Long Term Evolution LTE L11
Training Programs

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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:

<table>
<thead>
<tr>
<th>Icon</th>
<th>Delivery Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>![Person]</td>
<td>Instructor Led Training (ILT)</td>
</tr>
<tr>
<td>![People]</td>
<td>Seminar (SEM)</td>
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<td>![Laptop]</td>
<td>Workshop (WS)</td>
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<tr>
<td>![Screen]</td>
<td>Virtual Classroom Training (VCT)</td>
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<tr>
<td>![Screen2]</td>
<td>Web Based Learning/eLearning (WBL)</td>
</tr>
<tr>
<td>![Wave]</td>
<td>Structured Knowledge Transfer (SKT)</td>
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</table>

Delivery Enablers

- Remote Training Lab (RTL)
LTE L11 Access Transport Network Dimensioning

Description

Dimensioning the transport network in LTE (Long Term Evolution) is a challenge. Not only is all the traffic packet switched to its nature, LTE also provides very high peak rates that have to be taken care of by the backbone network. Also the RBS6000 hardware has to be dimensioned in such a way that it can handle the high baseband processing loads.

This course explains the methods of dimensioning the L11 version of the E-UTRAN nodes. Co-siting with WCMDA or GSM nodes is not covered in this version of the course, which means that the focus is on the actual RBS6000 for LTE and the dimensioning of the node hardware and the transport interfaces towards the SAE (System Architecture Evolved).

Learning objectives

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

1. **Describe the EPC Architecture**
   1.1 Describe the interfaces in EPS (Evolved Packet System)
   1.2 Describe the Evolved Packet Core (EPC)
   1.3 Describe the role of the MME, S-GW and PDN-GW
   1.4 Describe the EPS bearer and what traffic types and services can be expected in LTE L11

2. **Explain the IP Functionality of the L11 LTE RAN Transport Network**
   2.1 Explain how IP and Ethernet fit into the protocol layers in the LTE RAN.
   2.2 Explain the basic structure of an IP Packet and Ethernet frame.
   2.3 Explain IP concepts such as IPSec, MPLS, VLAN and routing and how they impact the dimensioning of the network.
   2.4 Explain how Quality of Service (QoS) is achieved using IP and Ethernet and how DSCP values are mapped to Pbit values.

3. **Perform link dimensioning in LTE L11**
   3.1 Explain terms and concepts related to dimensioning
   3.2 Describe the dimensioning process
   3.3 Perform Transport Network overhead calculations
   3.4 Perform last mile and mobile backhaul dimensioning

4. **Perform node dimensioning for RBS6000**
   4.1 Describe the RBS6000 hardware in LTE
   4.2 Dimension the RBS6000 hardware
Target audience

The target audience for this course is: Service Planning Engineer, Service Design Engineers, Network Design Engineer.

This audience is responsible for the dimensioning and design of the LTE Access Transport Network.

Prerequisites

Successful completion of the following courses:

<table>
<thead>
<tr>
<th>Course</th>
<th>Code</th>
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<tbody>
<tr>
<td>LTE L11 Air Interface</td>
<td>LZU1087897</td>
</tr>
<tr>
<td>LTE L11 Protocols and Procedures</td>
<td>LZU1087898</td>
</tr>
<tr>
<td>LTE L11 Radio Network Functionality</td>
<td>LZU1087899</td>
</tr>
<tr>
<td>LTE L11 Network Design</td>
<td>LZU1087900</td>
</tr>
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</table>

Duration and class size

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

Learning situation

This course is based on theoretical instructor-led lessons given in a classroom environment.

Time schedule

The time required always depends on the knowledge of the attending participants and the hours stated below can be used as estimate.

<table>
<thead>
<tr>
<th>Day</th>
<th>Topics in the course</th>
<th>Estimated time</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>EPC architecture and IP network overview</td>
<td>1 hour</td>
</tr>
<tr>
<td></td>
<td>IP Transport Network Functionality</td>
<td>2 hours</td>
</tr>
<tr>
<td></td>
<td>IP Link Dimensioning with Link Dimensioning exercise</td>
<td>2 hours</td>
</tr>
<tr>
<td></td>
<td>Node dimensioning with Node HW dimensioning exercis</td>
<td>1 hour</td>
</tr>
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</table>
LTE/SAE System Overview

Description
If you want to know what LTE/SAE (Long Term Evolution / System Architecture Evolution) is, this course will give you an overview of the new radio technology and protocols involved in the E-UTRAN (Evolved UTRAN, also referred to as LTE) and the architecture behind EPC (Evolved Packet Core, also referred to as SAE – System Architecture Evolution).
The course also provides descriptions of the CPP hardware platform, operation and maintenance and RBS hardware.

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

1. **Explain the background and architecture of E-UTRAN and EPC**
   1.1 Describe the evolution of cellular networks
   1.2 Summarize the evolution of 3GPP releases, from release 99 to release 8
   1.3 Explain the logical architecture of EPS (E-UTRAN and EPC)
   1.4 Describe briefly the features available in LTE
   1.5 Give an overview of the QoS framework

2. **Describe the EPC Architecture**
   2.1 Describe the interfaces in EPS
   2.2 Describe the Evolved Packet Core (EPC)
   2.3 Describe the role of the MME, S-GW and PDN-GW
   2.4 Describe the S1 (and X2) protocol stacks
   2.5 Explain the interaction with IMS on an overview level

3. **Describe the E-UTRAN principles**
   3.1 List the radio interface protocols
   3.2 Describe the radio interface techniques used in uplink and downlink
   3.3 Describe the channel structure of the radio interface
   3.4 Explain the OFDM principle and benefits
   3.5 Detail the reference symbols in UL & DL
   3.6 Describe the basic principles of MIMO
   3.7 Describe the RBS hardware in LTE

4. **Describe O&M (Operation and Maintenance) for EPS**
   4.1 Describe the impact of EPC on the Ericsson OSS-RC
   4.2 Explain the concepts related to Smart Simplicity, Self Organizing Networks (SON), RBS Auto-integration, Automated Neighbor Relations (ANR)
   4.3 Describe the overall role and function of OSS-RC
Target audience
The target audience for this course is: Network Engineer, Service Engineer, Service Design Engineer, Network Design Engineer.

Prerequisites
The participants should be familiar with telecommunication basics.

Duration and class size
The length of the course is 2 days and the maximum number of participants is 16.

Learning situation
This course is based on theoretical instructor-led lessons and theoretical exercises given in a classroom environment.

Time schedule
The time required always depends on the knowledge of the attending participants and the hours stated below can be used as estimate.

<table>
<thead>
<tr>
<th>Day</th>
<th>Topics in the course</th>
<th>Estimated time</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Course Introduction, LTE/SAE Introduction</td>
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</tr>
<tr>
<td></td>
<td>EPC Architecture</td>
<td>3 hours</td>
</tr>
<tr>
<td>2</td>
<td>Radio Interface principles</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Operation and Maintenance and RBS HW</td>
<td>3 hours</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3 hours</td>
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<td>3 hours</td>
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<td>3 hours</td>
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</table>
KPIs in LTE/SAE Network

LZU1087713-R2B

Description

How can the performance of the Ericsson LTE/SAE network be monitored? What Key Performance Indicators (KPIs) are used for Long Term Evolution (LTE) and Evolved Packet Core (EPC) nodes? How are evolved NodeB (eNodeB), Serving Gateway (SGW) and Mobility Management Entity (MME) counters used to create KPI formulas?

This ‘KPIs in LTE/SAE Network’ course will allow students to become familiar with using counters from eNodeB, SGW and MME nodes to create KPI formulas to measure network Accessibility, Retainability, Integrity, Mobility and Availability performance.

The knowledge gained in this ‘KPIs in LTE/SAE Network’ course will enable Engineers to efficiently measure the performance of the LTE/SAE Network and make more efficient use of their time during network optimization.

Learning objectives

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

1. **Explain Evolved Packet System (EPS) Architecture.**
   1.2 Explain the LTE UE states and EPS bearer concept.
   1.3 Describe the functionality of the EPS nodes.

2. **Create LTE KPIs using eNodeB counters.**
   2.1 Describe the eNodeB counter types and structures.
   2.2 Use Ericsson CPI documentation to explain eNodeB counters.
   2.3 Use eNodeB counters to create LTE KPI formulas.

3. **Create EPC KPIs using SGW counters.**
   3.1 Describe the SGW counter types and structures.
   3.2 Use Ericsson CPI documentation to explain SGW counters.
   3.3 Use SGW counters to create EPC KPI formulas.

4. **Create EPC KPIs using MME counters.**
   4.1 Describe the MME counter types and structures.
   4.2 Use Ericsson CPI documentation to explain MME counters.
   4.3 Use MME counters to create EPC KPI formulas.

Target audience

The target audience for this course is: Service Planning Engineers, Service Design Engineers, Network Design Engineers, System Engineers and Service Engineers.

This audience is responsible for LTE/SAE Optimization.
Prerequisites
The participants should be familiar with Radio Access Network performance management and have a basic knowledge of Microsoft Excel.

Duration and class size
The length of the course is 2 days and the maximum number of participants is 16.

Learning situation
This course is based on theoretical instructor-led lessons with practical exercises using Microsoft Excel.

Time schedule
The time required always depends on the knowledge of the attending participants and the hours stated below can be used as estimate.

<table>
<thead>
<tr>
<th>Day</th>
<th>Topics in the course</th>
<th>Estimated time</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>LTE/SAE Network Introduction</td>
<td>2 hours</td>
</tr>
<tr>
<td></td>
<td>LTE KPIs using eNodeB Counters</td>
<td>4 hours</td>
</tr>
<tr>
<td>2</td>
<td>EPC KPIs using SGW Counters</td>
<td>3 hours</td>
</tr>
<tr>
<td></td>
<td>EPC KPIs using MME Counters</td>
<td>3 hours</td>
</tr>
</tbody>
</table>
LTE Evolution Advantages in Features and Applications

Description

Are you ready to introduce LTE/SAE (Long Term Evolution/System Architecture Evolution)? We will give you a kick-start on how to handle the different business aspects covering both opportunities and challenges for LTE/SAE.

The impact of introducing LTE/SAE on existing networks is examined and different network considerations related to Radio, Transport and Core are presented.

A high level LTE/SAE network overview is provided as an introduction.

Learning objectives

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

1  Have LTE/SAE overview
   1.1 Explain the evolution of cellular networks GSM, WCDMA, CDMA, TD-SCDMA
   1.2 Name different driving factors behind LTE/SAE
   1.3 Have high level understanding of LTE radio fundamentals
   1.4 Explain the architecture of EPS (E-UTRAN and EPC)
   1.5 List a selection of more important key LTE/SAE features

2  Discuss LTE/SAE Business Environment
   2.1 Explore current Market outlook
   2.2 Identify key business challenges
   2.3 Get familiar with various end user services and trends
   2.4 Distinguish different revenue and price models
   2.5 Explore various LTE device concepts

3  Examine LTE/SAE Network Considerations
   3.1 Discuss general Network Deployment Aspects
   3.2 Outline different Radio Network Considerations
   3.3 Outline different Transport Network Considerations
   3.4 Outline different Core Network Considerations
   3.5 Have a high level understanding of Voice over LTE

Target audience

The target audience for this course is: Business Developer and Fundamentals.

This audience is typically working in Marketing and Sales or as Operation Managers.

Prerequisites

A general knowledge in cellular systems and radio technology.
**Duration and class size**

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

**Learning situation**

This course is based on theoretical instructor-led lessons and theoretical exercises given in a classroom environment.

**Time schedule**

The time required always depends on the knowledge of the attending participants and the hours stated below can be used as estimate. (This paragraph is mandatory).

