Radio Network Configuration

MSRBS-V1

USER DESCRIPTION

172/1553-HSC 105 50/1-V1 Uen F

Contents

1 Introduction

This document describes the Radio Network Configuration feature in MSRBS-V1 managed element types and the configuration of the RBS in the LTE Radio Access Network (RAN). The LTE RAN includes the RAN component of the Operation and Support System - Radio and Core (OSS-RC) and the IP transport that connects the RBS and OSS-RC to the core network elements. The Internet Protocol (IP) transport configuration and OSS-RC configuration are detailed in other documents.

The components of LTE RAN include the following:

- Cells and sectors
- Antenna units
- Common channels
- RBS synchronization
- IP transport
- Intra-LTE mobility
- Inter-Radio Access Technology (IRAT) mobility

For information about configuring parameters, see OSS-RC documentation.

1.1 Further Information

For further information, refer to:

- *Transport Network Configuration*
- *OSS-RC configuration documentation*
- *3GPP TS 23.203 Policy and charging control architecture*
- *3GPP TS 36.300 Overall description; Stage 2*
- *3GPP TS 36.101 User Equipment (UE) radio transmission and reception*
- *3GPP TS 36.104 Base Station (BS) radio transmission and reception*
- *3GPP TS 36.211 Physical Channels and Modulation*
- *3GPP 36.413 S1 Application Protocol (S1AP)*
- *3GPP TS 36.213 Physical Layer Procedures*

- *3GPP TS 36.331 Radio Resource Control (RRC); Protocol Specification*

2 RAN Overview

The LTE RAN consists of all the RBSs in a network, one or more instances of OSS-RC (RAN part), and the transport infrastructure required to interconnect these nodes and to connect the nodes to the Evolved Packet Core (EPC) network.

OSS-RC is also connected to the Network Management Subsystem (NMS), as shown in the following figure:

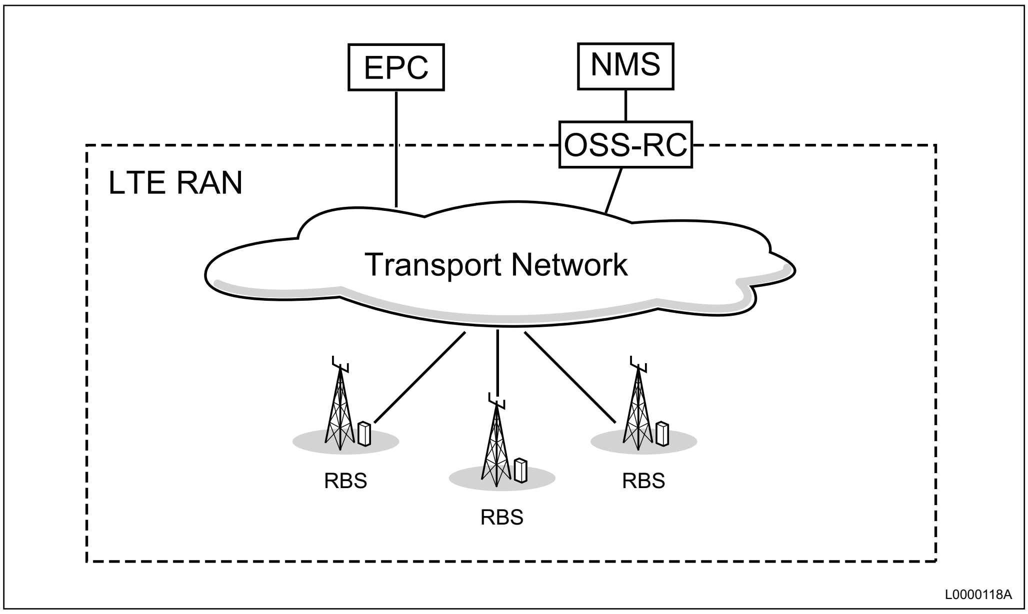

Figure 1 High Level Overview of LTE RAN

The main element of LTE RAN is the RBS. In LTE RAN, the RBS performs the following activities:

