LTE L13 Radio Access Network
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>
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<tbody>
<tr>
<td><img src="image1" alt="Icon" /></td>
<td>Instructor Led Training (ILT)</td>
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<tr>
<td><img src="image2" alt="Icon" /></td>
<td>Virtual Classroom Training (VCT)</td>
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<td><img src="image3" alt="Icon" /></td>
<td>eLearning (WBL)</td>
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<td><img src="image4" alt="Icon" /></td>
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<td>Structured Knowledge Transfer (SKT)</td>
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<td><img src="image7" alt="Icon" /></td>
<td><strong>mLearning</strong></td>
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<td><img src="image8" alt="Icon" /></td>
<td>Job duty analysis (JDA)</td>
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<tr>
<td><img src="image9" alt="Icon" /></td>
<td>Competence GAP Analysis (CGA)</td>
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AIR in a Nutshell

LZU1089091 R1A

Description
The new Antenna Integrated Radio (AIR) unit is a single tower-mounted unit that can replace the antenna/s and radio for one sector. The focus of this training is on building the participant’s knowledge of AIR product used by Ericsson in the current market. This is a 30 minute web based learning module that will give a brief introduction into the design, application and installation of the AIR unit.

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

1 Describe the new AIR unit
   1.1 Mention how the unit is multi-standard ready and is part of Ericsson’s new RBS 6000 product family
   1.2 Explain the main drivers behind air

2 Describe on an overview level the design of the AIR unit
   2.1 Define the characteristics of the AIR unit
   2.2 Show the site design of the new unit

3 Describe the application of the AIR unit
   3.1 Recognize which cabinets of the RBS 6000 product family can be implemented with the AIR unit
   3.2 Show suitable locations for installing the AIR unit

4 Recognize and identify the installation process of the AIR unit
   4.1 Show examples of site deployment for the AIR unit along with the RBS 6000 family products.
   4.2 Explain the evolution process from today’s solution compared with future possibilities.

5 Explain how the AIR unit’s internal architecture makes a difference to Power consumption
   5.1 Mention the evolution of new frequencies being introduced.
   5.2 Mention the introduction of dual column with 4 Rx branches and the benefits of it
Target audience

The target audience for this course is:

Anyone with an interest on building knowledge in the new AIR unit

Prerequisites

Successful completion of the following courses:

- WCDMA RAN Overview (WBL), LZU108 5202
- GSM Radio Network Overview (WBL), LZU108 6235
- LTE/SAE in Nutshell (WBL), LZU108 7417

Duration and class size

The length of the course is about 30 minutes.

Learning situation

This is a web based learning course

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 (hours)</th>
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<tbody>
<tr>
<td>1</td>
<td>Background and architecture of E-UTRAN and EPC</td>
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<tr>
<td></td>
<td>RF inter-working scenarios</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>RF characteristics of CDMA, 1xEV DO and LTE</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>Antenna co-existence and interference</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Performance characteristics</td>
<td>3</td>
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</table>
HetNet in a Nutshell

LZU1089092 R1A

Description

‘Heterogeneous’ or HetNet for short stands for the different types of base stations (macro, micro, pico, relay) that are operating on different technologies (GSM, WCDMA and LTE) that are used together in the same network to build the good coverage and high capacity that end-users demand from their operator (contrary to ‘homogeneous’ networks that are mainly built with one type of base station, often macro). The focus of this training is on building the participant’s knowledge of the HetNet and how it is implemented by Ericsson. This is a thirty minute, web based learning module.

Learning objectives

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

1. Understand the meaning of the term HetNet
   1.1 Explain the predictions of future growth and how Ericsson will use HetNet to meet high volume traffic demands

2. Describe how it ensures higher performance
   2.1 Explain the different approaches that can be taken to meet traffic and data rate demands.
   2.2 Mention the differences between Improved Macro, Densified Macro and a Heterogeneous Network.

3. Detail the RBS 6000 portfolio for compact macro, main-remote and micro RBS
   3.1 Describe the full size macro base station RBS 6201
   3.2 Describe the compact main-remote base station RBS 6601 and AIR unit
   3.3 Describe the small cell product portfolio
   3.4 Describe the different deployment scenarios for the mRBS, mRRU’s and pRBS.

4. Explain the concept of Evo RAN and how it is related to the Ericsson HetN Et solution
   4.1 Give an outline of the end user experience challenges.
   4.2 Briefly mention the components of the Radio Network Toolbox
   4.3 Describe the transport options for HetNet
   4.4 Explain how the integration time for adding a new cell has been reduced from weeks to minutes
   4.5 Briefly mention the concept of SON and Smart Simplicity
Target audience
The target audience for this course is:
Anyone interested in learning more about the HetNet Solution

Prerequisites
Successful completion of the following courses:
LTE/SAE in Nutshell (WBL), LZU108 7417

Duration and class size
The length of the course is 30 minutes.

Learning situation
This is a web based learning module
KPIs in the LTE/SAE Network

LZU1087713 R2E

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:

   1.1 Explain the terms EPS, LTE, E-UTRAN, SAE, and EPC.
   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
Successful completion of the following courses:
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 (hours)</th>
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<tbody>
<tr>
<td>1</td>
<td>LTE/SAE Network Introduction</td>
<td>2</td>
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<tr>
<td></td>
<td>LTE KPIs using eNodeB counters</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>EPC KPIs using SGW counters</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>EPC KPIs using MME counters</td>
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LTE Evolution, Advantages in Feature 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**
Successful completion of the following courses:
A general knowledge in cellular systems and radio technology.

**Duration and class size**
The length of the course is 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 (hours)</th>
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<td>1</td>
<td>LTE/SAE overview and evolution of Cellular Networks</td>
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<td>Driving factors behind LTE/SAE</td>
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<tr>
<td></td>
<td>LTE Radio fundamentals</td>
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<td>Architecture of EPS (E-UTRAN and EPC)</td>
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<td>LTE/SAE Business aspects: Market Outlook and Market Trends</td>
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<td>Key Business Challenges</td>
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<td>End User Services, Applications and Devices</td>
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<td>Revenue and pricing models</td>
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<td>2</td>
<td>Network Deployment considerations</td>
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<tr>
<td></td>
<td>Radio Network Considerations</td>
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<td>Transport Network Considerations</td>
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<td></td>
<td>Core Network Considerations</td>
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<td>Exercise</td>
<td>2</td>
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<tr>
<td></td>
<td>Summary and Conclusion</td>
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</table>
LTE L12 to L13 Delta

LZU1089113  R1A

Description
LTE is already commercially used in many operators but the system does not stop to evolve. So the main question is what is new in Ericsson LTE L13A RAN solution? This course summarizes both new and enhanced features and functionalities in Ericsson LTE L13A.