<table>
<thead>
<tr>
<th>Day</th>
<th>Topics in the course</th>
<th>Estimated time</th>
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<tbody>
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<td>1</td>
<td><strong>LTE/SAE overview:</strong></td>
<td>0,5 hour</td>
</tr>
<tr>
<td></td>
<td>Evolution of Cellular Networks</td>
<td>0,5 hour</td>
</tr>
<tr>
<td></td>
<td>Driving factors behind LTE/SAE</td>
<td>1 hour</td>
</tr>
<tr>
<td></td>
<td>LTE Radio fundamentals</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Architecture of EPS (E-UTRAN and EPC)</td>
<td>1 hour</td>
</tr>
<tr>
<td></td>
<td><strong>LTE/SAE Business aspects:</strong></td>
<td></td>
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<tr>
<td></td>
<td>Market Outlook</td>
<td>0,5 hour</td>
</tr>
<tr>
<td></td>
<td>Market Trends</td>
<td>0,5 hour</td>
</tr>
<tr>
<td></td>
<td>Key Business Challenges</td>
<td></td>
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<tr>
<td></td>
<td>End User Services and Applications</td>
<td>0,5 hour</td>
</tr>
<tr>
<td></td>
<td>Devices</td>
<td>0,5 hour</td>
</tr>
<tr>
<td></td>
<td>Revenue and pricing models</td>
<td>1 hour</td>
</tr>
<tr>
<td></td>
<td><strong>Network Considerations:</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Network Deployment considerations</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Radio Network Considerations</td>
<td></td>
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<tr>
<td></td>
<td>Transport Network Considerations</td>
<td></td>
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<tr>
<td></td>
<td>Core Network Considerations</td>
<td></td>
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<tr>
<td></td>
<td>Exercise</td>
<td>1 hour</td>
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<tr>
<td></td>
<td>Summary and Conclusion</td>
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<td>2 hours</td>
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</table>
LTE L11 Air Interface

LZU1087897-R1A

Description

This course reveals the radio technology involved in E-UTRAN (Evolved UTRAN, also referred to as LTE – Long Term Evolution).

The course provides detailed descriptions and explanations of the radio interface channel structure and explains the concepts of channel coding, modulation, OFDM (Orthogonal Frequency Division Multiplexing), SC-FDMA (Single-Carrier Frequency Division Multiple Access), MIMO (Multiple Input Multiple Output), Resource Blocks, Scheduling, control signaling, System Information, FDD, TDD. Mobility, paging, cell search and random access are also explained on an overview level.

Learning objectives

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

1. **Explain the LTE Radio Interface general principles**
   1.1 Describe the evolution of cellular networks
   1.2 Summarize the evolution of 3GPP releases, from release 99 to release 8
   1.3 Describe the radio interface techniques
   1.4 Explain the difference between the FDD and TDD mode
   1.5 Describe the flexible spectrum usage
   1.6 Explain the concepts of channel coding and FEC (Forward Error Correction)
   1.7 Describe the principle for OFDM

2. **Detail the Radio Interface structure and signaling**
   2.1 Detail the channel structure of the radio interface
   2.2 Describe the physical signals in UL and DL
   2.3 Detail the radio interface protocols
   2.4 Detail the time-domain structure in the radio interface in UL and DL for both FDD and TDD mode
   2.5 Detail the downlink transmission technique
   2.6 Have a good understanding of the OFDM principle, signal generation and processing
   2.7 Detail the reference symbols in DL
   2.8 Detail the DL control signaling and formats
   2.9 Detail the paging procedures
   2.10 Explain HARQ
   2.11 Explain the cell search procedure
   2.12 Detail the uplink transmission technique
   2.13 Have a good understanding of the SC-FDMA principle, signal generation and processing
   2.14 Explain the pros and cons with OFDM and SC-FDMA
   2.15 Detail the UL control signaling and formats
   2.16 Detail the random access procedure
   2.17 Describe the Power Control in UL
2.18 Describe the concepts of layers, channel rank, spatial multiplexing, open and closed loop spatial multiplexing, TX diversity, beamforming, SU-MIMO and MU-MIMO

3 Describe the Radio Resource and Mobility Management
3.1 Describe UL and DL Scheduling principles and signaling
3.2 Explain the scheduler interactions with other functions
3.3 Explain the concepts of dynamic and semi-persistent scheduling
3.4 Describe intra-LTE mobility in ECM-CONNECTED and ECM-IDLE mode
3.5 Explain the concept of event triggered periodical reporting
3.6 Describe the mobility measurements
3.7 List the benefits of CS Fallback

Target audience
The target audience for this course is: Service Engineer, Service Design Engineer, Network Design Engineer.

Prerequisites
Successful completion of the following course:
LTE/SAE System Overview
LZU1087020
Attendees should have a general knowledge in cellular systems and radio technology. An in-depth knowledge in WCDMA, HSPA and/or GSM radio interface is profitable.

Duration and class size
The length of the course is 3 days and the maximum number of participants is 16.

Learning situation
This course is based on theoretical instructor-led lessons and theoretical exercises given in a classroom environment.

Time schedule
The time required always depends on the knowledge of the attending participants and the hours stated below can be used as estimate.

<table>
<thead>
<tr>
<th>Day</th>
<th>Topics in the course</th>
<th>Estimated time</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Introduction, Radio Interface general principles</td>
<td>4 hours</td>
</tr>
<tr>
<td></td>
<td>Radio Interface Structure and signaling</td>
<td>2 hours</td>
</tr>
<tr>
<td>2</td>
<td>Radio Interface Structure and signaling continued</td>
<td>6 hours</td>
</tr>
<tr>
<td>3</td>
<td>Radio Interface Structure and signaling continued</td>
<td>4 hours</td>
</tr>
<tr>
<td></td>
<td>Radio Resource &amp; Mobility Management</td>
<td>2 hours</td>
</tr>
</tbody>
</table>
LTE L11 Protocols and Procedures

Description
This course covers the LTE RAN protocols and procedures. It gives an in-depth understanding of the LTE Systems radio access network architecture and signaling, as well as the EPS Bearer Service, End-to-End service from QoS aspects. It covers the LTE radio access interfaces, such as X2 and S1, and corresponding controlling protocols X2AP and S1AP.

Also covered in this course are the L3 and L2 protocols used over these interfaces: NAS, RRC, GTP-U and PDCP, RLC, MAC and the physical layer for the radio interface.

Security aspects are also explained such as Authentication and Security Key generation.

The purpose of the course is to enable the students to understand complete traffic case in EPS including CS Fallback.

Learning objectives
On completion of this course the participants will be able to

1. **Explain the EPS Protocol Architecture**
   1.1 Distinguish between the different EPS Protocols
   1.2 Explain the EPS architecture, Bearer and Tracking Area
   1.3 Draw a simplified EPS diagram showing the protocols used.

2. **Explain the LTE/SAE Quality of Service and Security in LTE**
   2.1 Explain the purpose of EPS Bearer Services and eUTRA Radio Bearer
   2.2 List the different attributes of the eUTRA Radio Bearer and explain how they are used
   2.3 Explain Authentication Procedure
   2.4 Explain Radio Access Security
   2.5 Explain TN Security

3. **Explain the L3 Signaling Protocols**
   3.1 Explain the purpose with Non Access Stratum NAS protocol
   3.2 Explain the functions and services of NAS such as Authentication.
   3.3 Explain the interaction between RRC and the lower layers in the control plane
   3.4 Explain the RRC Service States and the difference between connected and idle mode
   3.5 Explain the functions and services of RRC such as System Information Broadcast, Paging, Cell Selection and Mobility
   3.6 Explain the main functions and procedures of X2AP signaling protocol.
   3.7 Explain the main functions and procedures of S1AP signaling protocol.
   3.8 Explain the main functions and procedures of the signaling protocol GTP-C.

4. **Explain the L2 transport protocols PDCP, RLC, MAC and GTP-U Protocols**
   4.1 Explain the PDCP functions and services such as header compression and ciphering
   4.2 Explain the RLC functions.
   4.3 List the different modes of RLC (transparent, unacknowledged and acknowledged mode) and explain the structure of the PDU involved in these cases.
4.4 Explain the MAC functions such as HARQ, BCH Reception, PCH reception
4.5 Explain the MAC architecture, its entities and their usage for the mapping of transport channels.
4.6 List the contents of the MAC Packet Data Unit (PDU).
4.7 Explain the main functions and procedures of the transport protocol GTP-U

5 Explain Mobility in LTE
5.1 Describe X2 Handover
5.2 Explain S1 Handover
5.3 Describe IRAT Handover
5.4 Explain CS Fall Back for Dual Radio UEs

Target audience
The target audience for this course is: Service Design Engineer, Network Design Engineer, System Engineer.

Prerequisites
The participants should be familiar with radio interface solution for LTE or successful completion of the following course:

LTE L11 Air Interface   LZU 108 7897

Duration and class size
The length of the course is 3 days and the maximum number of participants is 16.

Learning situation
This course is based on theoretical instructor-led lessons and theoretical exercises given in a classroom environment

Time schedule
The time required always depends on the knowledge of the attending participants and the hours stated below can be used as estimate.
<table>
<thead>
<tr>
<th>Day</th>
<th>Topics in the course</th>
<th>Estimated time</th>
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<tbody>
<tr>
<td>1</td>
<td>EPS Architecture</td>
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<tr>
<td></td>
<td>Explain the LTE/SAE Quality of Service and Security</td>
<td>3 hours</td>
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<td></td>
<td></td>
<td>3 hours</td>
</tr>
<tr>
<td>2</td>
<td>Explain the L3 Protocols:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>NAS and RRC</td>
<td>4 hours</td>
</tr>
<tr>
<td></td>
<td>Explain the X2/S1 Interface, X2AP/S1AP and GTP-C Protocols</td>
<td>2 hours</td>
</tr>
<tr>
<td>3</td>
<td>Explain L2 Protocols</td>
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<tr>
<td></td>
<td>Explain the PDCP, RLC and MAC Protocols</td>
<td>3 hours</td>
</tr>
<tr>
<td></td>
<td>Explain the GTP-U Protocol</td>
<td>0,5 hours</td>
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<tr>
<td></td>
<td>Explain Mobility in LTE</td>
<td>2,5 hours</td>
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</table>
LTE L11 Radio Network Functionality

Description

Do you want to have full and detailed understanding of the Ericsson E-UTRAN features and functionalities? If so, the LTE L11 Radio Network Functionality course will give you all that. This course describes the Idle Mode Behaviour, how Radio Connection Supervision is carried out, Power Control calculations, settings and functions as well as Link Adaptation and scheduling behaviour. Also, the Capacity Management and Mobility functionality will definitely boost your competence and understanding of the Ericsson E-UTRAN solution.

Learning objectives

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

1  Explain the logical architecture of E-UTRAN and introduce Radio Functionality
   1.1  Detail the logical architecture of the Ericsson E-UTRAN
   1.2  List the Radio Functionality supported in the Ericsson E-UTRAN
2  Describe the purpose and function of Idle Mode Behavior
   2.1  Explain PLMN and Cell selection and reselection
   2.2  Explain registration updating procedures
   2.3  Explain paging procedures
   2.4  Describe the organization of system information
3  Explain the purpose and function of Radio Connection Supervision
   3.1  Explain how the radio connection supervision is carried out
   3.2  Explain how in-synch and out-of-synch is determined by the radio link monitoring algorithm in the RBS
4  Describe the purpose and use of the function Power Control, Link Adaptation and Scheduling
   4.1  Explain the interaction between Power Control, Link Adaptation and Scheduling
   4.2  Explain open loop power control for initial access
   4.3  Configure the power of common channels
   4.4  Explain uplink power control for PUSCH and PUCCH
   4.5  Explain the impact of MIMO
5  Describe the purpose and function of the Capacity Management
   5.1  Describe the interaction between the Monitored System Resources (MSRs) and the different algorithms
   5.2  Explain the static and dynamic MSRs
   5.3  Explain Admission Control
   5.4  Explain Congestion Control
   5.5  Explain the interaction with QoS
6  Explain the purpose and function of Intra-LTE Mobility, Inter-Radio Access Technologies (IRAT) Mobility and IRAT and Inter Frequency Session Continuity
6.1 Explain Intra LTE Handover
6.2 Explain Coverage Triggered Session Continuity
6.3 Describe the interworking with GRAN
6.4 Describe the interworking with UTRAN
6.5 Distinguish between release with redirect and handover
6.6 Detail what type of events trigger measurement reports to be sent to the eNB
6.7 Describe the purpose of the handover evaluation algorithm and Best Cell Evaluation
6.8 Explain CS Fallback for dual-radio UEs
6.9 Describe the UE positioning

7 Explain the purpose and function of Automated Neighbor Relations (ANR)
7.1 Explain the detection and adding of external RBS
7.2 Explain the detection and adding of external cells
7.3 Explain the detection and adding of cell relations
7.4 Explain the detection and adding X2 connections

8 Future functionality

Target audience
The target audience for this course is: Service Design Engineers and Network Design Engineers.

