knowledge of planning and dimensioning a NR radio network, typically Service Planning Engineers, Service Design Engineers and Network Design Engineers.

Prerequisites:

Successful completion of the following courses:

Successful completion of the following courses:
5G Overview, LZU1082613
5G RAN Concepts, LZU1082658
5G RAN NR Air Interface, LZU1082750
5G RAN NR Protocols and Procedures, LZU1082748
5G RAN NR N19 Functionality, LZU1082804

Duration and class size:

The length of the course is 2 days and the maximum number of participants per session is 16.

Ericsson AB
Global Services
SE-164 80 Stockholm
Telephone: +46 10 719 0000
www.ericsson.com/ourportfolio/services/learning-services

5G RAN NR N19 Functionality

LZU1082804 R1A

Description:

Do you want to have detailed understanding of the Ericsson 5G NR 2019.Q2 functionality? If so, this course will give you that, including 5G RAN Non-Stand-Alone (NSA) EN-DC features, configuration and performance.
This course describes the Idle Mode Behavior, how Radio Link Failure is carried out, settings and functions as well as Link Adaptation and Scheduling and NSA mobility behavior.

Learning situation:

This is an Instructor-Led Training.

This course is based on theoretical instructor-led lessons.

Learning objectives:

On completion of this course the participants will be able to:

1 Explain the logical architecture of 5G RAN and introduce Radio Functionality
1.1 Explain the NR release strategy
1.2 Describe the EN-DC Architecture
1.3 List the Radio Functionality supported in the Ericsson 5G RAN

2 Describe the purpose and function of Idle Mode Behavior
2.1 Describe the system information structure

3 Explain the purpose and function of Radio Link Monitoring
3.1 Explain how the Radio Link Monitoring is carried out
3.2 Explain how in-synch and out-of-synch is determined by the radio link monitoring algorithm in the RBS
3.3 Describe the Beam Recovery procedure

4 Describe the use of Power Control, Link Adaptation and Scheduling
4.1 Explain the interaction between Link Adaptation and Scheduling
4.2 Explain open loop power control for initial access
4.3 Describe SU-MIMO

5 Explain the concepts of 5G RAN NSA Mobility
5.1 Detail what type of events trigger measurement reports to be sent to the RBS
5.2 Explain IF and IRAT mobility
5.3 Detail the NSA mobility

Target audience:

This course is suitable for anyone who is required to have detailed knowledge of NR N19 functionalities.

Prerequisites:

Successful completion of the following courses:

LTE Foundation for 5G, LZU1082648
5G Overview, LZU1082613
5G RAN NR Air Interface, LZU1082750
5G RAN NR Protocols and Procedures, LZU1082748

Duration and class size:

The length of the course is 2 days and the maximum number of participants per session is 16.

Ericsson AB
Global Services
SE-164 80 Stockholm
Telephone: +46 10 719 0000
www.ericsson.com/ourportfolio/services/learning-services

5G RAN NR Performance Management

LZU1082805 R1A

Description:

How are gNodeB counters used to monitor the performance of the 5G RAN NR network? How are these counters collected and stored? What are the Key Performance Indicators (KPI) for the 5G RAN NR network? What are the parameters that influence these KPIs? What is contained in the NR Cell Trace and how is it handled by the Ericsson Network Manager (ENM)? This 5G RAN NR Performance Management course will allow students to become familiar with using gNodeB counters to create KPI formulas to measure the Accessibility, Retainability, Integrity and Availability performance in the non-Stand Alone (NSA) 5G RAN NR network. Through practical exercises they will learn how to use the ENM to collect counters from the gNodeB and setup and decode NR Cell Trace recordings. They will also use the Advanced MO Scripting (AMOS) tool to display counter values and KPIs on the gNodeB.

Learning situation:

This is an Instructor-Led Training.

This course is based on theoretical and practical instructor-led lessons given in a technical environment using equipment and tools.