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

1 Understand Capacity Improvements in L13A
2 Understand new and impacted features in Mobility
   2.1 Packet Forwarding
   2.2 High speed UE
   2.3 Handover To UTRAN (SRVCC to UTRAN)
   2.4 Packet Forwarding at S1 Handover
   2.5 Mobility Control at Poor Coverage Area
3 Understand LPPa based Location Support
   3.1 Understand E-CID Support
4 Understand new and impacted features in RAN Implementation
   4.1 Understand Contention Free Random Access
   4.2 Understand PRACH IRC Hybrid
   4.3 Understand TTI Bundling
   4.4 Understand Forwarding For RLC UM
   4.5 Understand RRC Connection Re-Establishment
   4.6 Understand Neighbor Cell Relation List Clean Up
   4.7 Understand Downlink Frequency-Selective Scheduling
   4.8 Understand Advanced Cell Supervision
   4.9 Understand Battery savings for DBS/SABE

Target audience
The target audience for this course is:
Service Design Engineer, Network Design Engineer, Service Technician, System
Administrator, Network Deployment Engineer, Service Deployment Engineer

Prerequisites
Successful completion of the following courses:
Participants should have previous competence in ERICSSON LTE RAN in earlier product releases.
The following trainings listed below or equivalent knowledge is desired in order to attend to this class:
- LTE/SAE System Overview Lzu1087020 R6B
- LTE L12 Air Interface Lzu1088557 R2A
- LTE L12 Radio Network Functionality Lzu1088559 R1B

Duration and class size
The length of the course is 2 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.

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<thead>
<tr>
<th>Day</th>
<th>Topics in the course</th>
<th>Estimated Time (hours)</th>
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<tr>
<td></td>
<td>Capacity Improvements in L13A</td>
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<tr>
<td></td>
<td>Packet Forwarding</td>
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<tr>
<td></td>
<td>High speed UE</td>
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</tr>
<tr>
<td>1</td>
<td>Handover To UTRAN (SRVCC to UTRAN)</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Packet Forwarding at S1 Handover</td>
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<tr>
<td></td>
<td>Mobility Control at Poor Coverage Area</td>
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<tr>
<td></td>
<td>E-CID Support</td>
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<tr>
<td></td>
<td>Contention Free Random Access</td>
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<td></td>
<td>PRACH IRC Hybrid</td>
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<td>TTI Bundling</td>
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<td></td>
<td>Forwarding For RLC UM</td>
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<tr>
<td>2</td>
<td>RRC Connection Re-Establishment</td>
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<tr>
<td></td>
<td>Neighbor Cell Relation List Clean Up</td>
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<tr>
<td></td>
<td>Downlink Frequency-Selective Scheduling</td>
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<tr>
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<td>Advanced Cell Supervision</td>
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<tr>
<td></td>
<td>Battery savings for DBS/SABE</td>
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LTE L13 Access Transport Network Dimensioning

Description
How is the Ericsson LTE L13 Access Transport Network dimensioned? What are the types of traffic carried by LTE and how are they affected by transport network capacity? What transport network overheads need to be considered and how are these incorporated into dimensioning calculations? How is the Ericsson RBS 6000 hardware dimensioned for the LTE transport interfaces?

With the help of the LTE L13 Access Transport Network Dimensioning course the attendees will learn about the type of traffic that is carried by LTE and how the Access Network dimensioning is carried out according to the latest Ericsson recommendation. They will also learn how the RBS6000 node hardware and transport interfaces are dimensioned for LTE. This new competence is tested on sample dimensioning exercises at the end of the course so that the students leave with competence in the area of LTE Access Transport Network dimensioning.

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

1. Describe the EPS architecture and interfaces
   1.1 List the interfaces in the EPS (Evolved Packet System)
   1.2 Explain the EPS protocol stacks for user and control plane

2. Describe the different types of traffic carried by LTE networks
   2.1 List the protocols that support the various LTE traffic types
   2.2 Explain the operation of TCP, UDP, HTTP and FTP Internet Protocols
   2.3 Explain the issues surrounding Voice over LTE.

3. Explain the IP Functionality of the L13 LTE RAN Transport Network
   3.1 Identify the structure of IPv4 and IPv6 packets
   3.2 Explain the structure of the Ethernet frames used in the LTE Transport Network
   3.3 Explain IPSec and VLAN routing and how they impact dimensioning
   3.4 Explain how IP and Ethernet Quality of Service (QoS) is implemented in LTE

4. Perform LTE link dimensioning for FDD and TDD Networks
   4.1 Describe the different LTE link dimensioning approaches
   4.2 Perform Transport Network overhead calculations
   4.3 Perform last mile and mobile backhaul dimensioning

5. Perform RBS6000 node hardware and transport interfaces dimensioning for LTE
5.1 Identify the RBS6000 hardware for LTE
5.2 Explain the LTE Synchronization mechanism
5.3 Dimension the RBS6000 node hardware and transport interfaces for LTE

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

Prerequisites
Successful completion of the following courses:
LTE Air Interface LZU1089102
LTE Protocols and Procedures LZU1089104
LTE Radio Network Functionality LZU1089105
LTE Radio Network Functionality LZU1089104

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>
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<th>Day</th>
<th>Topics in the course</th>
<th>Estimated Time (hours)</th>
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<td>LTE Traffic</td>
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<td>1</td>
<td>LTE IP Transport Network Functionality</td>
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<td></td>
<td>LTE Link Dimensioning (including exercise)</td>
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</tr>
<tr>
<td></td>
<td>LTE Node Dimensioning (including exercise)</td>
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</tbody>
</table>
LTE L13 Air Interface

Description
Do you need to know what information elements are within each of the LTE layer 1 channels and where to find them in the physical layer resource? 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 9
   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 different types of intraLTE and interLTE mobility

**Target audience**

The target audience for this course is:

Service Engineer, Service Design Engineer, Network Design Engineer

**Prerequisites**

Successful completion of the following courses:

LTE/SAE System Overview, LZU1087020

**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 (hours)</th>
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<tbody>
<tr>
<td>1</td>
<td>• Introduction, Radio Interface general principles</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>• Radio Interface Structure and signaling</td>
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<td>• Radio Resource &amp; Mobility Management</td>
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LTE L13 Configuration

LZU1089108 R1A

Description
Are you now ready to configure your own LTE radio access network? What needs to be done at the RBS site, how would the tools in OSS-RC be used and what do the configuration files look like?

LTE L13 Configuration describes how an RBS6000 is configured in the L13 version of LTE RAN. The course includes both theoretical sessions describing what need to be configured, and practical sessions during which the configurations are made. Configurations are carried out step by step using OSS-RC’s Base Station Integration Manager (BSIM) and the RBS Element Manager.