- Transmits overhead channels
- Establishes and maintains radio link connections with User Equipment (UE)
- Manages mobility for UE between RBS nodes
- Manages and maintains links to the core network

2.1 Logical Structure

The LTE RAN consists of these parts:

- RBS

- OSS-RC RAN components
- Interconnecting IP transport network

The following figure shows the logical structure of a single RBS in LTE RAN and how it interconnects with other components of LTE RAN:

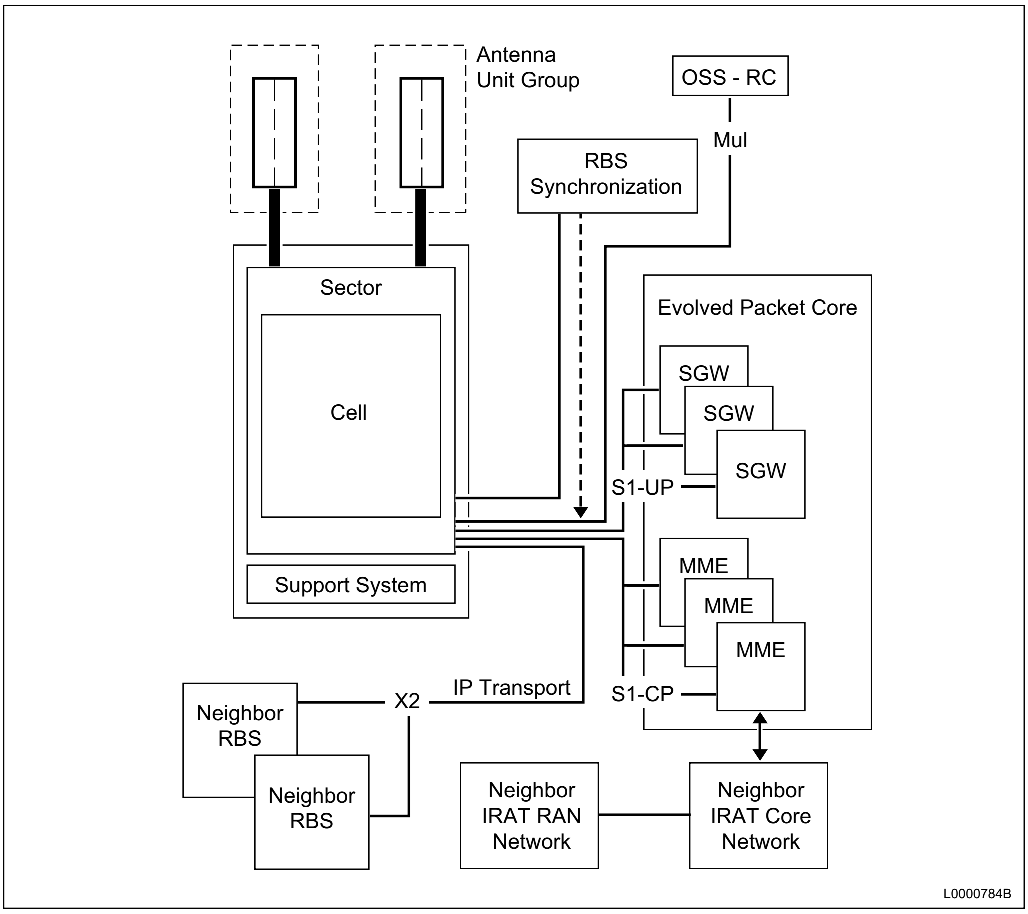

Figure 2 Logical Components of LTE PRBS

Logically, the RBS is comprised of a sector, a digital unit, and a support system. The sector is connected to an antenna unit group. The antenna unit group consists of the antennas only. Connection to other RAN and core network elements is provided by the IP transport infrastructure.