Learning objectives:

On completion of this course the participants will be able to:

1 Explain the 5G RAN NR Performance Management solution
1.1 Explain E-UTRA NR Dual Connectivity (EN-DC) network observability concepts
1.2 Describe how gNodeB counters are collected and stored
1.3 Describe the gNodeB counter types and structures
1.4 Explain briefly the 5G RAN NR network Quality of Service concepts

2 Measure NR NSA Accessibility performance
2.1 Explain the EN-DC Setup procedure
2.2 Use eNodeB counters to measure the Initial E-RAB Establishment Success Rate
2.3 Describe the non-Stand Alone (NSA) Random Access procedure
2.4 Use counters to measure the Random Access in the gNodeB and eNodeB
2.5 Use counters to measure the EN-DC Setup Success Rate in the gNodeB and eNodeB
2.6 Explain the parameters that influence the NR NSA Accessibility performance

3 Measure NR NSA Retainability performance
3.1 Explain the counters what defines an abnormal release in NR NSA
3.2 Use counters to measure the E-RAB Retainability in the gNodeB and eNodeB
3.3 Explain the parameters that influence the NR NSA Retainability performance

4 Measure NR NSA Integrity performance
4.1 Explain the counters that are used to measure NR NSA Integrity
4.2 Use counters to measure the downlink throughput for EN-DC UEs
4.3 Use counters to measure the uplink throughput for EN-DC UEs
4.4 Explain the parameters that influence the NR NSA Integrity performance

5 Measure NR NSA Availability performance
5.1 Explain the counters that are used to measure NR NSA Availability
5.2 Use counters to measure NR NSA Cell Availability
5.3 Explain the parameters that influence the NR NSA Availability performance

6 Explain what is collected by NR Cell Trace recordings
6.1 Explain briefly how NR Cell Trace recordings are collected and stored

7 Use ENM to handle NR statistics and Cell Trace recordings
7.1 Initiate a new subscription profile in PMIC
7.2 Describe and use the KPI Management application in ENM
7.3 Use the ENM PM Event File Decoder to decode NR Cell Trace recordings

8 Use AMOS for 5G RAN NR Performance Management
8.1 Open an AMOS session
8.2 Use AMOS to perform basic Performance Management operation in the gNodeB

Target audience:

This course is suitable for anyone who is required to understand and work with performance management in a 5G RAN environment, namely Service Planning Engineer, Service Design Engineer, Network Design Engineer, System Engineer, Service Engineer.

Prerequisites:

Successful completion of the following courses:

5G Overview, LZU1082613
5G RAN Concepts, LZU1082658
5G RAN NR Air Interface, LZU1082750
5G RAN NR Protocols and Procedures, LZU1082748
5G RAN NR N19 Functionality, LZU1082804

Duration and class size:

The length of the course is 3 days and the maximum number of participants per session is 8.

Ericsson AB
Global Services
SE-164 80 Stockholm
Telephone: +46 10 719 0000
www.ericsson.com/ourportfolio/services/learning-services

5G RAN NR Protocols and Procedures

LZU1082748 R2A

Description:

Do you need to know what procedures are triggered in the 5G RAN and how? What messages are exchanged among the RAN and core nodes? And which protocols are used to implement them? This course provides an in-depth understanding of the various protocols and procedures in the 5G RAN. It looks into the overall 5GS and EPS architectures, the functionalities of each node and the interfaces interconnecting them. It details how Quality of Service and the different levels of security are implemented in 5G RAN. Focus is given on the functions and services provided by various L3 signaling protocols, NAS and RRC, and the different L2 transport protocols, PDCP, RLC and MAC. It provides a thorough discussion on the Attach procedure and the different types of mobility and dual-connectivity possibilities in 5G RAN.

Learning situation:

This is an Instructor-Led Training.

This course is based on theoretical instructor-led lessons.

Learning objectives:

On completion of this course the participants will be able to:

1 Explain the 5GS Protocol Architecture
1.1 Distinguish between the different EPS and 5GS protocol types
1.2 Explain the EPS and 5GS architecture, interfaces and logical functions
1.3 Describe the split architecture
1.4 Explain Non-Standalone / EN-DC and Standalone NR deployment

2 Explain Security and Evolved Quality of Service in 5G RAN
2.1 Explain Authentication and Key Agreement Procedure
2.2 Detail Radio Access Security
2.3 Describe Transport Network Security
2.4 Explain QoS Flows and NR Data Radio Bearers
2.5 Describe Reflective Quality of Service