After the course, participants will be familiar with the difference between manual- and autointegration procedures, understand the structures and contents of configuration files that are required during the integration of the RBS, including the impact of IpSec support during the integration. The Mul-, S1- and X2- interfaces, including basic radio network configurations are made during the training.

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

1 Explain LTE L13 interfaces and the integration of RBS6000
1.1 Describe the interfaces S1, X2 and Mul to an eNodeB in LTE L13
1.2 Identify the main differences between various RBS6000 products, such as RBS6101, RBS6102, RBS6201, RBS6202, RBS6301, RBS 6302 and RBS6601
1.3 Summarize the integration process of an RBS6000 and differentiate between the manual integration and auto integration procedures
1.4 Identify the tools that are used in the different steps of the integration procedure
1.5 Explain what the Managed Object Model (MOM) is, why it is important in configuration and where to find information about it

2 Configure the Transport Network in RBS6000
2.1 Relate the IP and Ethernet functionality to the L13 RAN Transport Network
2.2 Describe the hardware used to support IP/Ethernet transmission in RBS6000
2.3 List the various ways Network Synchronization reference may be realized for a RBS6000
2.4 Recognize the Managed Objects related to the Mul-, the S1- and X2-interfaces
implementation, and how some key attributes implement the transport network functionalities

2.5 Edit BSIM templates in the OSS-RC to be used during configuration
2.6 Perform the on-site integration of an RBS6000 manually with the Site Installation file, the Site Basic file and the Site External file
2.7 Configure the Transport Network and Radio Network using both manual and auto integration procedures

3 Configure the Radio Network in RBS6000
3.1 Explain the concept of cell and its relation to sector and antennae system in RBS6000
3.2 Recognize the Managed Objects related to radio network configuration
3.3 Identify some basic parameters related to cell and cell relations
3.4 Identify, and, if necessary, change QoS related parameters in RBS6000

4 Understand the impact of IpSec during the Transport Network Configuration in RBS6000
4.1 Explain what IP Security (IpSec) is and how it is supported in the LTE RAN
4.2 Recognize Managed Objects related to IpSec implementation and the some key attributes that define the working of IpSec
4.3 State how the configuration files would be affected with IpSec in the LTE RAN
4.4 Identify how the configuration procedure would be affected by having IpSec in the RBS6000

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

Prerequisites
Successful completion of the following courses:
LTE L13 Operation LZU1089107
LTE L13 Air Interface LZU1089102 (Optional)

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 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>Topics in the course</th>
<th>Estimated Time (hours)</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>
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<td></td>
<td>Transport Network Configuration theory</td>
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<td>Radio Network Configuration theory</td>
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</tr>
<tr>
<td>2</td>
<td>Radio Network Configuration theory</td>
<td>1.5</td>
</tr>
<tr>
<td></td>
<td>Manual on-site configuration of the RBS6000</td>
<td>1.5</td>
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<tr>
<td></td>
<td>Configuration of the S1 and X2 interfaces</td>
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<td>3</td>
<td>Configuration of the Radio Network and QoS</td>
<td>3</td>
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<tr>
<td></td>
<td>Impact of IpSec theory</td>
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<tr>
<td></td>
<td>Understanding IPsec</td>
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<td></td>
<td>Summary of the course</td>
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LTE L13 eNodeB Commissioning

LZU1089106 R1A

Description
Do you need to understand how to integrate the LTE eNodeB (implemented on a RBS6000) from a site perspective? What does Autointegration imply? This course provides the participants with hands-on experience of the procedures that need to be performed for the commissioning and integration of the eNodeB.

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 on a overview level the RBS6000 platform and hardware
   1.2 List the integration steps of RBS6000

2. Explain the concept of Management Tools
   2.1 Use the Element Manager (EM) to find information relevant for a LTE RBS commissioner
   2.2 Use the Command Line Interface (COLI) to print some basic information
   2.3 Configure a client computer to connect to the RBS to open the Element Manager

3. Perform commissioning and integration of the RBS
   3.1 Power up the RBS
   3.2 Check the RBS status
   3.3 Connect the client computer
   3.4 Select integration scenario
   3.5 Integrate the RBS manually
   3.6 Understand how the integration procedure differs with Autointegration
   3.7 Monitor the RBS integration
   3.8 Verify external alarms
   3.9 Check hardware status
   3.10 Test User Plane Traffic
   3.11 Complete and store integration report

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

Prerequisites
Successful completion of the following courses:
LTE/SAE System Overview LZU1087020
RBS 6000 Overview LZU1087503
Or
LTE/SAE Overview, WBL LZU1087318
RBS 6000 in a Nutshell, WBL LZU1087504

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 (hours)</th>
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<td>Introduction</td>
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<tr>
<td></td>
<td>eNode B Management Applications</td>
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<td></td>
<td>eNode B Integration (theory and practical exercises)</td>
<td>5</td>
</tr>
</tbody>
</table>
LTE L13 Initial Tuning

LZU1089111 R1A

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 L12 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 inter-frequency interference ratio
   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 Engineer, Service Engineer

Prerequisites
Successful completion of the following courses:
- LTE L13 Air Interface LZU1089102
- LTE L13 Configuration LZU1089108
- LTE L13 Protocols and Procedures LZU1089103
- LTE L13 Radio Network Functionality LZU1089104
- LTE L13 Troubleshooting LZU1089109

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 (hours)</th>
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<tbody>
<tr>
<td>1</td>
<td>Explain the process of tuning</td>
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<td></td>
<td>Perform preparations necessary for the tuning</td>
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<td></td>
<td>Cell tuning</td>
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<td>2</td>
<td>Perform a Network and UE tuning</td>
<td>3</td>
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</tbody>
</table>
LTE L13 Network Design

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 L13 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 L13 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 FDD and TDD.
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
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 6101, 6102, 6201, 6202, and 6601.

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

Prerequisites
Successful completion of the following courses:
LTE L12 Air Interface LZU1089102
LTE L12 Protocols and Procedures LZU1089103
LTE L12 Radio Network Functionality LZU1089104

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 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.