Prerequisites
Successful completion of the following courses:

- LTE/SAE System Overview
- LTE L11 Air Interface
- LTE L11 Protocols and Procedures

Duration and class size
The length of the course is 2 days and the maximum number of participants is 16.

Learning situation
This course is based on theoretical instructor-led lessons and theoretical exercises given in a classroom environment.
## Time schedule

The time required always depends on the knowledge of the attending participants and the hours stated below can be used as estimate.

<table>
<thead>
<tr>
<th>Day</th>
<th>Topics in the course</th>
<th>Estimated time</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Introduction of the course and Radio Network Solution</td>
<td>1 hour</td>
</tr>
<tr>
<td></td>
<td>Idle Mode Behavior</td>
<td>2.5 hours</td>
</tr>
<tr>
<td></td>
<td>Radio Connection Supervision</td>
<td>1 hour</td>
</tr>
<tr>
<td></td>
<td>Link Adaptation</td>
<td>1.5 hours</td>
</tr>
<tr>
<td>2</td>
<td>Power Control</td>
<td>1 hour</td>
</tr>
<tr>
<td></td>
<td>Scheduling</td>
<td>1 hour</td>
</tr>
<tr>
<td></td>
<td>Capacity Management</td>
<td>0.5 hour</td>
</tr>
<tr>
<td></td>
<td>Mobility</td>
<td>1.5 hours</td>
</tr>
<tr>
<td></td>
<td>Automated Neighbor Relations (ANR)</td>
<td>1 hour</td>
</tr>
<tr>
<td></td>
<td>Future functionality</td>
<td>1 hour</td>
</tr>
</tbody>
</table>
Intentionally Blank
LTE L11 Radio Network Design

LZU1087900-R1A

Description
What is the 3GPP Long Term Evolution (LTE) strategy for the UMTS Network? How does Orthogonal Frequency Division Multiplexing (OFDMA) and Single-Carrier Frequency Division Multiple Access (SC-FDMA) used in the evolved UMTS Terrestrial Radio Access Network (eUTRAN) produce data rates in excess of 100 Mbps? What types of traffic are carried by the LTE Network? How is the coverage and capacity of an LTE cell calculated? How is the LTE Radio Network implemented with Ericsson hardware?

This LTE L11 Network Design course introduces attendees to the concepts of LTE and the operation of OFDMA and SC-FDMA. With this knowledge they will be guided through the LTE Radio Network dimensioning process and given the opportunity to perform sample LTE dimensioning exercises. They will also be introduced to the TEMS CellPlanner LTE module and the hardware that supports the Ericsson LTE L11 network.

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

1. Explain the reasons behind the 3GPP Long Term Evolution (LTE) strategy for UMTS.
   1.1 Explain the general dimensioning principles

2. Perform calculations on the radio interface capacity
   2.1 Explain how the LTE downlink and uplink data rates are achieved and calculated.
   2.2 List the LTE UE category capabilities.
   2.3 Explain radio wave propagation and typical channel models

3. Describe the different types of traffic carried by LTE networks.
   3.1 Explain the protocols that support the various LTE traffic types.
   3.2 Explain the operation of TCP, UDP, HTTP and FTP Internet Protocols.
   3.3 Explain the issues surrounding Voice over LTE.

4. Explain the Ericsson LTE dimensioning process.
   4.1 Perform uplink and downlink coverage and capacity calculations for LTE.
   4.2 Perform Control Channel dimensioning
   4.3 Perform Tracking Area planning
   4.4 Perform Paging Capacity calculations
   4.5 Explain which tools are used in radio network dimensioning
   4.6 Apply subscriber and traffic growth scenarios and perform dimensioning exercise using RNPT and/or the analytical method
   4.7 Recommend sites for LTE deployment to meet coverage and capacity requirements set by the customer

5. Perform analysis of co-location and co-existence scenarios
   5.1 Explain on overview level the transmitter interference characteristics.
   5.2 Explain Adjacent Channel Leakage Ratio (ACLR) and spurious emissions.
5.3 Describe the receiver interference characteristics
5.4 Explain Adjacent Channel Selectivity (ACS) and receiver blocking.
5.5 Explain Adjacent Channel Interference Ratio (ACIR).
5.6 Explain the co-location and co-existence and problems that may occur

6 Explain the tools and hardware associated with LTE cell planning.
6.1 Explain the downlink and uplink analysis supported by the TEMS CellPlanner LTE module.
6.2 List the Ericsson products in the RBS 6000 family.
6.3 Explain the hardware structure and capabilities of the RBS 6201 and 6102.

Target audience

The target audience for this course is: Service Planning Engineers, Service Design Engineers and Network Design Engineers.

This audience is responsible for the dimensioning and design of the LTE Radio Access Network.

Prerequisites

Successful completion of the following courses:

<table>
<thead>
<tr>
<th>Course</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>LTE L11 Air Interface</td>
<td>LZU1087897</td>
</tr>
<tr>
<td>LTE L11 Protocols and Procedures</td>
<td>LZU1087898</td>
</tr>
<tr>
<td>LTE L11 Functionality</td>
<td>LZU1087899</td>
</tr>
</tbody>
</table>

Duration and class size

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

Learning situation

This course is based on theoretical instructor-led lessons with practical exercises using a calculator or PC.

Time schedule

The time required always depends on the knowledge of the attending participants and the hours stated below can be used as estimate.

<table>
<thead>
<tr>
<th>Day</th>
<th>Topics in the course</th>
<th>Estimated time</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Introduction</td>
<td>1 hour</td>
</tr>
<tr>
<td></td>
<td>General dimensioning principles</td>
<td>1 hour</td>
</tr>
<tr>
<td></td>
<td>Radio interface capacity</td>
<td>0.5 hour</td>
</tr>
<tr>
<td></td>
<td>Traffic types and protocols</td>
<td>1 hour</td>
</tr>
<tr>
<td></td>
<td>LTE dimensioning</td>
<td>2.5 hours</td>
</tr>
<tr>
<td>2</td>
<td>LTE dimensioning</td>
<td>3 hours</td>
</tr>
<tr>
<td></td>
<td>Co-location and co-existence</td>
<td>2 hours</td>
</tr>
<tr>
<td></td>
<td>LTE cell planning</td>
<td>1 hour</td>
</tr>
</tbody>
</table>
LTE L11 eNode B Commissioning

LZU1087901-R1A

Description

Do you need to understand how to integrate LTE eNode B, RBS 6000.
This course provide the participants hands-on experience of the procedures that need to be performed for the commissioning and integration of the eNode B.

Learning objectives

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

1. **Describe the LTE system from an overview level**
   1.1 Describe from an overview level the RBS 6000 platform and hardware
   1.2 Explain the integration steps of RBS 6000

2. **Explain the concept of Management Tools**
   2.1 Use the Element Manager (EM)
   2.2 Use the Command Line Interface (CLI)
   2.3 Configure the Client to connect to the RBS

3. **Perform the commissioning and integration of the RBS**
   3.1 Powering Up RBS
   3.2 Checking RBS Status
   3.3 Connecting Clients
   3.4 Selecting Integration Scenario
   3.5 Auto-integrating RBS using Site Installation Files
   3.6 Integrating RBS Manually
   3.7 Monitoring RBS Integration
   3.8 Verifying External Alarms
   3.9 Checking Hardware Status
   3.10 Performing Test Calls
   3.11 Completing and Storing Integration Reports

Target audience

The target audience for this course is: Network Deployment Engineer, Field Technician and System Technician.

This audience is responsible for configuration of the eNode B.
Prerequisites
Successful completion of the following courses:

- LTE/SAE System Overview LZA1087020
- RBS6000 Overview LZA1087503

Or

- LTE/SAE Overview, WBL LZA1087318
- RBS 6000 in a Nutshell LZA1087504

Duration and class size
The length of the course is 1 day and the maximum number of participants is 8.

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

Time schedule
The time required always depends on the knowledge of the attending participants and the hours stated below can be used as estimate.

<table>
<thead>
<tr>
<th>Day</th>
<th>Topics in the course</th>
<th>Estimated time</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Introduction</td>
<td>0.5 hour</td>
</tr>
<tr>
<td></td>
<td>eNode B Management Applications</td>
<td>0.5 hour</td>
</tr>
<tr>
<td></td>
<td>eNode B Integration (theory and practical exercises)</td>
<td>5 hours</td>
</tr>
</tbody>
</table>
LTE L11 Operation

Description

Do you have sufficient skills to operate your Long Term Evolution (LTE) radio access network?

This course covers common operational tasks in the LTE radio network that NOC and OMC personnel come across in their daily work. Hardware, Software, Configuration, Fault and Performance Management concepts are covered. Practical exercises, based on work-order like instructions, contribute to the understanding of LTE network operations. OSS-RC tools and Element Management tools relevant for LTE are used where applicable.

Learning objectives

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

1. Explain the LTE network architecture and the Operation and Maintenance (OaM) support
   1.1 Describe the nodes that build up LTE/SAE
   1.2 Describe on an overview level the OaM infrastructure
   1.3 Describe the Operation and Maintenance architecture of an RBS6000 and where to find documentation about the Managed Object Model

2. Perform Hardware and Software Management on a LTE RAN
   2.1 Explain the hardware building practice of RBS6000 (MPE, DUL, RUL) and which ways O&M connectivity can be established to the node
   2.2 Display, export and handle hardware and software resources in an RBS6000 via OSS-RC and EMAS
   2.3 Describe the file system in an RBS6000
   2.4 Describe the Configuration Version concepts
   2.5 Manage Configuration Versions and file system using OSS-RC, EMAS, COLI and AMOS
   2.6 Describe the Upgrade process for a batch of RBS6000 nodes

3. Perform Fault Management on a LTE RAN
   3.1 Explain the Fault Management Model
   3.2 Describe the Fault Management process in the LTE RAN
   3.3 Solve some common alarms by following Procedural Information, and using OSS (Alarm List Viewer, Alarm Log Browser and Alarm Status Matrix), AMOS and EM in the process
   3.4 Describe the function of the command line interface (CLI) and Node Command Line Interface (NCLI)

4. Perform Performance Management on the LTE RAN
4.1 Describe what Observability of the LTE RAN means and how this is related to Key Performance Indicators
4.2 Describe the E-UTRAN PM solution
4.3 Describe the performance statistics generated in the LTE RAN (Counter collection, Cell Traffic Recording, User Equipment Traffic Recording)
4.4 Explain the Subscription Profile principle
4.5 Get an overview of statistics and recording concepts in the LTE, and use the OSS-RC to initiate UE Tracing
4.6 Describe what streaming events are and collect these events in OSS-RC

5 Perform basic RBS6000 Configuration procedures using OSS-RC and Element Manager
5.1 Describe the main steps in RBS6000 Integration
5.2 Explain Radio Network Handling in OSS-RC
5.3 Be familiar with the different ways configuration could be performed and changed in an RBS6000, and perform a parameter change using EM, AMOS and BCM

Target audience
The target audience for this course is: System Engineers and Service Engineers

This audience is responsible for operation of the LTE RAN, most likely from a Network Management Center or OMC.