3 Explain the various L3 Signaling Protocols
3.1 List the functions of the Non-Access Stratum (NAS) protocol
3.2 Describe the different procedures in the NAS layer
3.3 Explain the interaction between Radio Resource Control (RRC) and the lower layers in the control plane
3.4 Distinguish the RRC connected, inactive and idle UE states
3.5 Detail the functions and services of RRC

3.6 List the main functions and procedures of XnAP signaling protocol
3.7 List the main functions and procedures of NGAP signaling protocol

4 Explain the L2 transport protocols SDAP, PDCP, RLC, MAC and GTP-U Protocols
4.1 Describe the SDAP functions in the user plane
4.2 Explain the PDCP functions and highlight the improvements from LTE
4.3 Explain the RLC functions and highlight the improvements from LTE
4.4 Describe the different RLC modes
4.5 Explain the MAC functions and highlight the improvements from LTE
4.6 Describe the contents of the SDAP, PDCP, RLC and MAC Packet Data Unit
4.7 Explain the main functions and procedures of the transport protocol GTP-U

5 Explain Mobility and Dual Connectivity in 5G
5.1 Describe Inactive and Idle mode mobility in Standalone and Non-Standalone NR
5.2 Detail the bearer type transitions in Non-Standalone NR
5.3 Explain Dual Connectivity mobility
5.4 Explain connected mode mobility in Standalone NR
5.5 Explain IRAT handover

Target audience:

This course is suitable for anyone who is required to have a detailed knowledge of signaling procedures in 5G RAN, like Service Design Engineer, Network Design Engineer, Service Engineer.

Prerequisites:

Successful completion of the following courses:

LTE Foundation for 5G, LZU1082648
5G Overview, LZU1082613
5G RAN NR Air Interface, LZU 1082750

Duration and class size:

The length of the course is 3 days and the maximum number of participants per session is 16.

Ericsson AB
Global Services
SE-164 80 Stockholm
Telephone: +46 10 719 0000
www.ericsson.com/ourportfolio/services/learning-services

5G RAN Operation and Configuration

LZU1082806 R1A

Description:

Are you ready for a 5G/NR radio access network? What are the features and functionalities of the new 5G RAN? How will the configuration of transport and radio network managed objects look like for the 5G nodes compared to 4G? Which are the tools (user interfaces) that could be used to manage RAN nodes? How would one handle Configuration, Performance, Security and Fault management operations for a 5G/NR NSA (non-standalone) RAN?

"5G RAN Operation and Configuration" provides the answers to all the questions above. The course includes theoretical sessions where what need to be configured are described and investigated, followed by practical exercises in which the configurations are made.

The course introduces the RAN Compute portfolio [also known as (or associated with) “Baseband /Radio Node], and its features and characteristics. After the course, participants will be familiar with integration procedure, the managed objects that are configured according to the Ericsson Common Information Model (ECIM). The NR NSA interfaces (with and without IPSec) including basic radio network configuration for LTE/NR are defined during the training. The students also get hands-on experience with ENM (in the areas of Fault/ Software/ Configuration/ Performance/Security Managements) on a RAN compute unit (Baseband) deployed in a LTE/eNodeB and NR/gNodeB (19.Q2 software) environment.

Learning situation:

This is a Blended Learning.

The WBL component is self-paced interactive learning with multimedia content, delivered online and the ILT component is based on theoretical and practical instructor-led lessons given in a technical environment using equipment and tools.

Learning objectives:

On completion of this course the participants will be able to:

1 Explain NR RAN Architecture and network evolution strategy with 5G.
1.1 Explore the 5G targets, use cases and deployment scenarios (NSA and SA).
1.2 Explain Ericsson's 4G and 5G RAN deployment options (D, C, E and V-RAN).
1.3 List the main building blocks in Ericsson Radio System and E2E offering for RAN evolution
1.4 Describe 5G/NR product (RAN compute (Baseband) & AIR) capabilities and how they will be deployed across the network.

1.5 Explore 5G/NR Operation and Management options with RAN compute products and ENM application.

2 Describe the 5G/NR transport network functionalities and MOM in RAN Compute (Baseband) products.
2.1 Describe the interfaces and protocols in 5G/NR NSA and SA (stand-alone) architecture.
2.2 List the transmission capabilities for RAN Compute products.
2.3 Relate the IP and Ethernet functionalities of RAN Compute to the 5G/NR RAN transport network.
2.4 List out the different synchronization options for 5G/NR NSA deployment.
2.5 Explain in brief ECIM and recognize the Managed Objects related to transport network.