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<tr>
<th>Day</th>
<th>Topics in the course</th>
<th>Estimated Time (hours)</th>
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<td>1</td>
<td>Introduction</td>
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<tr>
<td></td>
<td>General dimensioning principles</td>
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<td>Radio interface capacity</td>
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<td></td>
<td>Traffic types and protocols</td>
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<td>LTE dimensioning</td>
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<td>LTE dimensioning</td>
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<tr>
<td>2</td>
<td>Co-location and co-existence</td>
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<td></td>
<td>LTE cell planning</td>
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</tr>
</tbody>
</table>
LTE L13 Operation

LZU1089107 R1A

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 (O&M) support
   1.1 Note the primary functions of the nodes that build up LTE/SAE
   1.2 Describe on an overview level the O&M infrastructure
   1.3 Explain 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, RU) and which ways O&M connectivity can be established to the node
   2.2 Export and handle hardware and software resources in an RBS6000 via OSS-RC and EMAS
   2.3 Recognize the file system in an RBS6000
   2.4 Describe the key Configuration Version concepts
   2.5 Work with Configuration Versions and file system using OSS-RC, EM, COLI and AMOS
   2.6 Note 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 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
   3.3 Differentiate between the functions of the command line interface (COLI) and Node
Command Line Interface (NCLI)

4 Perform Performance Management on the LTE RAN
4.1 Describe what Observables of the LTE RAN means and how this is related to Key Performance Indicators
4.2 Explain the E-UTRAN PM solution
4.3 Identify the various performance statistics/recordings generated in the LTE RAN (Statistics, Cell Traffic Recording, User Equipment Traffic Recording)
4.4 Create a new Subscription Profile in the OSS-RC
4.5 Initiate a UE Trace using the OSS-RC
4.6 Explain what streaming events are and collect these events in OSS-RC
4.7 Perform Key Performance Indicators checks using AMOS

5 Perform basic RBS6000 Configuration procedures using OSS-RC and Element Manager
5.1 Describe the main steps in RBS6000 Integration
5.2 Note the different tools and procedures that could be used for configuration
5.3 Perform configuration changes in an existing eNodeB using Element Manager and/or OSS-RC and/or AMOS

Target audience

The target audience for this course is:

System Engineer, Service Engineer
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:

LTE/SAE System Overview LZU1087020
RBS6000 Overview LZU1087503
Or
LTE/SAE Overview (WBL) LZU1087318
RBS 6000 in a Nutshell (WBL) LZU1087504

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, 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 (hours)</th>
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<td>1</td>
<td>Network architecture and LTE features</td>
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<td>RBS6000 Hardware and Software concepts and related OSS-RC tools</td>
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<td>Operational exercises (ALEX library and MOM documentation familiarization)</td>
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<td>Operational exercises (HW and SW management)</td>
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<td>Operational exercises (HW and SW management) continued</td>
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<td>Fault Management</td>
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<td>Operational exercises (Performance Management)</td>
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<td>LTE Configuration Management</td>
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</table>
 LTE L13 Performance Management and Optimization

LZU1089110 R1A

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 L13 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 Identify 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 and Features 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 and Features 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 and Features that influence Integrity

5. Measure LTE Mobility performance
5.1 Explain the various LTE mobility procedures and associated counters
5.2 Use eNodeB counters to create E-UTRAN Mobility KPIs
5.3 Explain the eNodeB parameters and Features 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 and Features that influence Cell Availability and System Utilization

7 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 AMOS and counters
9.1 Explain AMOS
9.2 Show only the most basic AMOS commands
9.3 Read counters directly from the eNodeB

10 Explain the ENIQ and Business Objects (BO) Web Intelligence Rich Client operation
10.1 Real-time KPI in LTE
10.2 Use Business Objects (BO) Web Intelligence Rich Client to open and refresh Ericsson predefined LTE performance reports
10.3 Create user defined LTE performance reports using the Business Objects (BO) Web Intelligence Rich Client
10.4 Share user defined LTE performance reports with other ENIQ users

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

Prerequisites
Successful completion of the following courses:
LTE L13 Air Interface LZU1089102
LTE L13 Configuration LZU1089108
LTE L13 Protocols and Procedures LZU1089103
LTE L13 Radio Network Functionality LZU1089104
LTE L13 Troubleshooting LZU1089109
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 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>
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<tr>
<th>Day</th>
<th>Topics in the course</th>
<th>Estimated Time (hours)</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>LTE Performance Management Introduction</td>
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<tr>
<td></td>
<td>LTE Accessibility Optimization</td>
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<tr>
<td></td>
<td>LTE Retainability Optimization</td>
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<tr>
<td></td>
<td>LTE Integrity Optimization</td>
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<td>2</td>
<td>LTE Mobility Optimization</td>
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<tr>
<td></td>
<td>LTE Availability Optimization</td>
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</tr>
<tr>
<td></td>
<td>LTE Cell and UE Trace</td>
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<td></td>
<td>OSS-RC Statistics, Cell and UE Trace Handling</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>MOSHELL and counters</td>
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<tr>
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<td>ENIQ and Business Objects</td>
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</table>
LTE L13 Protocols and Procedures

Description
Do you need to know what procedures are triggered in the EPS network and how? What messages are exchanged among the LTE and EPC nodes? And which protocols are used to implement them? This course provides an in-depth understanding of the various protocols and procedures in the E-UTRAN. It looks into the overall EPS architecture, the functionalities of each node and the interfaces interconnecting them. It details how Quality of Service and the different levels of security are implemented in LTE. Focus is given on the functions and services provided by various L3 signaling protocols, NAS, RRC, GTP-C, and the different L2 transport protocols, PDCP, RLC and MAC. It provides a thorough discussion of the Attach procedure and the different types of intraLTE, interLTE, and IRAT mobility. Furthermore, new features such as coverage triggered and service triggered handovers are discussed.

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 purposes of EPS Bearer Service and Data Radio Bearer
   2.2. List the different attributes of the Data 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 various L3 Signaling Protocols
   3.1. Explain the functions of the Non Access Stratum NAS protocol
   3.2. List the different procedures in the NAS layer
   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 X2 Handover
5.2 S1 Handover
5.3 IRAT Session Continuity and Handover
5.4 Explain CS Fall Back for Dual Radio UEs
5.5 Service triggered and subscriber triggered mobility
5.6 Interfrequency load balancing
5.7 Redirect with system information

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

Prerequisites
Successful completion of the following courses:
LTE L13 Air Interface LZU1089102

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 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 (hours)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>EPS Architecture</td>
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<td></td>
<td>Explain the LTE/SAE Quality of Service and Security</td>
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<td>Explain the NAS and RRC protocols</td>
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<td>2</td>
<td>Explain the X2/S1 Interface, X2AP/S1AP and GTP-C protocols</td>
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<td>Explain the PDCP, RLC and MAC protocols</td>
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<td>3</td>
<td>Explain the GTP-U protocol</td>
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</tr>
<tr>
<td></td>
<td>Explain Mobility in LTE</td>
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</tr>
</tbody>
</table>
LTE L13 Radio Network Functionality

LZU1089104 R1A

Description
Do you want to have full and detailed understanding of the Ericsson E-UTRAN features and functionalities? If so, the LTE L13 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 TDD
   4.6 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 Describe the interaction with CDMA2000
6.6 Distinguish between release with redirect and handover
6.7 Detail what type of events trigger measurement reports to be sent to the eNB
6.8 Describe the purpose of the handover evaluation algorithm and Best Cell Evaluation
6.9 Explain CS Fallback
7 Explain the purpose and function of Automated Neighbor Relations (ANR)