Prerequisites
Successful completion of the following courses:

<table>
<thead>
<tr>
<th>Course</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>LTE/SAE System Overview</td>
<td>Lzu1087020</td>
</tr>
<tr>
<td>RBS6000 Overview</td>
<td>Lzu1087503</td>
</tr>
</tbody>
</table>

Or

<table>
<thead>
<tr>
<th>Course</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>LTE/SAE Overview, WBL</td>
<td>Lzu1087318</td>
</tr>
<tr>
<td>RBS 6000 in a Nutshell</td>
<td>Lzu1087504</td>
</tr>
</tbody>
</table>

Duration and class size
The length of the course is 3 days and the maximum number of participants is 8.

Learning situation
The course is based on theoretical and practical instructor-led lessons given in both classroom and a technical environment using equipment and tools, which can be accessed remotely.
## Time schedule

The time required always depends on the knowledge of the attending participants and the hours stated below can be used as estimate.

<table>
<thead>
<tr>
<th>Day</th>
<th>Topics in the course</th>
<th>Estimated time</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>• Network architecture and LTE features</td>
<td>1 hour</td>
</tr>
<tr>
<td></td>
<td>• RBS6000 Hardware and Software concepts and related OSS-RC tools</td>
<td>3 hours</td>
</tr>
<tr>
<td></td>
<td>• Operational exercises (ALEX library and MOM documentation familiarization)</td>
<td>0,5 hour</td>
</tr>
<tr>
<td></td>
<td>• Operational exercises (HW and SW management)</td>
<td>1,5 hours</td>
</tr>
<tr>
<td>2</td>
<td>• Operational exercises (HW and SW management)</td>
<td>1,5 hours</td>
</tr>
<tr>
<td></td>
<td>continued</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Fault Management</td>
<td>1 hour</td>
</tr>
<tr>
<td></td>
<td>• Operational exercises (Fault management)</td>
<td>2 hours</td>
</tr>
<tr>
<td></td>
<td>• LTE Performance Management</td>
<td>1 hour</td>
</tr>
<tr>
<td></td>
<td>• Operational exercises (Performance Management)</td>
<td>0,5 hours</td>
</tr>
<tr>
<td>3</td>
<td>• LTE Configuration Management</td>
<td>1 hour</td>
</tr>
<tr>
<td></td>
<td>• Operational exercises (Configuration Management)</td>
<td>3 hours</td>
</tr>
<tr>
<td></td>
<td>• Operational exercises summary</td>
<td>1 hour</td>
</tr>
<tr>
<td></td>
<td>• Course summary</td>
<td>1 hour</td>
</tr>
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LTE L11 Configuration

Description

This course describes how to integrate an RBS6000 from scratch in the L11 version of LTE RAN. The course includes theoretical parts covering how the integration should be carried out step by step to bring the RBS into service. The tools used in this process are described and exercises give the participant the possibility to investigate how the different configuration files and tools are used. Apart from this, Ethernet and the IP suite of protocols used to configure the Transport Network in an RBS6000 are described along with the related Managed Objects required for configuration.

After this course, the participants will be familiar with how to bring an RBS6000 into service both manually and by using the Autointegration feature.

Learning objectives

After completing the course the student will be able to:

1. Explain LTE L10 interfaces and the integration of RBS6000
   1.1 Describe the interfaces S1, X2 and Mul to an eNodeB in LTE L10.
   1.2 Explain the main differences between various RBSs, such as RBS6101, RBS6102, RBS6201, RBS6202 and RBS6601.
   1.3 Explain on an overview level the integration process of an RBS6000 and in which ways this process can be carried out (manual, auto-integration).
   1.4 Describe which tools that could be used in the different steps of the integration procedure.
   1.5 Explain what the MOM is, why it is important in configuration and where to find information about it

2. Explain Ethernet, IP Suite and related MOs in L10
   2.1 Explain the IP Functionality of the L10 RAN Transport Network.
   2.2 Explain how IP and Ethernet fit into the protocol layers in the LTE L10 RAN.
   2.3 Explain the basic structure of an IP Packet and Ethernet frame and how switching is done on Layer 2 and 3.
   2.4 Explain what IP Security (IPsec) is and how it is supported in the LTE RAN
   2.5 Explain how Quality of Service (QoS) is supported by IP and Ethernet
   2.6 Explain the feature Network Synchronization reference over SASE and how it is supported by the RBS6000
   2.7 Describe the hardware used to support IP/Ethernet transmission in RBS6000.
   2.8 Explain how generic IP and Ethernet concepts are related to the MicrOCPP MOM in L10.

3. Integrate an RBS6000
   3.1 Describe the integration process of an RBS6000 in detail
3.2 Perform the on-site integration of an RBS6000 manually with the Site Installation file, the Site Basic file and the Site External file.

3.3 Configure the Transport Network carrying S1 and X2 user plane and control plane traffic to an RBS6000 with and without IPsec.

3.4 Configure the Radio Network in an RBS6000.

3.5 Configure QoS parameters in RBS6000.

3.6 Configure the RBS6000 with the Auto-integration feature.

**Target audience**

The target audience for this course is: Service Planning Engineer, Service Design Engineer and Network Design Engineer.

**Prerequisites**

Successful completion of the following courses:

- LTE L11 Operation Lzu1087902
- LTE L11 Air Interface Lzu1087897

**Duration and class size**

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

**Learning situation**

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

**Time schedule**

The time required always depends on the knowledge of the attending participants and the hours stated below can be used as estimate.

<table>
<thead>
<tr>
<th>Day</th>
<th>Topics in the course</th>
<th>Estimated time</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Course introduction and introduction of LTE/SAE, the integration procedure of an RBS6000 and the Managed Object Model</td>
<td>1,5 hours</td>
</tr>
<tr>
<td></td>
<td>Ethernet, IP Suite and the RBS6000 IP related MOM</td>
<td>3,5 hours</td>
</tr>
<tr>
<td></td>
<td>Manual on-site configuration of the RBS6000</td>
<td>1 hour</td>
</tr>
<tr>
<td>2</td>
<td>Manual on-site configuration of the RBS6000 (cont.)</td>
<td>1 hour</td>
</tr>
<tr>
<td></td>
<td>Configuration of the S1 and X2 interfaces</td>
<td>1,5 hours</td>
</tr>
<tr>
<td></td>
<td>Configuration of the Radio Network and QoS</td>
<td>1,5 hours</td>
</tr>
<tr>
<td></td>
<td>Auto-integration of RBS6000</td>
<td>1,5 hours</td>
</tr>
<tr>
<td></td>
<td>Summary of the course</td>
<td>0,5 hour</td>
</tr>
</tbody>
</table>
LTE L11 Troubleshooting

**LZU1087904-R1A**

**Description**

While configuring and operating a L10 based LTE RAN network, what are the usual faults, how are they detected and solved in a RBS 6000 node? How does Ericsson local/field support enable and collect logs from a RBS6000 node?

LTE L10 Troubleshooting explains how a fault is detected, the different types of logs in a RBS6000 and how logs are collected to be appended to Customer Service Requests (CSRs). Alarm handling procedures and tools are covered, together with the procedure for initiating performance recordings and statistics in the process of working with troubleshooting a problem. Verification of connectivity issues and emergency recovery concepts are also explained, making it ideal for operation and maintenance personnel. Customer Product Information (CPI) in ALEX is used as much as possible during the training.

**Learning objectives**

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

1. **Describe and use the different troubleshooting tools for the LTE RAN**
   1.1 Describe which on-site tools that are available for troubleshooting the RBS and understand how to log in to and use these tools
   1.2 Describe which OSS-RC tools that are available for troubleshooting the RBS and understand when each tool could be useful
   1.3 Describe the OSS-RC Cell/UE Trace support and how to activate traces

2. **Describe how to recover an RBS and how to use the Data Collection Guideline when creating CSRs/TRs**
   2.1 Describe the Ericsson support process
   2.2 Explain what the Data Collection Guideline (DCG) is used for and how to collect the mandatory files required in it
   2.3 Describe the logs that CPP provides and when they are useful to use
   2.4 Describe the CV directory structure and the files that are building up a CV
   2.5 Describe different ways of recovering an eNB after a fault

3. **Describe the eNB interfaces and perform system level troubleshooting**
   3.1 Describe which interfaces that the RBS provides
   3.2 Describe how to check O&M connectivity on the Mul interface
   3.3 Describe how to check and act on Alarms
   3.4 Explain what Network Synchronization is and how its status can be verified in an eNB
   3.5 Verify MO status
   3.6 Explain how Node performance can be verified
   3.7 Describe some ways to check end-to-end system performance and execute commands to check S1 connectivity issues

**Target audience**
The target audience for this course is: System Engineers, Service Engineers, Field Technicians.

This audience is responsible for RBS6000 in a LTE environment, including troubleshooting and emergency handling of the node.

Prerequisites
Successful completion of the following courses:
- LTE L11 Air Interface  
- LTE L11 Configuration  
- LTE L11 Protocols and Procedures  
- LTE L11 Radio Network Functionality

Duration and class size
The length of the course is 2 days and the maximum number of participants is 8.

Learning situation
This is a task-oriented learning course based on tasks in the work-process given in a technical environment using equipment and tools.

Time schedule
The time required always depends on the knowledge of the attending participants and the hours stated below can be used as estimate.

<table>
<thead>
<tr>
<th>Day</th>
<th>Topics in the course</th>
<th>Estimated time</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Introduction</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Troubleshooting tools</td>
<td></td>
</tr>
<tr>
<td></td>
<td>RBS6000 Hardware structure</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Troubleshooting tools Exercises</td>
<td></td>
</tr>
<tr>
<td></td>
<td>RBS Recovery and Data Collection Guideline</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>RBS Recovery and Data Collection Guideline Exercises</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>RBS6000 interfaces (S1/X2/Mul)</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>System view troubleshooting</td>
<td></td>
</tr>
<tr>
<td></td>
<td>System view Exercises</td>
<td></td>
</tr>
</tbody>
</table>
LTE L11 Performance Management and Optimization

Description

How are eNodeB counters used to monitor the performance of the LTE network? How are these counters collected and stored? What are the Key Performance Indicators (KPI) for the LTE network? What are the parameters that influence these KPIs? What is contained in LTE Cell and UE Trace and how are they handled by the Ericsson OSS-RC?

This ‘LTE L11 Performance Management and Optimization’ course will allow students to become familiar with using eNodeB counters to create KPI formulas to measure E-UTRAN Accessibility, Retainability, Integrity, Mobility and Availability performance and the parameters that may be used to optimize these areas.

Through practical exercises they will learn how to use the Ericsson OSS-RC to collect counters from the eNodeB, setup and decode LTE Cell and UE Trace and produce user defined performance reports using ENIQ.