3 Explain the 5G/NR Radio Network Functionality in NSA deployment scenario.
3.1 Explain the concept of split architecture, Dual Connectivity and NR Cell.
3.2 Recognize the L1, L2 and RRM differences between 5G/NR and LTE.
3.3 Relate the Managed Objects related to 5G/NR radio network configuration.
3.4 Explain EN-DC (E-UTRAN New Radio – Dual Connectivity) leg setup/release, transmission modes and mobility scenarios in NSA deployment.
3.5 Edit and implement the files for integration that would create the radio network in an gNodeB and eNodeB.

4 Describe the Integration, Operation and Management aspects of 5G/NR NSA network using ENM.
4.1 Explain the possible External Management interfaces and login option to the RAN compute nodes.
4.2 Describe in brief the Integration process for eNodeB and gNodeB with ENM.
4.3 Explain the configuration files that are used in the 5G/NR NSA integration.
4.4 List and review the ENM applications used for Operation and Configuration of 5G/NR
4.5 Demonstrate with exercises the Configuration Management, Performance Management and Fault Management of 5G/NR NSA network.
4.6 Explain Security Management in 5G/NR NSA deployment.

Ericsson AB
Global Services
SE-164 80 Stockholm
Telephone: +46 10 719 0000
www.ericsson.com/ourportfolio/services/learning-services

Target audience:

This course is suitable for anyone who is required to configure and operate a NSA-based NR radio access network.

Prerequisites:

Successful completion of the following courses:

LTE/SAE System Overview, LZU1087020
5G Overview, LZU1082613
Ericsson Radio System Overview, LZU1089991
5G RAN NR - System Techniques, LZU1082802

Duration and class size:

The length of the course is 2 days and 2 hours and the maximum number of participants is 8

Ericsson AB
Global Services
SE-164 80 Stockholm
Telephone: +46 10 719 0000
www.ericsson.com/ourportfolio/services/learning-services

5G RAN Transport Solution and Design Overview

LZU1082661 R1A

Description:

The course covers the basic 5G architecture, technical concepts and functionality for transport networks.

Learning situation:

This is an Instructor-Led Training.

This course is based on theoretical instructor-led lessons.

Learning objectives:

On completion of this course the participants will be able to:

1 Describe the basic concepts, drivers, architecture and deployment scenarios for 5G

2 Describe the transport functionality in Baseband
2.1 Physical port capability
2.2 Layer 2/Layer 3 capabilities
2.3 QoS
2.4 Performance monitoring including TWAMP
2.5 Troubleshooting

3 Describe Ericsson's backhaul product portfolio
3.1 Baseband
3.2 Router 6000
3.3 Fronthaul 6000
3.4 MINI-LINK

4 Describe the RAN security solution
4.1 Transport and OAM Security
4.2 Node hardening
4.3 Certificate management

5 Describe the synchronization solution
5.1 Frequency, and time and phase
5.2 Synchronization options for NR NSA: PTP and GNSS
5.3 Synchronization reference solutions

6 Describe the NR NSA Transport Network Dimensioning method

7 Describe the 5G NR NSA connectivity reference solutions

Target audience:

This course is suitable for anyone who is required to be familiar with 5G RAN Transport Solution and Design.

Prerequisites:

Successful completion of the following courses:

5G Overview

Duration and class size:

The length of the course is 1 day and the maximum number of participants per session is 16.

Ericsson AB
Global Services
SE-164 80 Stockholm
Telephone: +46 10 719 0000
www.ericsson.com/ourportfolio/services/learning-services

AIR/AAS Operation, Configuration and Troubleshooting

LZU1082655 R3A

Description:

The "AIR/AAS Operation, Configuration and Troubleshooting" course gives a detailed knowledge on the operation and maintenance aspects related to the AIR products from Ericsson's Advanced Antenna System (AAS) portfolio.
During the course, participants learn how Antenna Integrated Radio (AIR) is implemented in LTE and NR Networks, and the associated differences in operation of the 5G NSA networks, using AIR 6468,3246 in 5G Plugin LTE deployments ,6488(Mid band) and 5121,5322,1281,6701 (high band) NR deployments. The course also introduces the basic MIMO feature and functionality seen in Ericsson AIR FDD/TDD products.