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

Prerequisites
Successful completion of the following courses:
LTE/SAE System Overview LZU1087020
LTE L13 Air Interface LZU1089102
LTE L13 Protocols and Procedures LZU1089103
### 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 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 (hours)</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Introduction of the course and Radio Network Solution</td>
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<tr>
<td>1</td>
<td>Idle Mode Behavior</td>
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<tr>
<td></td>
<td>Radio Connection Supervision</td>
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<tr>
<td></td>
<td>Link Adaptation</td>
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<td>2</td>
<td>Power Control</td>
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</tr>
<tr>
<td></td>
<td>Scheduling</td>
<td>2.5</td>
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<tr>
<td></td>
<td>Capacity Management</td>
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</tr>
<tr>
<td>3</td>
<td>Mobility</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Automated Neighbor Relations (ANR)</td>
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</tr>
</tbody>
</table>
LTE L13 Troubleshooting

Description
While configuring and operating an L13 based LTE RAN network, what are the common faults, how are they detected and solved in a RBS 60000 node? How does Ericsson local/field support enable and collect logs from a RBS6000 node?

LTE L13 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 in LTE RAN
   1.1 List and use tools available at the RBS site which are available for troubleshooting the RBS
   1.2 Identify tools in the OSS-RC are useful for troubleshooting the LTE RBS
   1.3 Distinguish between Cell Trace and UE Trace support and be able to activate these traces

2. Explain the emergency recovery procedure of an RBS and collect data while creating Customer Service Requests (CSRs)
   2.1 Understand the Ericsson support process
   2.2 Explain what Data Collection Guideline (DCG) is, and apply commands to gather mandatory inputs while writing CSRs
   2.3 Browse through and appreciate the various logs that RBS provides while troubleshooting
   2.4 List and explain the functions of the various files that make up a Configuration Version (CV)
   2.5 Recover a RBS6000 from an emergency cyclic restart state, and from a different CV

3. Discuss and perform system level troubleshooting concepts
3.1 Describe which interfaces that the RBS provides
3.2 Check O&M connectivity on the Mul interface
3.3 Expand and act on Alarms
3.4 Verify the Network Synchronization status
3.5 Differentiate between the various states of Managed Objects
3.6 Relate counter values to RBS’s performance
3.7 Discuss various end-to-end system performance issues
3.8 Execute commands to check S1 connectivity

Target audience
The target audience for this course is:
System Engineer, Service Engineer, Field Technician

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 L13 Configuration LZU1089108
LTE L13 Radio Network Functionality LZU1089104 (optional)

Duration and class size
The length of the course is 3 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 (hours)</th>
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<td>1</td>
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<tr>
<td></td>
<td>Troubleshooting tools</td>
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<tr>
<td></td>
<td>RBS6000 Hardware structure</td>
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<tr>
<td></td>
<td>Troubleshooting tools Exercises</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>RBS Recovery and Data Collection Guideline</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>RBS Recovery and Data Collection Guideline Exercises</td>
<td>1.5</td>
</tr>
<tr>
<td></td>
<td>RBS6000 interfaces (S1/X2/Mul)</td>
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</tr>
<tr>
<td>3</td>
<td>System view troubleshooting</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>System view Exercises</td>
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</tr>
</tbody>
</table>
LTE RBS 6101 Field Maintenance

LZU 108 7896 R2A

Description
This course is a task-based course covering hardware replacement and maintenance of the RBS 6101 node types. The participants will perform hardware fault localization, 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 such as Element Manager (EM), COmmand Line Interface (COLI) and Node Command line Interface (NCLI).

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)

2. Perform maintenance and configuration tasks on the RBS 6101 nodes
   2.1 Explain RBS 6101 Main features
   2.2 Explain the RBS 6101 Hardware architecture
   2.3 Identify the RBS 6101 Connection interfaces
   2.4 Explain DUL Hardware architecture
   2.5 Identify the DUL connection Interfaces
   2.6 Explain the Battery Backup System 6101
   2.7 Understand the RBS 6101 Maintenance procedures
   2.8 Explain RBS 6101 Handling faulty equipment

3. Use the Customer Product Information (CPI) and Tool Kits
   3.1 Explain the CPI library structure of the node
   3.2 Find information in the Library with use of regular expression
   3.3 Find operational instructions (OPI) and maintain the node according to the OPI
   3.4 Find additional information on an alarm and solve the problem with the help of the CPI and Element Manager

4. Connect to a node using COLI and also using NCLI
   4.1 Understand basic commands using COLI and using NCLI
   4.2 Have a basic understanding of the functionality and technology used in COLI and
NCLI
4.3 Understand the basic principles behind the Managed Object Model (MOM)
4.4 Understand the file system in a CPP based node
4.5 Investigate the purpose and the location of the various types of logs.

5 Use the Element Manager
5.1 Download and start the Element Manager
5.2 Access and use the different “Views”; Containment, Equipment, IP, Licensing, Radio Network and the Software.
5.3 Find the alarm list and comment on the Alarms and Events on the Alarm and Event Log
5.4 Access the property help feature from each window
5.5 Handling License Key Files, LKF
5.6 Explain how to format the node
5.7 Explain how to load the basic package software
5.8 Have a basic understanding of system upgrade
5.9 Explain backup handling

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

Prerequisites
Successful completion of the following courses:
LTE/SAE System Overview Lzu 108 7020
RBS 6000 Overview Lzu 108 7503
LTE L11 Air Interface (optional) Lzu108 7897
Or
LTE/SAE - System Overview (WBL) Lzu1087318
RBS 6000 in a Nutshell Lzu1087504

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 (hours)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Course Introduction</td>
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</tr>
<tr>
<td></td>
<td>LTE RAN Systems and Site Introduction</td>
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<td>LTE RBS 6101 Maintenance</td>
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<tr>
<td></td>
<td>Element Manager</td>
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</tr>
</tbody>
</table>
LTE RBS 6102 Field Maintenance

LZU 108 7645 R2A

Description
This course is a task-based course covering hardware replacement and maintenance of the RBS 6102 node types. The participants will perform hardware fault localization, 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 such as Element Manager (EM), COmmand Line Interface (COLI) and Node Command line Interface (NCLI).