The following list defines terms used to describe parts of the RBS:

Antenna Unit Group

An Antenna Unit Group (AUG) is the logical structure that includes all details of an antenna and associated equipment. This includes the antenna, and any associated Tower Mounted Amplifier (TMA) and Remote Electrical Tilt (RET) equipment. There are no associated equipment, only the antennas.

Cell
A geographical area with its own carrier frequency and channels within the sector frequency band.

Digital Unit
The Digital Unit LTE (DU) includes the baseband, control, and switching functions of the LTE component of the RBS. It also contains the interfaces to IP transport and RBS synchronization.

eNode B
The terminology used in the 3GPP standards for an RBS.

IP Transport
The IP Transport provides connectivity from the RBS to the core network, to other RBSs, and to OSS-RC. System synchronization can be provided through the IP transport interface using the Clock Source over NTP feature, the IEEE 1588 Frequency Synchronization feature, and through the IEEE 1588 Time and Phase Synchronization feature. The physical IP Transport infrastructure provides a number of logical channels. Refer to *Transport Network Configuration* for further details.

MME
The Mobility Management Entity (MME) manages the core network control functions. The MME nodes are designed to operate in a pooled architecture. The MME handles the mobility and session management functions including:

- UE registration and detachment handling
- Security and Authentication, Authorization and Accounting (AAA)
- Evolved Packet System (EPS) bearer handling
- Mobility Anchor for active-mode UE
- Mobility Management for idle-mode UE

OSS-RC
OSS-RC facilitates remote network management of LTE RAN.

Radio Unit
A Radio Unit (RU) refers to the physical hardware that serves a sector. Each radio unit is connected to antenna equipment that is part of an AUG. The radio unit is physically located inside the cabinet.

Synchronization
The LTE Digital Unit uses an external synchronization source for generating the required system clock signals. The default method for synchronization is via Global Positioning System (GPS) equipment. It is also possible to use a Network Time Protocol (NTP) time server to provide synchronization via the IP transport interface. For further details refer to *Clock Source over NTP*.

Sector
A geographical area spanned by the transmission angle from one or a group of antennas. The sector is configured to handle one specific frequency band, and is connected to the *SectorEquipmentFunction* MO class.

Sector Carrier
A sector carrier represents the usage of the resources that the *SectorEquipmentFunction* refers to, for example power, antenna.

SGW
The Serving Gateway (SGW) provides an interface to external networks for User Plane (UP) data. It is also anchor point for the user plane for UE mobility between RBS. The SGW also performs some Quality of Service (QoS) related signalling. The SGW nodes are designed to operate in a pooled architecture.

Support System
The Support System provides basic functions to the RBS. This can include functions such as power supplies, battery backup, external alarms, and climate control systems.

2.2 Managed Object Model Structure

Full details of the Managed Object Model (MOM) structure can be found in *Managed Object Model (MOM) User Guide*. The document describes how Managed Objects (MOs) and parameters are organized in the model.

For details of the MOM structure for configuring the radio network managed area, see *Radio Network*.

3 RAN Configuration

The LTE RAN configuration includes the RBS, sectors and cells, antenna unit group, common channels, system information, IP transport, RBS synchronization, and mobility.

3.1 RBS

The RBS functions are controlled by the `ENodeBFunction` MO. This MO contains parameters that uniquely identify the RBS and that control the IP transport interface functions. Refer to *Transport Network Configuration* for further details.

The following table describes RBS ID parameters in the `ENodeBFunction` MO:

Table 1 RBS ID Parameters in ENodeBFunction MO

Parameter	Description
eNBId	RBS ID forms part of the Cell Global ID that identifies the node over the S1 interface.
eNodeBPlmnId	RBS PLMN ID forms part of the RBS Global ID that identifies the node over the S1 interface.