Learning situation:

This is an Instructor-Led Training.

This course is based on theoretical and practical instructor-led lessons given in a technical environment using equipment and tools.

Learning objectives:

On completion of this course the participants will be able to:

1 Describe the need of AAS in 4G and 5G RAN deployment.
1.1 Explain the 5G Plugins, targets and technology areas.
1.2 Discuss the benefits and requirements of AAS product.
1.3 List the AIR products in Ericsson Radio System portfolio.

2 List and explain the features and functionality supported by AAS products.
2.1 Describe the general concepts of beamforming, diversity and spatial multiplexing.
2.2 Explain SU-MIMO and MU-MIMO concepts with corresponding features in LTE/NR RAN.
2.3 Describe interfaces and supported configurations for AIR 6468/6488 with Baseband.
2.4 List supported configurations for high band deployments with AIR 5121/5322 and 6701.
2.5 List the differences between C1 and C2-interface in various AAS configurations.

3 Describe the Managed Objects, parameters for Mid band/mm wave AIR products.
3.1 Explain the Managed Objects changes for AIR 6468/6488 compared to other radios.
3.2 Describe the synchronization and antenna calibration requirements for AIR TDD/FDD.
3.3 Explain integration procedure for NR NSA network with FDD/TDD AIR and baseband.

4 Describe the Configuration, Fault and Performance management for AIR/AAS products.
4.1 Identify the new counters and supported alarms specific to AIR 6468/6488/1281/5322.
4.2 List commands useful for AAS CM, FM, PM and health checks.

4.3 Follow a few troubleshooting use cases and recovery procedures for AIR 6468/6488.

Target audience:

This course is suitable for anyone who is required to configure/operate/maintain AIR /AAS products.

Prerequisites:

Successful completion of the following courses:

5G Overview (LZU1082613)
Ericsson Radio System Overview (LZU1089991)
5G RAN Operation and Configuration (LZU1082806)

Duration and class size:

The length of the course is 1 day and the maximum number of participants per session is 16.

Ericsson AB
Global Services
SE-164 80 Stockholm
Telephone: +46 10 719 0000
www.ericsson.com/ourportfolio/services/learning-services

Ericsson Radio System Overview

LZU1089991 R6A

Description:

Do you need to understand how Ericsson Radio System is a solution to the changing radio access needs towards the 5G? What are new products that have been introduced in Ericsson Radio System which will coexist with the existing products in Ericsson's radio access networks? The "Ericsson Radio System Overview" course provides the participants with a comprehensive overview of Ericsson's new packaging of the radio access network products in Ericsson Radio System.

Learning situation:

This is an Instructor-Led Training.

This course is based on theoretical instructor-led lessons.

Learning objectives:

On completion of this course the participants will be able to:

1 Discuss the evolution of the radio access network
1.1 Identify a typical existing site and its challenges to meet the future demands
1.2 List the requirements for the future networks with roadmap
1.3 Explain the multi-standard, multi-band and multi-layer solutions with Ericsson Radio System
1.4 Discuss how a typical Ericsson Radio System based site could look like

2 List the features of the baseband products
2.1 Identify and list the primary features of new Basebands and Radio Processors
2.2 Explain with use cases different baseband deployment configurations

3 Describe what Fronthaul is
3.1 Describe the different Fronthaul products suited for macro and small cell deployments
3.2 Explain the characteristics and products under DWDM and CWDM

4 Identify different Radio Products and their primary features
4.1 List the characteristics of the latest radio units including the 5G/NR radios that are available in Ericson Radio System
4.2 Explain the characteristics and advantages of the Antenna Integrated Radio (AIR) products
4.3 List the benefits of the new installation options and features introduced

5 Describe the wide range of Backhaul products for Outdoor and Indoor Scenarios
5.1 List the various Aggregation Units offered in Ericsson Radio System, and explain their usage
5.2 List the characteristics of the new products in Router 6000 Series
5.3 Match the new products in the Mini Link Portfolio to the Indoor and Outdoor usage