Learning objectives

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

1. **Explain the E-UTRAN Performance Management solution**
   1.1 Describe the difference between Initial Tuning and Optimization
   1.2 Describe how eNodeB counters are collected and stored
   1.3 Describe the eNodeB counter types and structures

2. **Measure LTE Accessibility performance**
   2.1 Describe the E-RAB setup procedure and associated counters
   2.2 Use eNodeB counters to create E-RAB Accessibility KPIs
   2.3 Explain the eNodeB parameters that influence Accessibility

3. **Measure LTE Retainability performance**
   3.1 Describe the E-RAB release procedure and associated counters
   3.2 Use eNodeB counters to create E-RAB Retainability KPIs
   3.3 Explain the eNodeB parameters that influence Retainability

4. **Measure LTE Integrity performance**
   4.1 Explain the counters that are used to measure LTE Radio Bearer LTE throughput
   4.2 Use eNodeB counters to create E-UTRAN Integrity KPIs
   4.3 Explain the eNodeB parameters that influence Integrity

5. **Measure LTE Mobility performance**
   5.1 Explain the intra LTE handover procedure and associated counters
   5.2 Use eNodeB counters to create E-UTRAN Mobility KPIs
   5.3 Explain the eNodeB parameters that influence Mobility

6. **Measure LTE Cell Availability**
   6.1 Explain the counters that are used to measure LTE Cell Availability
   6.2 Use eNodeB counters to create Cell Availability KPIs and measure System Utilization
6.3 Explain the eNodeB parameters that influence Cell Availability and System Utilization

7 Explain what is collected by LTE Cell and UE Trace
7.1 Explain briefly how LTE Cell and UE Trace are collected and stored

8 Use the OSS-RC to collect E-UTRAN counters and handle LTE Cell and UE Trace.
8.1 Create, activate and delete subscription profiles.
8.2 Use the OSS-RC to open and view the contents of LTE Cell and UE Trace files

9 Explain the ENIQ and Business Objects (BO) Web Intelligence Rich Client operation.
9.1 Use Business Objects (BO) Web Intelligence Rich Client to open and refresh Ericsson predefined LTE performance reports
9.2 Create user defined LTE performance reports using the Business Objects (BO) Web Intelligence Rich Client
9.3 Share user defined LTE performance reports with other ENIQ users

Target audience
The target audience for this course is: Service Planning Engineers, Service Design Engineers, Network Design Engineers, System Engineers and Service Engineers.

This audience is responsible for LTE Performance Management and Optimization.

Prerequisites
Successful completion of the following courses:

- LTE L11 Air Interface Lzu1087897
- LTE L11 Configuration Lzu1087903
- LTE L11 Protocols and Procedures Lzu1087898
- LTE L11 Radio Network Functionality Lzu1087899
- LTE L11 Troubleshooting Lzu1087904 (optional)

The students should also have a basic knowledge of Microsoft Excel.

Duration and class size
The length of the course is 3 days and the maximum number of participants is 8.

Learning situation
This course is based on theoretical and practical instructor-led lessons given in both a classroom and technical environment using equipment and tools, which are accessed remotely.
### Time schedule

The time required always depends on the knowledge of the attending participants and the hours stated below can be used as estimate.

<table>
<thead>
<tr>
<th>Day</th>
<th>Topics in the course</th>
<th>Estimated time</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>LTE Performance Management Introduction</td>
<td>2 hours</td>
</tr>
<tr>
<td></td>
<td>LTE Accessibility Optimization</td>
<td>2 hours</td>
</tr>
<tr>
<td></td>
<td>LTE Retainability Optimization</td>
<td>2 hours</td>
</tr>
<tr>
<td>2</td>
<td>LTE Integrity Optimization</td>
<td>2 hours</td>
</tr>
<tr>
<td></td>
<td>LTE Mobility Optimization</td>
<td>2 hours</td>
</tr>
<tr>
<td></td>
<td>LTE Availability Optimization</td>
<td>2 hours</td>
</tr>
<tr>
<td>3</td>
<td>LTE Cell and UE Trace</td>
<td>1 hour</td>
</tr>
<tr>
<td></td>
<td>OSS-RC Statistics, Cell and UE Trace Handling</td>
<td>2 hours</td>
</tr>
<tr>
<td></td>
<td>ENIQ and Business Objects</td>
<td>3 hours</td>
</tr>
</tbody>
</table>
LTE L11 Initial Tuning

Description
When starting up your new LTE network, initial tuning is the most powerful way to verify the performance.

With the help of the LTE L11 Initial Tuning course the attendees will learn the mechanisms involved in the initial tuning process. We will define the theoretical formulas and processes, as well as analyze data according to the KPI's wanted.

Learning objectives

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

1 Explain the process for LTE RAN tuning
   1.1 Describe the difference between tuning and optimization
   1.2 Describe the different steps in the tuning process

2 Perform the Preparations necessary for a tuning exercise
   2.1 Perform a network design review and consistency check
   2.2 Define cluster and drive test routes
   2.3 Define the services to test
   2.4 Perform the setup of the drive test tools

3 Perform CELL tuning
   3.1 Describe the different interference scenarios in a LTE network
   3.2 Describe the interference interference ratio, $F$
   3.3 Define coverage in different scenarios e.g. macro and hotspot
   3.4 Implement changes to improve coverage
   3.5 Describe the neighbor list with or without the Automated Neighbor Relations

4 Perform UE tuning
   4.1 Explain Accessibility formulas (KPI) and analysis of the data from drive test
   4.2 Explain Retainability formulas (KPI) and analysis of the data from the drive test
   4.3 Explain Integrity formulas (KPI) and analysis of the data from the drive test
   4.4 Explain Mobility formulas (KPI) and analysis of the data from the drive test

Target audience
The target audience for this course is: System Engineers, Service Engineers.

Prerequisites
Successful completion of the following courses:

<table>
<thead>
<tr>
<th>Course</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>LTE L11 Air Interface</td>
<td>LZU1087897</td>
</tr>
<tr>
<td>LTE L11 Configuration</td>
<td>LZU1087903</td>
</tr>
</tbody>
</table>

Duration and class size
The length of the course is 2 days and the maximum number of participants is 8.
Learning situation

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

Time schedule

The time required always depends on the knowledge of the attending participants and the hours stated below can be used as estimate.

<table>
<thead>
<tr>
<th>Day</th>
<th>Topics in the course</th>
<th>Estimated time</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Explain the process of tuning</td>
<td>3 hours</td>
</tr>
<tr>
<td></td>
<td>Perform preparations necessary for the tuning</td>
<td>3 hours</td>
</tr>
<tr>
<td>2</td>
<td>Cell tuning</td>
<td>3 hours</td>
</tr>
<tr>
<td></td>
<td>Perform a Network and UE tuning</td>
<td>3 hours</td>
</tr>
</tbody>
</table>
LTE RBS 6101 Field Maintenance

This course is a task-based course covering hardware replacement and maintenance of the RBS 6101 node types. The participants will perform hardware fault localisation, hardware replacement and configuration tasks on a RBS 6101 type. On completion of this course the participants will also be familiar with the features of the operation and maintenance tools Element Manager and NCLI (Node Command line Interface).

**Learning objectives**

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

1. **Explain on overview level the LTE RAN Site Concept for RBS**
   1.1 Explain the basic LTE Radio Access Network
   1.2 Identify the Power and Battery Cabinets on Site
   1.3 Identify LTE Interface for Transmission on Site
   1.4 Identify, locate and handle the connection Unit for External Alarms
   1.5 Identify and locate Remote Electrical Tilt (RET)
   1.6 Identify the Antenna System Controller (ASC)

2. **Use the Customer Product Information (CPI)**
   2.1 Explain the CPI Library structure of the node
   2.2 Find information in the Library with use of regular expression
   2.3 Find operational instructions (OPI) and maintain the node according to the OPI
   2.4 Find additional information on an alarm and solve the problem with the help of the CPI and Element Manager

3. **Connect to a node using CLI and also using NCLI.**
   3.1 Understand basic commands using CLI and using NCLI.
   3.2 Have a basic understanding of the functionality and technology used in CLI and NCLI.
   3.3 Understand the basic principles behind the Managed Object Model (MOM).

4. **Use the Element manager and understand the concepts behind Object Explorer**
   4.1 Download and start the Element Manager.
   4.2 Access and use the different “Views”; Containment, ATM, Equipment, IP, Licensing, Radio Network and the Software.
   4.3 Find the alarm list and comment on the Alarms and Events on the Alarm and Event Log.
   4.4 Access the property help feature from each window.
   4.5 Create a Customized View (User Defined) in Element Manager.

5. **Perform maintenance and configuration tasks on the RBS 6101 nodes**
   5.1 Trace the uplink and downlink traffic paths through the RBS 6101 hardware
   5.2 Trace the control and supervision communication throughout the node and the antenna system of an RBS 6101 site
   5.3 Power up/down the RBS 6101 and connect a thin client to the node
   5.4 Perform preventative maintenance on the RBS 6101
   5.5 Find Faulty Hardware units and replace them
5.6 Perform Configuration tasks on the RBS 6101
5.7 Perform configuration version backup and restore on RBS 6101

Target audience
The target audience for this course is:
Field Technician

Prerequisites
Successful completion of the following flow and course:

- LTE/SAE - System Overview   LZU1087020
- LTE L10 Air Interface (Optional)   LZU1087260

Duration and class size
The length of the course is 1 day and the maximum number of participants is 8.

Learning situation
This course is based on theoretical instructor-led lessons and practical exercises given in a classroom environment.

Time schedule
The time required always depends on the knowledge of the attending participants and the hours stated below can be used as estimate.

<table>
<thead>
<tr>
<th>Day</th>
<th>Topics in the course</th>
<th>Estimated time</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Course Introduction</td>
<td>15 min</td>
</tr>
<tr>
<td></td>
<td>LTE RAN Systems and Site Introduction</td>
<td>0.5 hour</td>
</tr>
<tr>
<td></td>
<td>Customer Product Information and tool kits</td>
<td>15 min</td>
</tr>
<tr>
<td></td>
<td>Command Line Interface/Node Command Line Interface</td>
<td>1 hour</td>
</tr>
<tr>
<td></td>
<td>Element Management</td>
<td>1 hour</td>
</tr>
<tr>
<td></td>
<td>LTE RBS 6101 Maintenance</td>
<td>3 hours</td>
</tr>
</tbody>
</table>
RBS 6000 Overview

Description
The new RBS 6000 product family is the compact multi standard base stations used in GSM, WCDMA and LTE networks. The focus of this course is to cover all RBS models used by Ericsson in the current market. We will explain the RBS 6000 units, block diagram, technical specifications and optional units. Installation, operation and maintenance procedures will be briefly described.

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

Learning objectives

1. Recognize and identify the main components of Radio Access Network, RBS Site Solutions and RBS 6000 basic functions.
   1.1 Give a high level overview on the GSM, WCDMA and LTE Network nodes
   1.2 Outline the RBS main functions
   1.3 Give an outline of the sustainable solutions for RBS 6000 site
   1.4 Describe how more room for expansion is generated
   1.5 Compare the power consumption of a RBS 6000 to today’s technologies
   1.6 Describe Antenna, TMA, Site Transmission and Power Backup System for different RBSs
   1.7 Understand the Power Supply, external cables and antenna connections for the RBS 6000.

2. Describe on an overview level the RBS 6000 Platform and understand how Radio Access for various radio technologies is implemented in the RBS 6000
   2.1 Describe the generic building and form structure used in RBS 6000
   2.2 Describe on an overview level the building practice
   2.3 Describe on block level which boards and units gives the WCDMA Functionality
   2.4 Describe on block level which boards and units gives the LTE Functionality
   2.5 Describe on block level which boards and units gives the GSM Functionality
   2.6 Explain the advantages of multi-standard RBS

3. Detail the RBS 6000 portfolio for compact macro, full-size macro, main-remote and micro RBS
   3.1 Describe the compact outdoor macro base station RBS 6101
   3.2 Describe the full size macro base station RBS 6102
   3.3 Describe the full size macro base station RBS 6201
   3.4 Describe the full size macro base station RBS 6202
   3.5 Describe the compact main-remote base station RBS 6601
   3.6 Describe the main remote/micro RBS 6301

4. Outline the main Operation and Maintenance tools for RBS 6000
Target audience
The target audience for this course is: Engineers that would like to get an introduction to the RBS 6000 family and corresponding Site Products.

Prerequisites
Successful completion of the following courses:

- Ericsson WCDMA System Overview LZU1085418
- GSM System Survey LZU108852
- LTE/SAE - System Overview LZU1087020

Or

- WCDMA RAN Overview (WBL) LZU1085202
- GSM Radio Network Overview (WBL) LZU1086235
- LTE/SAE in Nutshell (WBL) LZU1087417

Duration and class size
The length of the course is 1 day and the maximum number of participants is 16.