A number of other RBS functions are set in the `ENodeBFunction` MO, and are listed in the following table:

Table 2 Common Functions of RBS Configured in ENodeBFunction MO

RBS Function	Description
Paging	The RBS paging functions are common for all cells and are controlled by the `Paging` MO, a child of the `ENodeBFunction` MO. Further details on the LTE RAN paging functions can be found in *Paging*.
X2 Link Configuration	Parameters associated with the automatic configuration of X2 links are configured in the `ENodeBFunction` MO and apply to all cells connected to the RBS. Further details are provided in *Automated Neighbor Relations*.

3.2 Sector

A sector is comprised of a cell in a specific frequency band and provides coverage to a geographic area. A PRBS can have one sector.

The configuration of each sector in the LTE RBS is stored in the `SectorEquipmentFunction` MO.

The frequency band covered by the sector is controlled by the RU capabilities connected to the same MO.

The configurable parameters contained in the `SectorEquipmentFunction` MO are described in the following table:

Table 3 Parameters in SectorEquipmentFunction MO

Parameter	Description
`confOutputPower`	Represents the sum of the power for all antenna connectors used by the sector in units of 1 milliwatt.

The process to follow for managing the `SectorEquipmentFunction` MO is defined in *Radio Network*.

3.3 Cell

The `EUtranCellFDD` MO contains the parameters for cell configuration. The cell characteristics and parameters defined in this MO are listed below.

3.3.1 Predefined Cell Characteristics

Each cell is connected to a sector and a number of logical antennas. By default, each cell is configured to operate with two transmit and two receive antennas.

Other default settings defined for each cell include:

- Sub-carrier spacing of 15 kHz
- Cyclic prefix type Normal
- Frequency Division Duplex (FDD) frame structure, Type 1

Further details on these configuration settings are available in *3GPP TS36.300* and *3GPP TS36.211*.

Random Access (RA) to the cell is preconfigured to provide one RA opportunity in each radio frame (10 milliseconds). This allows for a cell range of approximately 15 km.

The cell channel bandwidth is symmetrical in downlink and uplink. The physical bandwidth is controlled by the RU hardware capabilities.

3.3.2 Configurable Cell Characteristics

A number of cell parameters must be defined by the operator. These parameters are categorized as follows:

- Cell ID parameters (refer to Table 4)
- Cell configuration parameters (refer to Table 5)
- Idle mode reselection parameters (see *Idle Mode Support*)

Each parameter is configured in the `EUtranCellFDD` MO and has values optimized for particular deployment scenarios, as described in the following table:

Table 4 Cell ID Parameters Configured in EUtranCellFDD and ENodeBFunction MOs

Parameter	Description
`eNodeBPlmnId`	The ENodeB Public Land Mobile Network (PLMN) ID that forms part of the ENodeB Global ID used to identify the node over the S1 interface.
`physicalLayerCellIdGroup`	Physical-layer cell identities are grouped into 168 unique physical-layer cell-identity groups, numbered 0 – 167. Each group has 3 unique sub-identities, and the attribute identifies the group. This attribute together with `physicalLayerSubCellId` calculates physical layer cell identity (see *3GPP TS 36.211*) that is sent as part of the system information (see *3GPP TS 36.331*)
`physicalLayerSubCellId`	Identifies the sub-identity in the physical layer cell-identity group.
`tac`	Identifies the TAC [(1)] for the cell. The TAC assists in paging the UE and is transmitted in a SI message. Further details on the paging process can be found in *Paging*.

(1) Tracking Area Code

The cell ID groups need careful planning to ensure correct operation of intra-LTE handover. Significant problems can occur if UE detects two cells that have the same cell ID group. Further details are provided in *Automated Neighbor Relations*.

The following table describes cell parameters configured in the `EUtranCellFDD` MO. For complete details, refer to the *Managed Object Model (MOM) RBS*:

Table 5 Cell Parameters Configured in EUtranCellFDD MO

Parameter	Description
`earfcndl`	Specifies the channel number for the central downlink frequency. The mapping from channel number to physical frequency is described in *3GPP TS 36.101*. The channel raster is 0.1 MHz.
`earfcnul`	Specifies the channel number for the central uplink frequency. The mapping from channel number to physical frequency is described in *3GPP TS 36.101*. The channel raster is 0.1 MHz.