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)

2. Perform maintenance and configuration tasks on the RBS 6102 nodes
   2.1 Explain RBS 6102 Main features
   2.2 Explain the RBS 6102 Hardware architecture
   2.3 Identify the RBS 6102 Connection interfaces
   2.4 Explain DUL Hardware architecture
   2.5 Identify the DUL connection Interfaces
   2.6 Explain the Battery Backup System 6102
   2.7 Understand the RBS 6102 Maintenance procedures
   2.8 Explain RBS 6102 Handling faulty equipment

3. Use the Customer Product Information (CPI) and Tool Kits
   3.1 Explain the CPI library structure of the node
   3.2 Find information in the Library with use of regular expression
   3.3 Find operational instructions (OPI) and maintain the node according to the OPI
   3.4 Find additional information on an alarm and solve the problem with the help of the CPI and Element Manager

4. Connect to a node using COLI and also using NCLI
   4.1 Understand basic commands using COLI and using NCLI
   4.2 Have a basic understanding of the functionality and technology used in COLI and
NCLI
4.3 Understand the basic principles behind the Managed Object Model (MOM)
4.4 Understand the file system in a CPP based node
4.5 Investigate the purpose and the location of the various types of logs.
5 Use the Element Manager
5.1 Download and start the Element Manager
5.2 Access and use the different "Views"; Containment, Equipment, IP, Licensing, Radio Network and the Software.
5.3 Find the alarm list and comment on the Alarms and Events on the Alarm and Event Log
5.4 Access the property help feature from each window
5.5 Handling License Key Files, LKF
5.6 Explain how to format the node
5.7 Explain how to load the basic package software
5.8 Have a basic understanding of system upgrade
5.9 Explain backup handling

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

Prerequisites
Successful completion of the following courses:
LTE/SAE System Overview Lzu108 7020
RBS 6000 Overview Lzu108 7503
LTE L11 Air Interface (optional) Lzu108 7897
Or
LTE/SAE - System Overview (WBL) Lzu108 7318
RBS 6000 in a Nutshell Lzu108 7504

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.

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<td>Course Introduction</td>
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<tr>
<td></td>
<td>LTE RAN Systems and Site Introduction</td>
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</tr>
<tr>
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<td>Element Manager</td>
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</tr>
</tbody>
</table>
LTE RBS 6201 Field Maintenance

LZU 108 7648 R3A

Description
This course is a task-based course covering hardware replacement and maintenance of the RBS 6201 node types. The participants will perform hardware fault localization, 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 such as Element Manager (EM), COMmand Line InterfAce (COLI) and Node Command line Interface (NCLI).

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)

2. Perform maintenance and configuration tasks on the RBS 6201 nodes
   2.1 Explain RBS 6201 Main features
   2.2 Explain the RBS 6201 Hardware architecture
   2.3 Identify the RBS 6201 Connection interfaces
   2.4 Explain DUL Hardware architecture
   2.5 Identify the DUL connection Interfaces
   2.6 Explain the Battery Backup System 6201
   2.7 Understand the RBS 6201 Maintenance procedures
   2.8 Explain RBS 6201 Handling faulty equipment

3. Use the Customer Product Information (CPI) and Tool Kits
   3.1 Explain the CPI library structure of the node
   3.2 Find information in the Library with use of regular expression
   3.3 Find operational instructions (OPI) and maintain the node according to the OPI
   3.4 Find additional information on an alarm and solve the problem with the help of the CPI and Element Manager

4. Connect to a node using COLI and also using NCLI
   4.1 Understand basic commands using COLI and using NCLI
   4.2 Have a basic understanding of the functionality and technology used in COLI and
NCLI
4.3 Understand the basic principles behind the Managed Object Model (MOM)
4.4 Understand the file system in a CPP based node
4.5 Investigate the purpose and the location of the various types of logs.

5 Use the Element Manager
5.1 Download and start the Element Manager
5.2 Access and use the different “Views”; Containment, Equipment, IP, Licensing, Radio Network and the Software.
5.3 Find the alarm list and comment on the Alarms and Events on the Alarm and Event Log
5.4 Access the property help feature from each window
5.5 Handling License Key Files, LKF
5.6 Explain how to format the node
5.7 Explain how to load the basic package software
5.8 Have a basic understanding of system upgrade
5.9 Explain backup handling

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

Prerequisites
Successful completion of the following courses:

- LTE/SAE System Overview Lzu108 7020
- RBS 6000 Overview Lzu108 7503
- LTE L11 Air Interface (optional) Lzu108 7897
- Or
- LTE/SAE - System Overview (WBL) Lzu108 7318
- RBS 6000 in a Nutshell Lzu108 7504

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.

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<tr>
<th>Day</th>
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<tr>
<td>1</td>
<td>Course Introduction</td>
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</tr>
<tr>
<td></td>
<td>LTE RAN Systems and Site Introduction</td>
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</tr>
<tr>
<td></td>
<td>LTE RBS 6201 Maintenance</td>
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<tr>
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<td>Customer Product Information and Tool Kits</td>
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<td></td>
<td>Command Line Interface/Node Command Line Interface</td>
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</tr>
<tr>
<td></td>
<td>Element Manager</td>
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</tr>
</tbody>
</table>
LTE RBS 6601 Field Maintenance

LZU 108 7890 R2A

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 localization, 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 such as Element Manager (EM), COnmand Line Interface (COLI) and Node Command line Interface (NCLI).

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)

2. Perform maintenance and configuration tasks on the RBS 6601 nodes
   2.1 Explain RBS 6601 Main features
   2.2 Explain the RBS 6601 Hardware architecture
   2.3 Identify the RBS 6601 Connection interfaces
   2.4 Explain DUW Hardware architecture
   2.5 Identify the DUW connection Interfaces
   2.6 Explain the Battery Backup System 6601
   2.7 Understand the RBS 6601 Maintenance procedures
   2.8 Explain RBS 6601 Handling faulty equipment

3. Use the Customer Product Information (CPI) and Tool Kits
   3.1 Explain the CPI library structure of the node
   3.2 Find information in the Library with use of regular expression
   3.3 Find operational instructions (OPI) and maintain the node according to the OPI
   3.4 Find additional information on an alarm and solve the problem with the help of the CPI and Element Manager

4. Connect to a node using COLI and also using NCLI
   4.1 Understand basic commands using COLI and using NCLI
   4.2 Have a basic understanding of the functionality and technology used in COLI and
4.3 Understand the basic principles behind the Managed Object Model (MOM)
4.4 Understand the file system in a CPP based node
4.5 Investigate the purpose and the location of the various types of logs.