6 List the new enclosure and power options available under Ericsson Radio System Hardware
6.1 Describe the different Enclosure options and its Outdoor/indoor functionality
6.2 Identify Power System Solutions for Macro, Main remote and Hybrid configurations
6.3 Explain small cell implementation with the various Indoor Power Products
6.4 Discuss the Installation options and Configuration for the Power Products

7 Expand the products under Small cell portfolio and describe their features and benefits
7.1 List the characteristics of Micro RBS, Pico RBS and the Radio Dot System (RDS)

8 List and discuss the available Energy solution options under the Ericsson Radio System portfolio
8.1 Describe the various energy saving solutions implemented for a site deployment
8.2 Explain how Ericsson radio system products helps in reducing Total Cost of Ownership (TCO) and power consumption for the operator
8.3 Explain, with examples, how one can build energy-optimized networks

Target audience:

This course is suitable for anyone who is required to be familiar with Ericsson Radio System hardware and solutions.

Prerequisites:

Successful completion of the following courses:

LTE/SAE System Overview, LZU1087020
or
5G Overview, LZU1082613

Duration and class size:

The length of the course is 1 day and the maximum number of participants per session is 16.

Ericsson AB
Global Services
SE-164 80 Stockholm
Telephone: +46 10 719 0000
www.ericsson.com/ourportfolio/services/learning-services

LTE Foundation for 5G

LZU1082648 R2A

Description:

5G radio makes use of several LTE (Long Term Evolution) concepts, like channel structure, transmission techniques and protocols. Therefore, a good LTE understanding is required before learning 5G. This course provides that foundation knowledge and understanding of LTE.

The course is targeted to engineers who do not have the pre-requisite 4G knowledge to comprehend the 5G/NR radio. Besides, it also serves as a summary of the main LTE notions that are relevant in 5G too. It reveals the main concepts involved in E-UTRAN (Evolved UTRAN, also referred to as LTE), including L1 and L2 protocols, channels processing, scheduling principles, MIMO and mobility. Advanced LTE features, such as carrier aggregation, are also discussed.

After this course, students with no previous LTE knowledge should be able to take 5G radio training.

Learning situation:

This is an Instructor-Led Training.

This course is based on theoretical instructor-led lessons.

Learning objectives:

On completion of this course the participants will be able to:

1 Explain the LTE radio interface general principles
1.1 Show the evolution of cellular networks
1.2 Summarize the evolution of 3GPP releases, from release 99 to release 13
1.3 Detail the network architecture and node functions
1.4 Explain the ERAB concept and QoS in EPS
1.5 Detail the radio interface protocols
1.6 Describe the radio interface techniques
1.7 Describe the flexible spectrum usage
1.8 Explain the concepts of channel coding and FEC (Forward Error Correction)
1.9 Describe the principle for OFDM
1.10 Explain the time domain structure

2 Detail the downlink transmission technique and describe the radio interface structure and signaling

2.1 Detail the channel structure of the radio interface
2.2 Detail the downlink transmission technique
2.3 Have a good understanding of the OFDM principle, signal generation and processing
2.4 Describe the physical signals in DL
2.5 Detail the DL control signaling and formats
2.6 Detail the paging procedures
2.7 Explain the cell search procedure

3 Detail the uplink transmission technique
3.1 Have a good understanding of SC-FDMA principle, signal generation and processing
3.2 Detail the uplink physical channels
3.3 Detail the UL control signaling and the PUCCH formats
3.4 Detail the random access preamble formats
3.5 Describe Power Control and UL transmit timing control

4 Detail MIMO in LTE
4.1 Describe the general concepts of beamforming, diversity and spatial multiplexing
4.2 Describe the radio channel and antenna basics
4.3 Describe the concepts of channel rank, transmission rank, precoding and layers
4.4 List and explain the transmission modes in 3GPP Release 8-13
4.5 Explain SU-MIMO and MU-MIMO
4.6 Describe open loop and closed loop spatial multiplexing in LTE
4.7 Detail DL-SCH processing using MIMO