Learning situation
Instructor led training.

Time schedule
The time required always depends on the knowledge of the attending participants and the hours stated below can be used as estimate.

<table>
<thead>
<tr>
<th>Day</th>
<th>Topics in the course</th>
<th>Estimated time</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Introduction</td>
<td>0.5 hour</td>
</tr>
<tr>
<td></td>
<td>Radio Access Network, RBS Site Solutions and RBS 6000</td>
<td>1 hour</td>
</tr>
<tr>
<td></td>
<td>RBS 6000 Platform</td>
<td>1 hour</td>
</tr>
<tr>
<td></td>
<td>RBS 6101</td>
<td>0.5 hour</td>
</tr>
<tr>
<td></td>
<td>RBS 6102</td>
<td>0.5 hour</td>
</tr>
<tr>
<td></td>
<td>RBS 6201</td>
<td>0.5 hour</td>
</tr>
<tr>
<td></td>
<td>RBS 6601</td>
<td>0.5 hour</td>
</tr>
</tbody>
</table>
RBS 6000 in a Nutshell

LZU1087504-R1A

Description

This WBL course is intended to give the participant an overview of the RBS 6000 series. Are you interested in the latest RBS technology from Ericsson. The RBS 6000 Overview course will guide you thought the concept and explain you the main benefits of the new architectures. You will learn how the multi-standard concept is implemented, more room for expansion is generated and how you can lower the power consumption of your network for greater sustainability.

Learning objectives

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

1. **Describe on an overview level the RBS 6000 Platform**
   1.1 Describe the generic building and form structure used in RBS 6000
   1.2 Describe on an overview level the building practice
   1.3 Explain the advantages of multi-standard RBS
   1.4 Describe how more room for expansions is generated
   1.5 Compare the power consumption of a RBS 6000 to today’s technologies

2. **Understand how WCDMA is implemented in the RBS 6000**
   2.1 Describe on block level which boards and units gives the WCDMA Functionality

3. **Understand how LTE is implemented in the RBS 6000**
   3.1 Describe on block level which boards and units gives the LTE Functionality

4. **Understand how GSM is implemented in the RBS 6000**
   4.1 Describe on block level which boards and units gives the GSM Functionality

Target audience

The target audiences for this course are:
System Technician
Service Technician
System Engineers
Service Engineers

Prerequisites

The participants should be familiar with the WCDMA, GSM and LTE on overview level.
Duration
The length of the course is 1 hour.

Learning situation
This is a web-based interactive training course with multimedia content.
LTE RBS 6102 Field Maintenance

This course is a task-based course covering hardware replacement and maintenance of the RBS 6102 node types. The participants will perform hardware fault localisation, hardware replacement and configuration tasks on a RBS 6102 type. On completion of this course the participants will also be familiar with the features of the operation and maintenance tools Element Manager and NCLI (Node Command line Interface).

Learning objectives

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

1. Explain on overview level the LTE RAN Site Concept for RBS
   1.1 Explain the basic LTE Radio Access Network
   1.2 Identify the Power and Battery Cabinets on Site
   1.3 Identify LTE Interface for Transmission on Site
   1.4 Identify, locate and handle the connection Unit for External Alarms
   1.5 Identify and locate Remote Electrical Tilt (RET)
   1.6 Identify the Antenna System Controller (ASC)

2. Use the Customer Product Information (CPI)
   2.1 Explain the CPI Library structure of the node
   2.2 Find information in the Library with use of regular expression
   2.3 Find operational instructions (OPI) and maintain the node according to the OPI
   2.4 Find additional information on an alarm and solve the problem with the help of the CPI and Element Manager

3. Connect to a node using CLI and also using NCLI.
   3.1 Understand basic commands using CLI and using NCLI.
   3.2 Have a basic understanding of the functionality and technology used in CLI and NCLI.
   3.3 Understand the basic principles behind the Managed Object Model (MOM).

4. Use the Element manager and understand the concepts behind Object Explorer
   4.1 Download and start the Element Manager.
   4.2 Access and use the different “Views”; Containment, Equipment, IP, Licensing, Radio Network and the Software.
   4.3 Find the alarm list and comment on the Alarms and Events on the Alarm and Event Log.
   4.4 Access the property help feature from each window.
   4.5 Create a Customized View (User Defined) in Element Manager.

5. Perform maintenance and configuration tasks on the RBS 6102 nodes
   5.1 Trace the uplink and downlink traffic paths through the RBS 6102 hardware
   5.2 Trace the control and supervision communication throughout the node and the antenna system of an RBS 6102 site
   5.3 Power up/down the RBS 6102 and connect a thin client to the node
   5.4 Perform preventative maintenance on the RBS 6102
   5.5 Find Faulty Hardware units and replace them
5.6 Perform Configuration tasks on the RBS 6102
5.7 Perform configuration version backup and restore on RBS 6102

Target audience
The target audience for this course is:
Field Technician

Prerequisites
Successful completion of the following flow and course:
- LTE/SAE - System Overview Lzu 1087020
- LTE L10 Air Interface (Optional) Lzu 1087260

Duration and class size
The length of the course is 1 day and the maximum number of participants is 8.

Learning situation
This course is based on theoretical instructor-led lessons and practical exercises given in a classroom environment.

Time schedule
The time required always depends on the knowledge of the attending participants and the hours stated below can be used as estimate.

<table>
<thead>
<tr>
<th>Day</th>
<th>Topics in the course</th>
<th>Estimated time</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Course Introduction</td>
<td>15 min</td>
</tr>
<tr>
<td></td>
<td>LTE RAN Systems and Site Introduction</td>
<td>0.5 hour</td>
</tr>
<tr>
<td></td>
<td>Customer Product Information and tool kits</td>
<td>15 min</td>
</tr>
<tr>
<td></td>
<td>Command Line Interface/Node Command Line Interface</td>
<td>1 hour</td>
</tr>
<tr>
<td></td>
<td>Element Management</td>
<td>1 hour</td>
</tr>
<tr>
<td></td>
<td>LTE RBS 6102 Maintenance</td>
<td>3 hours</td>
</tr>
</tbody>
</table>
LTE RBS 6201 Field Maintenance

LZU1087648-R2A

This course is a task-based course covering hardware replacement and maintenance of the RBS 6201 node types. The participants will perform hardware fault localisation, hardware replacement and configuration tasks on a RBS 6201 type. On completion of this course the participants will also be familiar with the features of the operation and maintenance tools Element Manager and NCLI (Node Command line Interface).

Learning objectives

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

1. **Explain on overview level the LTE RAN Site Concept for RBS**
   1.1 Explain the basic LTE Radio Access Network
   1.2 Identify the Power and Battery Cabinets on Site
   1.3 Identify LTE Interface for Transmission on Site
   1.4 Identify, locate and handle the connection Unit for External Alarms
   1.5 Identify and locate Remote Electrical Tilt (RET)
   1.6 Identify the Antenna System Controller (ASC)

2. **Use the Customer Product Information (CPI)**
   2.1 Explain the CPI Library structure of the node
   2.2 Find information in the Library with use of regular expression
   2.3 Find operational instructions (OPI) and maintain the node according to the OPI
   2.4 Find additional information on an alarm and solve the problem with the help of the CPI and Element Manager

3. **Connect to a node using CLI and also using NCLI.**
   3.1 Understand basic commands using CLI and using NCLI.
   3.2 Have a basic understanding of the functionality and technology used in CLI and NCLI.
   3.3 Understand the basic principles behind the Managed Object Model (MOM).

4. **Use the Element manager**
   4.1 Download and start the Element Manager.
   4.2 Access and use the different "Views"; Containment, Equipment, IP, Licensing, Radio Network and the Software.
   4.3 Find the alarm list and comment on the Alarms and Events on the Alarm and Event Log.
   4.4 Access the property help feature from each window.
   4.5 Create a Customized View (User Defined) in Element Manager.
5 Perform maintenance and configuration tasks on the RBS 6201 nodes
5.1 Trace the uplink and downlink traffic paths through the RBS 6201 hardware
5.2 Trace the control and supervision communication throughout the node and the antenna system of an RBS 6201 site
5.3 Power up/down the RBS 6201 and connect a thin client to the node
5.4 Perform preventative maintenance on the RBS 6201
5.5 Find Faulty Hardware units and replace them
5.6 Perform Configuration tasks on the RBS 6201
5.7 Perform configuration version backup and restore on RBS 6201

Target audience
The target audience for this course is:
Field Technician

Prerequisites
Successful completion of the following flow and course:
LTE/SAE - System Overview  Lzu1087020
LTE L10 Air Interface (Optional)  Lzu1087260

Duration and class size
The length of the course is 1 day and the maximum number of participants is 8.

Learning situation
This course is based on theoretical instructor-led lessons and practical exercises given in a classroom environment.

Time schedule
The time required always depends on the knowledge of the attending participants and the hours stated below can be used as estimate.

<table>
<thead>
<tr>
<th>Day</th>
<th>Topics in the course</th>
<th>Estimated time</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Course Introduction</td>
<td>15 min</td>
</tr>
<tr>
<td></td>
<td>LTE RAN Systems and Site Introduction</td>
<td>0.5 hour</td>
</tr>
<tr>
<td></td>
<td>Customer Product Information and tool kits</td>
<td>15 min</td>
</tr>
<tr>
<td></td>
<td>Command Line Interface/Node Command Line Interface</td>
<td>1 hour</td>
</tr>
<tr>
<td></td>
<td>Element Management</td>
<td></td>
</tr>
<tr>
<td></td>
<td>LTE RBS 6201 Maintenance</td>
<td>3 hours</td>
</tr>
</tbody>
</table>
LTE RBS 6601 Field Maintenance

LZU 108 7890 R1A

Description

This course is a task-based course covering hardware replacement and maintenance of the RBS 6601 node types. The participants will perform hardware fault localisation, hardware replacement and configuration tasks on a RBS 6601 type. On completion of this course the participants will also be familiar with the features of the operation and maintenance tools Element Manager and CLI (Command line Interface).

Learning objectives

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

1 Explain on overview level the LTE RAN Site Concept for RBS
   1.1 Explain the basic LTE Radio Access Network
   1.2 Identify and describe the equipment associated with the RBS 6601
   1.3 Identify the power connections on the RBS (MU) and (RRU)
   1.4 Explain the Power and Battery Cabinets (PBC) on Site for the RBS 6601
   1.5 Identify LTE Interface for Transmission on Site
   1.6 Identify and describe additional site equipment

2 Use the Customer Product Information (CPI)
   2.1 Explain the CPI Library structure of the node
   2.2 Find information in the Library with use of regular expression
   2.3 Find operational instructions (OPI) and maintain the node according to the OPI
   2.4 Find additional information on an alarm and solve the problem with the help of the CPI
      and Element Manager

3 Use Element manager to operate and maintain the RBS 6601
   3.1 Download and start the Element Manager.
   3.2 Access and use the different “Views”; Containment, ATM, Equipment, IP, Licensing,
      Radio Network and the Software.
   3.3 Find the alarm list and comment on the Alarms and Events on the Alarm and Event
      Log.
   3.4 Access the property help feature from each window.

4 Connect to a node using CLI and also using NCLI.
   4.1 Understand basic commands using CLI and using NCLI.
   4.2 Have a basic understanding of the functionality and technology used in CLI and NCLI.
   4.3 Understand the basic principles behind the Managed Object Model (MOM).

5 Perform maintenance and configuration tasks on the RBS 6601 nodes
   5.1 Trace the uplink and downlink traffic paths through the RBS 6601 hardware
   5.2 Trace the control and supervision communication throughout the node and the
      antenna system of an RBS 6601 site
   5.3 Find Faulty Hardware units and replace them
   5.4 Manage Configuration Versions from Element manager and the CLI
**Target audience**

The target audience for this course is:

Field Technician and Field Engineers.