5 Use the Element manager
5.1 Download and start the Element Manager
5.2 Access and use the different “Views”; Containment, Equipment, IP, Licensing, Radio Network and the Software.
5.3 Find the alarm list and comment on the Alarms and Events on the Alarm and Event Log
5.4 Access the property help feature from each window
5.5 Handling License Key Files, LKF
5.6 Explain how to format the node
5.7 Explain how to load the basic package software
5.8 Have a basic understanding of system upgrade
5.9 Explain backup handling

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

Prerequisites
Successful completion of the following courses:
- LTE/SAE System Overview Lzu 108 7020
- RBS 6000 Overview Lzu 108 7503
- LTE L11 Air Interface (optional) Lzu108 7897
Or
- LTE/SAE - System Overview (WBL) Lzu1087318
- RBS 6000 in a Nutshell Lzu1087504

Duration and class size
The length of the course is 1 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>
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<th>Estimated Time (hours)</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Course Introduction</td>
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<tr>
<td></td>
<td>LTE Systems and Site Introduction</td>
<td>0.5</td>
</tr>
<tr>
<td></td>
<td>LTE RBS 6601 Maintenance</td>
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<tr>
<td></td>
<td>Customer Product Information and tool kits</td>
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</tr>
<tr>
<td></td>
<td>Command Line Interface/Node Command Line Interface</td>
<td>1</td>
</tr>
<tr>
<td></td>
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<td>1</td>
</tr>
</tbody>
</table>
LTE/SAE in Nutshell

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 be able to:

1. What is LTE/SAE?
2. How fast is LTE?
3. What is included in the Mobile Technology Evolution?
4. What is the end user experience?
5. What are possible services and application?
6. What is the speed and capacity?
7. Is it better than 3G?
8. How much does it cost?
9. Do I need a new phone?
10. Is the coverage and mobility better then today?
11. How does LTE/SAE work?
12. Which Frequencies are used?
13. Which nodes are included in the Radio Network?
14. Which nodes are included in the Core Network?
15. 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
Successful completion of the following courses:
- 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.
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 Give an overview of the LTE 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
3. Describe the E-UTRAN Architecture
   3.1 List the functionality of the eNodeB
   3.2 Describe the radio interface techniques used in uplink and downlink
   3.3 Explain the concept of Cyclic Prefix
   3.4 Discuss Link Adaption in LTE
   3.5 Describe the basic principles of MIMO
   3.6 Detail the reference symbols in UL & DL
   3.7 Describe the RBS 6000 Hardware for LTE
4. Explain the various LTE mobility scenarios
   4.1 Describe LTE idle mode mobility
   4.2 Detail the different types of handover in LTE
   4.3 Describe the measurement reporting procedures in LTE
   4.4 Explain intra and inter Frequency Handover in LTE
   4.5 Describe how Session Continuity is performed
4.6 Explain the various IRAT Handover scenarios
5 Describe the options for Voice in LTE
5.1 Explain how CS Fallback allows for the use of CS Services using legacy systems
5.2 Explain how IMS allows for the use of CS Services
6 Describe O&M (Operation and Maintenance) for EPS
6.1 Describe the impact of EPC on the Ericsson OSS-RC
6.2 Describe the overall role and function of OSS-RC
6.3 Explain the concepts related to Smart Simplicity, Self Organizing Networks (SON), RBS Auto integration,
6.4 Outline the Ericsson Network Optimization Tool Suite

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

Prerequisites
Successful completion of the following courses:
A general knowledge in cellular systems and radio technology.

Duration and class size
The length of the course is 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 (hours)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Course Introduction, LTE/SAE Introduction</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>EPC Architecture</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Radio Interface Principles</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>LTE Mobility</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>Voice in LTE</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>LTE Operation and Maintenance</td>
<td>2</td>
</tr>
</tbody>
</table>
LTE/SAE—System Overview, WBL

LZU 108 7318  R2A

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
3.14 Detail the Radio Resource Management and Mobility
3.15 Describe the Radio Resource Management
3.16 Describe UL and DL scheduling and signaling
3.17 Explain the concepts of dynamic and persistent scheduling
3.18 Describe LTE Mobility
3.19 Describe intra-LTE mobility in ECM_CONNECTED and ECM_IDLE mode
3.20 Explain inter-working with 2G/3G

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

Prerequisites
Successful completion of the following courses:
A general knowledge in cellular systems and radio technology.

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

Learning situation
This is a web-based interactive training course with multimedia content
RBS 6000 Hardware in a Nutshell

Description
The new RBS 6000 product family is the compact multi-standard base station used in GSM, WCDMA and LTE. The focus of this training is on building the participant’s knowledge of the RBS 6000 product family used by Ericsson in the current market. The RBS 6000 units block diagram, technical specification and optional units will all be explained. Operation and Maintenance tools will be briefly described. This is a one hour, web based learning module.

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

1. Describe the main benefits of the RBS 6000
   1.1 Mention how the RBS 6000 is the first mainstream commercial product to include LTE along with support GSM and WCDMA
   1.2 Briefly mention how more room for expansion can be generated
   1.3 Briefly mention how power efficiency, increased speed and performance have being improved

2. Recognize and identify the main components of Radio Access Network, RBS Site Solutions and RBS 6000 basic functions
   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

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. Explain the external equipment
   4.1 Give an outline of the sustainable solutions for RBS 6000 site
   4.2 Describe how more room for expansion is generated
   4.3 Describe Antenna, TMA, Site Transmission and Power Backup System for different
RBSs

4.4 Understand the Power Supply, external cables and antenna connections for the RBS 6000

5 Outline the main Operation and Maintenance tools for the RBS 6000
5.1 Mention the O&M tools used for LTE and WCDMA.
5.2 Describe how OMT is used for GSM and show the different views
5.3 Explain the CPI structure
5.4 Show how to navigate the ALEX library

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:
WCDMA RAN Overview (WBL), LZU108 5202
GSM Radio Network Overview (WBL), LZU108 6235
LTE/SAE in Nutshell (WBL), LZU108 7417

Duration and class size
The length of the course is about 1 hour.

Learning situation
This is a web based learning module
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 through 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
2. Describe the generic building and form structure used in RBS 6000
3. Describe on an overview level the building practice
4. Explain the advantages of multi-standard RBS
5. Describe how more room for expansions is generated
6. Compare the power consumption of a RBS 6000 to today’s technologies
7. Understand how WCDMA is implemented in the RBS 6000
7.1 Describe on block level which boards and units gives the WCDMA Functionality
8. Understand how LTE is implemented in the RBS 6000
8.1 Describe on block level which boards and units gives the LTE Functionality
9. Understand how GSM is implemented in the RBS 6000
9.1 Describe on block level which boards and units gives the GSM Functionality

Target audience
The target audience for this course is:

- System Technician
- Service Technician
- System Engineers
- Service Engineers
Prerequisites
The participants should be familiar with the WCDMA, GSM and LTE on overview level.

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.
RBS 6000 Overview

LZU 108 7503 R3A

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:

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
4.1 Understand Web browser (Netscape, Microsoft Internet Explorer or Mozilla Firefox) for Element Manager
4.2 Understand CPP Nodes operating on level software require a Element Manager running on JRE version 1.5, see http://java.sun.com/products/archive
4.4 Understand Local Administrative rights
4.5 How Ethernet connection for 10/100 BaseT works
4.6 How to FTP Client for functions such as retrieving Product Inventory log files, Uploading basic software to a node or retrieving the dump from the flash disk of the node. Some examples of FTP Clients are FileZilla, FTPPro.