5 Explain the L2 transport protocols PDCP, RLC and MAC
5.1 Explain the PDCP functions and services such as header compression and ciphering
5.2 Explain the RLC functions.
5.3 List the different modes of RLC (transparent, unacknowledged, and acknowledged
5.4 Explain the MAC architecture and its entities
5.5 Detail the channel mapping between transport channels and logical channels
5.6 List the contents of the MAC Packet Data Unit (PDU)
5.7 Explain the MAC functions such as HARQ, Random Access and Time Alignment
5.8 Describe DL and UL scheduling process

6 Explain the concepts of LTE Mobility
6.1 List the difference between idle and connected mode mobility
6.2 Explain X2 and S1 Handover
6.3 Detail what type of events trigger measurement reports to be sent to the eNB
6.4 Explain Inter-Frequency (IF) and Inter-Radio Access Technology (IRAT) mobility

7 Describe the Scheduling mechanism in LTE
7.1 Explain DL Scheduling Process
7.2 Discuss the different scheduling strategies
7.3 Show how Logical Channel Group (LCG) is used
7.4 Describe the Channel Quality Indicator (CQI)
7.5 Explain UL Scheduling Process

Ericsson AB
Global Services
SE-164 80 Stockholm
Telephone: +46 10 719 0000
www.ericsson.com/ourportfolio/services/learning-services

7.6 Describe the Inter-Cell Interference Coordination (ICIC) algorithm

8 Describe the Carrier Aggregation, CoMP and Combined Cell
8.1 Explain how and why Carrier Aggregation is used in LTE
8.2 Explain how and why CoMP is used in LTE
8.3 Explain how and why Combined Cell are used in LTE

Target audience:

This course is suitable for anyone who is required to have detailed knowledge on the LTE radio and RAN technology, especially as a foundation to understand 5G radio.

Prerequisites:

Successful completion of the following courses:

A general knowledge in cellular systems and radio technology

Duration and class size:

The length of the course is 4 days and the maximum number of participants per session is 16.

Ericsson AB
Global Services
SE-164 80 Stockholm
Telephone: +46 10 719 0000
www.ericsson.com/ourportfolio/services/learning-services

Massive MIMO and Beamforming for 5G

LZU1082545 R3A

Description:

Are you interested in Ericsson's view on the Massive MIMO concept for 5G? If so, this course will give you a detailed insight of Massive Beamforming and Massive MIMO, as well as Beam Management for high-band.

If you have wondered how MIMO works and how it can multiply the data rate and spectral efficiency and increase coverage and capacity in LTE and NR, then you will get your answers in this course.

The attendees will learn how multiple antenna solutions will be implemented in LTE Evolution and 5G and how much the performance can increase.
The basic radio channel and antenna properties is explained and related to the multiple antenna processing. We will also look into how the higher frequencies (mmW) for 5G will influence the radio channel behavior and impact the design choices.
With the guidance of the instructor the mysteries of MIMO, spatial multiplexing, layers and data rate multiplication will be uncovered reducing wasted time back at work.

Learning situation:

This is an Instructor-Led Training.

This course is based on theoretical instructor-led lessons.

Learning objectives:

On completion of this course the participants will be able to:

1 Define the main principles and concept of MIMO
1.1 Explain the reason for multi-antenna processing
1.2 Describe the different methods of multi-antenna processing
1.3 Explain the different multi antenna possibilities
1.4 Describe the general concepts of beamforming, diversity and spatial multiplexing
1.5 Explain the concepts of MIMO

2 Explain the basic antenna and array antenna theory
2.1 Describe basic antenna properties
2.2 Explain polarization properties of antennas
2.3 Describe beamforming using an ULA (Uniform Linear Array)
2.4 Describe the function of larger antenna arrays
2.5 Explain the concepts of sub-arrays and arrays of sub-arrays

3 Explain the basic radio channel properties and spatio-temporal properties
3.1 Describe multi-path propagation
3.2 Describe time dispersion and delay spread
3.3 Explain the doppler effect
3.4 Explain coherence bandwidth and coherence time
3.5 Explain angular spread and its impact on antenna configuration
3.6 Explain polarization properties of the radio channel

4 Describe mmW propagation and how it differs from wave propagation at lower frequencies
4.1 Describe the frequency dependency and impact on spatio-temporal properties at mmW frequencies