**Prerequisites**

Successful completion of the following courses:

- LTE/SAE - System Overview
  - LZU1087020
- LTE L10 Air Interface (Optional)
  - LZU1087260

**Duration and class size**

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

**Learning situation**

This course is based on theoretical instructor-led lessons and practical exercises given in a classroom environment.

**Time schedule**

The time required always depends on the knowledge of the attending participants and the hours stated below can be used as estimate.

<table>
<thead>
<tr>
<th>Day</th>
<th>Topics in the course</th>
<th>Estimated time</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Course Introduction</td>
<td>.5 hour</td>
</tr>
<tr>
<td></td>
<td>LTE RAN Systems and Site Introduction</td>
<td>2.0 hour</td>
</tr>
<tr>
<td></td>
<td>Customer Product Information</td>
<td>1.5 hour</td>
</tr>
<tr>
<td></td>
<td>Element Management</td>
<td>2.0</td>
</tr>
<tr>
<td>2</td>
<td>Command Line Interface/Node Command Line Interface</td>
<td>2.0</td>
</tr>
<tr>
<td></td>
<td>LTE RBS 6601 Maintenance</td>
<td>4.0</td>
</tr>
</tbody>
</table>
LTE RBS 6301 Field Maintenance

This course is a task-based course covering hardware replacement and maintenance of the RBS 6301 node types. The participants will perform hardware fault localisation, hardware replacement and configuration tasks on a RBS 6301 type. On completion of this course the participants will also be familiar with the features of the operation and maintenance tools Element Manager and NCLI (Node Command line Interface).

Learning objectives

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

1. **Explain on overview level the LTE RAN Site Concept for RBS**
   1.1 Explain the basic LTE Radio Access Network
   1.2 Identify the Power and Battery Cabinets on Site
   1.3 Identify LTE Interface for Transmission on Site
   1.4 Identify, locate and handle the connection Unit for External Alarms
   1.5 Identify and locate Remote Electrical Tilt (RET)
   1.6 Identify the Antenna System Controller (ASC)

2. **Use the Customer Product Information (CPI)**
   2.1 Explain the CPI Library structure of the node
   2.2 Find information in the Library with use of regular expression
   2.3 Find operational instructions (OPI) and maintain the node according to the OPI
   2.4 Find additional information on an alarm and solve the problem with the help of the CPI and Element Manager

3. **Connect to a node using CLI and also using NCLI.**
   3.1 Understand basic commands using CLI and using NCLI.
   3.2 Have a basic understanding of the functionality and technology used in CLI and NCLI.
   3.3 Understand the basic principles behind the Managed Object Model (MOM).

4. **Use the Element manager and understand the concepts behind Object Explorer**
   4.1 Download and start the Element Manager.
   4.2 Access and use the different “Views”; Containment, ATM, Equipment, IP, Licensing, Radio Network and the Software.
   4.3 Find the alarm list and comment on the Alarms and Events on the Alarm and Event Log.
   4.4 Access the property help feature from each window.
   4.5 Create a Customized View (User Defined) in Element Manager.
Perform maintenance and configuration tasks on the RBS 6301 nodes

5.1 Trace the uplink and downlink traffic paths through the RBS 6301 hardware
5.2 Trace the control and supervision communication throughout the node and the antenna system of an RBS 6301 site
5.3 Power up/down the RBS 6301 and connect a thin client to the node
5.4 Perform preventative maintenance on the RBS 6301
5.5 Find Faulty Hardware units and replace them
5.6 Perform Configuration tasks on the RBS 6301
5.7 Perform configuration version backup and restore on RBS 6301

Target audience

The target audience for this course is:

Field Technician

Prerequisites

Successful completion of the following flow and course:

<table>
<thead>
<tr>
<th>Course</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>LTE/SAE - System Overview</td>
<td>LZU1087020</td>
</tr>
<tr>
<td>LTE L10 Air Interface (Optional)</td>
<td>LZU1087260</td>
</tr>
</tbody>
</table>

Duration and class size

The length of the course is 1 day and the maximum number of participants is 8.

Learning situation

This course is based on theoretical instructor-led lessons and practical exercises given in a classroom environment.

Time schedule

The time required always depends on the knowledge of the attending participants and the hours stated below can be used as estimate.

<table>
<thead>
<tr>
<th>Day</th>
<th>Topics in the course</th>
<th>Estimated time</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Course Introduction</td>
<td>15 min</td>
</tr>
<tr>
<td></td>
<td>LTE RAN Systems and Site Introduction</td>
<td>0.5 hour</td>
</tr>
<tr>
<td></td>
<td>Customer Product Information and tool kits</td>
<td>15 min</td>
</tr>
<tr>
<td></td>
<td>Command Line Interface/Node Command Line Interface</td>
<td>1 hour</td>
</tr>
<tr>
<td></td>
<td>Element Management</td>
<td>1 hour</td>
</tr>
<tr>
<td></td>
<td>LTE RBS 6301 Maintenance</td>
<td>3 hours</td>
</tr>
</tbody>
</table>
WCDMA to LTE L11 Delta

LZU1087907-R1A

Description

Are you currently working with Operation, Configuration or Performance Management in the area of WCDMA RAN but soon moving into the LTE world?

This course targets the delta you need to know when it comes to tools, procedures, RBS6000 O&M support, Managed Objects etc. If you are familiar with IP configuration in WCDMA, you will know how to integrate an eNodeB from scratch after this course. If you know how to use the OSS-RC toolbox towards WCDMA nodes before the course, you are able to manage LTE eNodeB’s afterwards.

Learning objectives

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

1. **Explain the LTE network architecture and the Operation and Maintenance support**
   1.1 Describe the nodes that build up LTE/SAE
   1.2 Describe on an overview level the O&M infrastructure
   1.3 Describe the Operation and Maintenance architecture of an RBS6000 and where to find documentation about the Managed Object Model

2. **Perform Hardware and Software Management on a LTE RAN**
   2.1 Explain the hardware building practice of RBS6000 (MPE, DUL, RUL) and which ways O&M connectivity can be established to the node

3. **Integrate an RBS6000**
   3.1 Describe the integration process of an RBS6000 in detail
   3.2 Perform the on-site integration of an RBS6000 manually with the Site Installation file, the Site Basic file and the Site External file.
   3.3 Configure the Transport Network carrying S1 and X2 user plane and control plane traffic to an RBS6000 with and without IPsec.
   3.4 Configure the Radio Network in an RBS6000.
   3.5 Configure QoS parameters in RBS6000.
   3.6 Configure the RBS6000 with the Auto-integration feature.
4 Perform Performance Management on the LTE RAN
4.1 Describe what Observability of the LTE RAN means and how this is related to Key Performance Indicators
4.2 Describe the E-UTRAN PM solution
4.3 Describe the performance statistics generated in the LTE RAN (Counter collection, Cell Traffic Recording, User Equipment Traffic Recording)
4.4 Explain the Subscription Profile principle
4.5 Get an overview of statistics and recording concepts in the LTE, and use the OSS-RC to initiate UE Tracing
4.6 Describe what streaming events are and collect these events in OSS-RC

Target audience
The target audience for this course is: Service Planning Engineer, Service Design Engineer and Network Design Engineer.

Prerequisites
Successful completion of the following courses:

- LTE/SAE System Overview Lzu 108 7020
- LTE L11 Air Interface Lzu 108 7897

Duration and class size
The length of the course is 2 days and the maximum number of participants is 8.

Learning situation
Define the Learning Situation/s for which the product might be used, for example instructor-led training, task-oriented learning, web-based learning etc. Look into the document "Definition of Delivery Methods for Learning Products" in the LPD Guidelines.
**Time schedule**

The time required always depends on the knowledge of the attending participants and the hours stated below can be used as estimate.

<table>
<thead>
<tr>
<th>Day</th>
<th>Topics in the course</th>
<th>Estimated time</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Network architecture and RBS6000 O&amp;M and HW/SW concepts compared to the RBS3000 platform</td>
<td>2 hours</td>
</tr>
<tr>
<td></td>
<td>O&amp;M tools support for LTE RAN (EM, COLI and the OSS toolbox)</td>
<td>2 hours</td>
</tr>
<tr>
<td></td>
<td>O&amp;M tools support for LTE - exercises</td>
<td>2 hours</td>
</tr>
<tr>
<td>2</td>
<td>Auto-integration of a new eNodeB</td>
<td>2 hours</td>
</tr>
<tr>
<td></td>
<td>Integration of a new eNodeB - exercises</td>
<td>2 hours</td>
</tr>
<tr>
<td></td>
<td>LTE Performance Management support</td>
<td>1 hour</td>
</tr>
<tr>
<td></td>
<td>LTE Performance Management - exercises</td>
<td>1 hour</td>
</tr>
</tbody>
</table>
RBS 6000 in a Nutshell

LZU1087504 R1A

Description
This WBL course is intended to give the participant an overview of the RBS 6000 series. Are you interested in the latest RBS technology from Ericsson. The RBS 6000 Overview course will guide you thought the concept and explain you the main benefits of the new architectures. You will learn how the multi-standard concept is implemented, more room for expansion is generated and how you can lower the power consumption of your network for greater sustainability.

Learning objectives
On completion of this course the participants will be able to:
1. Describe on an overview level the RBS 6000 Platform
1.1 Describe the generic building and form structure used in RBS 6000
1.2 Describe on an overview level the building practice
1.3 Explain the advantages of multi-standard RBS
1.4 Describe how more room for expansions is generated
1.5 Compare the power consumption of a RBS 6000 to today’s technologies

2. Understand how WCDMA is implemented in the RBS 6000
2.1 Describe on block level which boards and units gives the WCDMA Functionality

3. Understand how LTE is implemented in the RBS 6000
3.1 Describe on block level which boards and units gives the LTE Functionality

4. Understand how GSM is implemented in the RBS 6000
4.1 Describe on block level which boards and units gives the GSM Functionality

Target audience
The target audience for this course are:
System Technician
Service Technician
System Engineers
Service Engineers

Prerequisites
The participants should be familiar with the WCDMA, GSM and LTE on overview level.
**Duration**

The length of the course is 1 hour.

**Learning situation**

This is a web-based interactive training course with multimedia content.
IP Networking

LZU 102 397 R5A

Description

This course will provide participants with an insight into and an understanding of the TCP / IP protocol stack from the physical layer to the application layer. Participants will learn the operation of different protocols and applications within the TCP / IP suite such as DHCP, DNS, NFS, NIS, NTP, HTTP, SNMP, SMTP, Telnet, FTP, TFTP and RTP. Participants will learn about IP addressing, both classful and classless (CIDR) and how subnetting / aggregation and VLSM operates. Participants will learn about different network devices and will develop a detailed understanding of LAN Switching, Routing and Routing protocols. Hands-on exercises using protocol analysers are used to facilitate the understanding of theory sessions.