**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  LZU108 5418
- GSM System Survey             LZU108 852
- LTE/SAE - System Overview     LZU108 7020
- WCDMA RAN Overview (WBL)      LZU108 5202
- GSM Radio Network Overview (WBL) LZU108 6235
- LTE/SAE in Nutshell (WBL)      LZU108 7417

**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>
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<tbody>
<tr>
<td>1</td>
<td><strong>Introduction</strong></td>
<td>0.5</td>
</tr>
<tr>
<td></td>
<td>Radio Access Network, RBS Site Solutions and RBS 6000 basic functions</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>RBS 6000 Platform</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>RBS 6101</td>
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<td></td>
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<td>0.25</td>
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<tr>
<td></td>
<td>Introduction</td>
<td>0.5</td>
</tr>
</tbody>
</table>
WCDMA RBS 6202 Field Maintenance

LZU 108 8278 R2A

Description
This course is a task-based course covering hardware replacement and maintenance of the RBS 6202 node types. The participants will perform hardware fault localization, hardware replacement and configuration tasks on a RBS 6202 type. On completion of this course the participants will also be familiar with the features of the operation and maintenance tools such as Element Manager (EM), COmmand Line Interface (COLI) and Node Command line Interface (NCLI).

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

1. Explain on overview level the WCDMA RAN Site Concept for RBS
   1.1 Explain the basic WCDMA Radio Access Network
   1.2 Identify the Power and Battery Cabinets on Site
   1.3 WCDMA 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)

2. Perform maintenance and configuration tasks on the RBS 6202 nodes
   2.1 Explain RBS 6202 Main features
   2.2 Explain the RBS 6202 Hardware architecture
   2.3 Identify the RBS 6202 Connection interfaces
   2.4 Explain DUW Hardware architecture
   2.5 Identify the DUW connection Interfaces
   2.6 Explain the Battery Backup System 6202
   2.7 Understand the RBS 6202 Maintenance procedures
   2.8 Explain RBS 6202 Handling faulty equipment

3. Use the Customer Product Information (CPI) and Tool Kits
   3.1 Explain the CPI library structure of the node
   3.2 Find information in the Library with use of regular expression
   3.3 Find operational instructions (OPI) and maintain the node according to the OPI
   3.4 Find additional information on an alarm and solve the problem with the help of the CPI and Element Manager

4. Connect to a node using COLI and also using NCLI
   4.1 Understand basic commands using COLI and using NCLI
   4.2 Have a basic understanding of the functionality and technology used in COLI and
NCLI
4.3 Understand the basic principles behind the Managed Object Model (MOM)
4.4 Understand the file system in a CPP based node
4.5 Investigate the purpose and the location of the various types of logs.

5 Use the Element Manager
5.1 Download and start the Element Manager
5.2 Access and use the different “Views”; Containment, ATM, Equipment, IP, Licensing, Radio Network and the Software.
5.3 Find the alarm list and comment on the Alarms and Events on the Alarm and Event Log
5.4 Access the property help feature from each window
5.5 Handling License Key Files, LKF
5.6 Explain how to format the node
5.7 Explain how to load the basic package software
5.8 Have a basic understanding of system upgrade
5.9 Explain backup handling

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

Prerequisites
Successful completion of the following courses:
WCDMA System Overview LZU 108 5418
RBS 6000 Overview LZU 108 7503
WCDMA W11 Air Interface (optional) LZU 108 7876

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 (hours)</th>
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<tbody>
<tr>
<td>1</td>
<td>Course Introduction</td>
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<tr>
<td></td>
<td>WCDMA RAN Systems and Site Introduction</td>
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<td>WCDMA RBS 6202 Maintenance</td>
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<td></td>
<td>Customer Product Information and Tool Kits</td>
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<tr>
<td></td>
<td>Command Line Interface/Node Command Line Interface</td>
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</tr>
<tr>
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<td>Element Manager</td>
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</tr>
</tbody>
</table>
CDMA-LTE Interworking and coexistence

LZU1087715 R1B

Description
This course provides a framework for CDMA to LTE interworking in radio network point of view. CDMA engineers could learn LTE concepts with ease through comparison diagrams between CDMA and LTE. Radio issues like interference, antenna Tx/Rx co-existence, and link budget are explained. To consolidate the understanding of the explained topics, RF calculation exercises are explained.
The course also provides descriptions of signal-to-noise ratio, power requirements and radio coverage.

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

1. Explain the background and architecture of CDMA2000
   1.1 Compare common control and overhead channels - CDMA vs 1xEV-DO
   1.2 Describe the radio interface techniques used in uplink and downlink
   1.3 Describe the channel structure of the radio interface
   1.4 Compare 1xRTT and 1xEV-DO coding and modulation for high data rates
2. Describe RF inter-working scenarios
   2.1 Highlight the RRM characteristics among CDMA, 1xEV-DO, and LTE
   2.2 Explain IRAT session continuity and handover
   2.3 Describe Search windows and intersystem synchronization
   2.4 Explain Operation of measurements of 1xEV-DO for IRAT purposes
   2.5 Describe Ncell planning during mobility
3. Illustrate RF characteristics among CDMA, 1xEV-DO, and LTE
   3.1 Describe BTS Tx and Rx performance
   3.2 Describe UE Tx and Rx performance
   3.3 Explain RF emissions
   3.4 Explain Channel Plans
   3.5 Compare Synchronization requirements - GPS vs NTP server
   3.6 Explain impact of RF hardware characteristics on SISO and MIMO performance including data fill issues
4. Describe Antenna Tx/Rx co-existence and interference
   4.1 Review Rx blocking, Tx noise and intermodulation issues
4.2 Explain Inter-band & Inter-technology interference issues including examples from practical experience in different parts of the world
4.3 Review various antenna isolation scenarios (Vertical vs Horizontal separation, and X polarization)
4.4 Describe Ancillary combining equipment - filters, combiners & TMAs
4.5 Provide discussion of repeaters at a high level
4.6 Give examples of managing intersystem isolation to maintain performance
4.7 Calculate isolation and filter characteristic requirements

5 Describe Performance Characteristics
5.1 Perform Link Budget comparison
5.2 Discuss the impact of Tx power and SINR in LTE performance and coverage
5.3 Discuss RF cell planning and design aspects for 3GPP2 vs LTE
5.4 Highlight differences in tuning and optimization requirements for 3GPP2 vs LTE

Target audience

The target audience for this course is:

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

Prerequisites

Successful completion of the following courses:

A general knowledge in cellular systems and radio technology.

Duration and class size

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

Learning situation

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