5 Explain the concepts of precoding and spatial multiplexing
5.1 Describe the concept of spatial multiplexing
5.2 Explain the role of the precoder
5.3 Explain SDM/SDMA (Spatial Division Multiplexing/Multiple Access)
5.4 Define the concepts of channel rank, transmission rank and layers

6 Describe MIMO in LTE Rel 8-14
6.1 Define the concept of antenna ports
6.2 Describe the UE feedback (CSI, PMI, RI and CQI) in LTE
6.3 Describe open loop spatial multiplexing in LTE
6.4 Describe closed loop spatial multiplexing in LTE

7 Define Massive MIMO and massive beamforming
7.1 Describe spatial multiplexing, SU-MIMO, MU-MIMO and high gain beamforming using massive MIMO
7.2 Explain beam based CSI Acquisition and Grid of Beams concepts
7.3 Explain point beams and beam mobility
7.4 Describe Beam Management

8 Explain implementation aspects of massive MIMO
8.1 Describe the beamforming architecture

Ericsson AB
Global Services
SE-164 80 Stockholm
Telephone: +46 10 719 0000
www.ericsson.com/ourportfolio/services/learning-services

Target audience:

This course is suitable for anyone who is required to have detailed knowledge of Massive MIMO and Beamforming techniques in 5G/NR RAN.

Prerequisites:

Successful completion of the following courses:

LTE Foundation for 5G, LZU1082648
5G Overview, LZU1082613
5G RAN NR Air Interface, LZU1082750

Duration and class size:

The length of the course is 2 days and the maximum number of participants per session is 16.

Ericsson AB
Global Services
SE-164 80 Stockholm
Telephone: +46 10 719 0000
www.ericsson.com/ourportfolio/services/learning-services

RAN Architecture Evolution to 5G

LZU1082505 R3A

Description:

How would the radio access network (RAN) architecture evolve as Ericsson moves from 4G towards 5G? What is Ericsson Cloud RAN?
The course "RAN Architecture Evolution to 5G" highlights the architecture, benefits and requirements of the D-RAN, C-RAN, E-RAN and V-RAN. It emphasizes the benefits of coordination in the 5G RAN with features like Carrier Aggregation and Dual Connectivity. The course also describes the concepts of network slicing, split architecture and virtualization of the RAN. In short, the course keeps you up to date with Ericsson's implementation of the 4G and 5G Virtualized RAN, while also examining the evolution of the network.

Learning situation:

This is an Instructor-Led Training.

This course is based on theoretical instructor-led lessons.

Learning objectives:

On completion of this course the participants will be able to:

1 Describe the Ericsson Cloud RAN
1.1 List the 5G targets and technology areas
1.2 Discuss the benefits and requirements of the Distributed RAN (D-RAN), Centralized RAN (C-RAN), Elastic RAN (E-RAN) and Virtualized RAN (V-RAN)
1.3 Explain the ETSI Management and Orchestration Architecture

2 Explain the Distributed RAN and Centralized RAN Architecture
2.1 Describe the baseband coordination in the D-RAN and C-RAN
2.2 Identify the benefits and requirements of the D-RAN and C-RAN
2.3 Review the Carrier Aggregation and CoMP features
2.4 Describe the Ericsson RAN Compute portfolio

3 Describe the Elastic RAN Architecture
3.1 Explain the baseband elasticity and coordination in the E-RAN
3.2 Identify the benefits and requirements of the E-RAN
3.3 Describe TIF and its functionality in the E-RAN
3.4 Describe Carrier Aggregation and CoMP in E-RAN

4 Explain the Virtualized RAN Architecture in LTE and NR
4.1 Identify the benefits and enablers of the V-RAN
4.2 Discuss the split architecture and the logical functions of the PPF, RCF and RPF

4.3 Describe VRAN in the NSA architecture

Target audience:

This course is suitable for anyone who is required to have detailed knowledge in the changing RAN network architecture as we move into 5G.

Prerequisites:

Successful completion of the following courses:

LTE/SAE System Overview, LZU1087020
LTE L18/L19 Functionality, or equivalent knowledge is recommended
5G Overview, LZU1082613

Duration and class size:

The length of the course is 1 day and the maximum number of participants per session is 16..

Ericsson AB
Global Services
SE-164 80 Stockholm
Telephone: +46 10 719 0000
www.ericsson.com/ourportfolio/services/learning-services