Learning objectives

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

1 Describe Ethernet, IP networking and the relevant Standards Bodies
1.1 List the functions of the different bodies involved in IP standards / RFCs
1.2 Analyze the OSI reference model and how it relates to the TCP / IP stack
1.3 Explain Ethernet in terms of Physical and Data Link Layer: MAC Address, CSMA/CD principles, Fast Ethernet, Gigabit Ethernet and speed negotiation
1.4 Explain the operation of Hubs, Switches and Routers
1.5 Explain Wireless LANs
1.6 Explain the IP Protocol
1.7 Explain the IPv4 packet structure, protocol header and features
1.8 Explain VLSM, CIDR, Subnetting, aggregation, NAT and NAPT
1.9 Explain the ICMP protocol, ping and traceroute
1.10 Explain the IGMP protocol
1.11 Perform exercises calculating IPv4 addresses and subnets
1.12 Describe the IPv6 packet structure, protocol header and features

2 Explain and compare the transport protocols
2.1 Explain TCP, UDP and SCTP protocol structures, headers and functionality

3 List the applications protocols
3.1 List and explain the operation of different protocols / applications such as DHCP, DNS, NFS, NIS, NTP, HTTP, SNMP, SMTP, Telnet, FTP, TFTP and RTP
4 Describe IP Switching and Routing Protocols and perform exercises
4.1 Explain the purpose and structure of ARP
4.2 Explain the purpose and implementation of VLANs
4.3 Perform exercises for VLAN implementations
4.4 Explain the purpose of Spanning Tree Protocol (STP)
4.5 Perform Spanning Tree Protocol (STP) exercises
4.6 Explain the operation of Static and Dynamic routing protocols
4.7 Perform Static routing exercises
4.8 Explain Interior and Exterior Gateway Protocols
4.9 List the differences between Vector Distance and Link State protocols
4.10 Explain the RIP routing protocol
4.11 Explain the OSPF routing protocol
4.12 Explain the BGP routing protocol
4.13 Explain the IS-IS routing protocol
4.14 Perform routing protocol exercises for RIP, OSPF, BGP and IS-IS

Target audience
The target audience for this course is: Network Design Engineers, Network Deployment Engineers, System Technicians, Service Technicians, System Engineers and Service Engineers.

Prerequisites
There are no pre-requisites.

Duration and class size
The length of the course is 5 days and the maximum number of participants is 8.

Learning situation
This course is based on theoretical and practical instructor-led lessons given in both classroom and in a technical environment using equipment and tools, which are accessed remotely.
# Time schedule

The time required always depends on the knowledge of the attending participants and the hours stated below can be used as estimate.

<table>
<thead>
<tr>
<th>Day</th>
<th>Short description of the topics in the course</th>
<th>Estimated time</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>• List the functions of the different Standard Bodies involved in IP Standards / RFCs&lt;br&gt;• Analyze the OSI Reference Model and how it relates to the TCP / IP stack&lt;br&gt;• Explain Ethernet in terms of Physical and Data Link Layer: MAC Address, CSMA/CD principles, Fast Ethernet, Gigabit Ethernet and speed negotiation&lt;br&gt;• Explain the operation of Hubs, Switches and Routers&lt;br&gt;• Explain Wireless LANs&lt;br&gt;• Explain the IP Protocol</td>
<td>0.5 hour&lt;br&gt;1.0 hour&lt;br&gt;1.5 hours&lt;br&gt;2.0 hours&lt;br&gt;0.5 hour&lt;br&gt;0.5 hour</td>
</tr>
<tr>
<td>2</td>
<td>• Explain the IPv4 packet structure, protocol header and features&lt;br&gt;• Explain VLSM, CIDR, Subnetting, aggregation, NAT and NAPT&lt;br&gt;• Explain the ICMP protocol, ping and traceroute&lt;br&gt;• Explain the IGMP Protocol&lt;br&gt;• Perform exercises calculating IPv4 addresses and subnets&lt;br&gt;• Describe the IPv6 packet structure, protocol header and features</td>
<td>1.0 hour&lt;br&gt;1.0 hour&lt;br&gt;1.0 hour&lt;br&gt;0.5 hour&lt;br&gt;2.0 hours&lt;br&gt;0.5 hour</td>
</tr>
<tr>
<td>3</td>
<td>• Explain TCP, UDP and SCTP protocol structures, headers and functionality&lt;br&gt;• List and explain the operation of different protocols / applications such as DHCP, DNS, NFS, NIS, NTP, HTTP, SNMP, SMTP, Telnet, FTP, TFTP and RTP&lt;br&gt;• Explain and perform exercises about ARP</td>
<td>2.0 hours&lt;br&gt;2.0 hours&lt;br&gt;2.0 hours</td>
</tr>
</tbody>
</table>
4
- Explain the purpose and structure of ARP 0.5 hour
- Explain the purpose and implementation for VLANs 0.5 hour
- Perform exercises for VLANs implementations 1.0 hour
- Explain the purpose of Spanning Tree Protocol (STP) 0.5 hour
- Perform Spanning Tree Protocol (STP) exercises 0.5 hour
- Explain the operation of Static and Dynamic routing protocols 0.5 hour
- Perform Static routing exercises 0.5 hour
- Explain Interior and Exterior Gateway Protocols 1.0 hour
- List the differences between Vector Distance and Link State protocols 0.5 hour

5
- Explain RIP routing protocol 1.0 hour
- Explain OSPF routing protocol 1.5 hours
- Explain BGP routing protocol 0.5 hour
- Explain IS-IS routing protocol 0.5 hour
- Perform routing protocol exercises for RIP, OSPF, BGP and IS-IS 2.5 hours
LTE/SAE– System Overview, WBL

Description
If you want to know what LTE/SAE (Long Term Evolution / System Architecture Evolution) is, this course will give you an overview of the new radio technology and protocols involved in the E-UTRAN (Evolved UTRAN, also referred to as LTE) and the architecture behind EPC (Evolved Packet Core, also referred to as SAE – System Architecture Evolution).

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

1 Explain the background and architecture of E-UTRAN and EPC
   1.1 Describe the evolution of cellular networks
   1.2 Summarize the evolution of 3GPP releases
   1.3 Describe the flexible spectrum usage

2 Describe the EPS Architecture
   2.1 Explain the logical architecture of EPS (E-UTRAN and EPC)
   2.2 Give an overview of the interfaces in EPS
   2.3 Describe the radio interface techniques
   2.4 Explain the difference between the FDD and TDD mode
   2.5 Detail the terminal states
   2.6 Describe the Evolved Packet Core
   2.7 Describe the role of the MME and the S-GW
   2.8 Detail the S1 and X2 interfaces and their protocol stacks

3 Describe the Air Interface
   3.1 Explain the radio interface structure
   3.2 Detail the channel structure of the radio interface
   3.3 Describe the physical signals in UL and DL
   3.4 Detail the time-domain structure in the radio interface in UL and DL for both FDD and TDD mode
   3.5 Detail the downlink transmission technique
   3.6 Have a good understanding of the OFDM principle, signal generation and processing
   3.7 Detail the reference symbols in DL
   3.8 Detail the control signaling in DL
   3.9 Detail the uplink transmission technique
   3.10 Have a good understanding of the SC-FDMA principle, signal generation and processing
   3.11 Explain the pros and cons with OFDM and SC-FDMA
   3.12 Detail the control signaling in UL
   3.13 Describe the concepts of layers, channel rank, spatial multiplexing, SU-MIMO and MU-MIMO
4  Detail the Radio Resource Management and Mobility
4.1  Describe the Radio Resource Management
4.2  Describe UL and DL scheduling and signaling
4.3  Explain the concepts of dynamic and persistent scheduling
4.4  Describe LTE Mobility
4.5  Describe intra-LTE mobility in ECM_CONNECTED and ECM_IDLE mode
4.6  Explain inter-working with 2G/3G

Target audience
The target audience for this course are:
Network Engineer
Service Engineer
Service Design Engineer
Network Design Engineer

Prerequisites
A general knowledge in cellular systems and radio technology.

Duration and class size
The length of the course is 3 hours.

Learning situation
This is a web-based interactive training course with multimedia content.
LTE/SAE in Nutshell

LZU1087417 R1A

Description

Do you want to know what LTE/SAE is all about. This eLearning course will give you an overview on end user experience of Long Term Evolution (LTE) in terms of services and applications, speed and capacity as well as network setup. The course will also highlight the mobile technology evolution. The course content is a simple explanation of the next generation technology with a focus on a non technical target audience.

Learning objectives

On completion of this course the participants will have answers to the following questions:

1. **What is LTE/SAE?**
   1.1 How fast is LTE?
   1.2 What is included in the Mobile Technology Evolution?

2. **What is the end user experience?**
   2.1 What are possible services and application?
   2.2 What is the speed and capacity?
   2.3 Is it better than 3G?
   2.4 How much does it cost?
   2.5 Do I need a new phone?
   2.6 Is the coverage and mobility better than today?

3. **How does LTE/SAE work?**
   3.1 Which Frequencies are used?
   3.2 Which nodes are included in the Radio Network?
   3.3 Which nodes are included in the Core Network?

4. **What is the meaning of the typical LTE related abbreviations?**

Target audience

The target audience for this course is: System Technicians, Service Technicians, Field Technicians, System Administrators, Application Developers, Business Developers, Customer Care Administrators.

The main focus of this course is on non technical personnel.

Prerequisites

None

Duration and class size

The length of the course is 1 hour.

Learning situation
This is a web-based interactive training course with multimedia content.
MIMO in WCDMA and LTE

Description
Have you wondered how MIMO works and how it can double the data rate and spectral efficiency in WCDMA and LTE?

With the help of the MIMO in WCDMA and LTE course the attendees will learn how multiple antennas in HSPA and LTE is implemented and how much the performance is can increase.

In this course, the basic radio channel and antenna properties is explained and related to the multiple antenna processing in HSPA and LTE.

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

1 Describe the basics of MIMO
1.1 Explain the reason for multi-antenna processing
1.2 List the different methods of multi-antenna processing
1.3 Explain the different multi antenna possibilities
1.4 Explain the general concepts of beamforming, diversity and spatial multiplexing
1.5 Explain the concepts of MIMO, SIMO, MISO and SISO

2 Describe the radio channel and antenna basics
2.1 Explain multi-path propagation
2.2 Explain time dispersion and delay spread
2.3 Explain the doppler effect
2.4 Explain coherence bandwidth and coherence time
2.5 Explain angular spread and its impact on antenna configuration
2.6 Explain polarization properties of the radio channel
2.7 Explain basic antenna properties
2.8 Explain polarization properties of antennas
2.9 Describe beamforming using an ULA (Uniform Linear Array)
2.10 Explain polarization diversity
3   **Explain the concepts of precoding and spatial multiplexing**
   3.1 Explain the concept of spatial multiplexing
   3.2 Explain SDMA (Spatial Division Multiple Access)
   3.3 Explain the difference of single-rank and multi-rank transmissions
   3.4 Explain the concepts of channel rank, transmission rank and layers
   3.5 Describe the difference of antenna ports and antenna elements
   3.6 Explain the role of the precoder and the matrix algebra involved

4   **Describe MIMO in WCDMA**
   4.1 Explain Tx diversity in WCDMA
   4.2 Explain spatial multiplexing in WCDMA
   4.3 Describe the UE feedback (PCI)
   4.4 Describe the configuration of MIMO in WCDMA

5   **Describe MIMO in LTE**
   5.1 Explain Tx diversity in LTE
   5.2 Describe SU-MIMO and MU-MIMO
   5.3 Explain spatial multiplexing in LTE
   5.4 Describe the UE feedback (CSI, PMI, RI and CQI) in LTE
   5.5 Describe open loop spatial multiplexing in LTE
   5.6 Describe closed loop spatial multiplexing in LTE
   5.7 Describe the configuration of MIMO in LTE

**Target audience**

The target audience for this course is: Service Engineer, System Engineer.

**Prerequisites**

The participants should be familiar with the WCDMA and/or LTE Radio Interface. An interest in radio channel properties and antennas would be an advantage.

**Duration and class size**

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

**Learning Situation**

This course is based on theoretical instructor-led lessons and theoretical exercises given in a classroom environment.
**Time schedule**

The time required always depends on the knowledge of the attending participants and the hours stated below can be used as estimate.

<table>
<thead>
<tr>
<th>Day</th>
<th>Topics of the course</th>
<th>Estimated time</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>MIMO Introduction</td>
<td>1 hour</td>
</tr>
<tr>
<td></td>
<td>Radio channel and antenna basics</td>
<td>2 hours</td>
</tr>
<tr>
<td></td>
<td>Precoding and spatial multiplexing</td>
<td>1 hour</td>
</tr>
<tr>
<td></td>
<td>MIMO in WCDMA</td>
<td>1 hour</td>
</tr>
<tr>
<td></td>
<td>MIMO in LTE</td>
<td>1 hour</td>
</tr>
</tbody>
</table>