Parameter	Description
pZeroNominalPucch	Specifies the nominal component of the UE transmit power for PUCCH [(1)].
pZeroNominalPusch	Specifies the nominal component of the UE transmit power for PUSCH [(2)].

(1) Physical Uplink Control Channel

(2) Physical Uplink Shared Channel

3.3.3 Idle Mode Cell Reselection

The *EUtranCellFDD* MO contains a number of parameters that control idle mode cell selection and reselection behavior. Functions controlled by these parameters include:

- Priority level for the carrier frequency layer
- Hysteresis values for cell reselection
- Cell reselection in medium and high-speed mode

Full details of the idle mode functions and associated parameters are provided in *Idle Mode Support*.

3.3.4 Cell Transmit Power Characteristics

The maximum possible cell transmission power is determined by a number of factors, including RU hardware power capability, licensed power provisioning, and MOM configuration parameters. The following table describes these factors. For default values and ranges, refer to *Managed Object Model (MOM) RBS*.

Table 6 Cell Transmit Power Parameters

Parameter	Description
confOutputPower	This parameter is contained in the *SectorEquipmentFunction* MO and stores the requested maximum sector power in milliwatts. This value represents the sum of the power for all antenna connectors used by the sector.
numOfTxAntennas	This parameter is contained in the *EUtranCellFDD* MO and describes how many TX antennas that the sector carrier shall use. For the RBS 6401 in the L14A release the parameter value must always be set to 2. If the parameter value is set to a value other than 0, the sector distributes its available output power evenly over the configured or available TX antennas in the sector. For example, if the sector has two TX antennas, but only one is configured (*numOfTxAntennas* =1), then that one TX antenna gets all the output power. The maximum output power for each configured TX antenna is limited to the RU port output power capacity. If the parameter value is set to 0, the installed optional features licenses for multiple antennas defines the configuration, and available resources will be used accordingly. If the parameter value is set to 0 and the optional features is Disabled, the predefined value for the number of TX antennas is 1.

3.4 Common Channels

Each cell transmits a number of physical signals and common channels as specified in the LTE standards. These signals and channels and the associated parameters are detailed in this section.

3.4.1 Downlink Cell-Specific Signals

Each cell transmits signals that are used by UE for synchronization and cell identification. The format of signal encoding allows the UE to uniquely identify the cell ID made up of *physicalLayerCellIdGroup* and *physicalLayerSubCellId*. These cell-specific signals are described in more detail in *3GPP TS 36.211*.

The following table describes cell-specific reference and synchronization signals:

Table 7 Cell-Specific Reference and Synchronization Signals

Signal	Description
PSS	The PSS (1) is used by the UE to undertake non-coherent cell detection and to make an initial estimate of cell timing. One of three orthogonal codes are used for the PSS. The code value depends on the value of physicalLayerSubCellId.
SSS	The SSS (2) allows the UE to detect the radio frame structure and also allows the full recognition of the cell ID. The *physicalLayerCellIdGroup* parameter defines the code value used for the SSS.
RS	The RS (3) allows the UE to make an estimate of channel conditions over the entire cell bandwidth. One RS is transmitted per downlink antenna port and REs (4) used for RS transmission on any antenna ports in a slot are not used for transmission by another antenna port in the cell. The seed value that generates the code transmitted as the RS values is based on the cell ID.

(1) Primary Synchronization Signal
(2) Secondary Synchronization Signal
(3) Reference Signal
(4) Resource Elements

3.4.2 Downlink Control Signalling

Downlink control signalling consists of different physical channels, as described in the following table:

Table 8 Downlink Control Signalling Channels

Channel	Description
PCFICH	The PCFICH (1) notifies the terminal about the number of OFDM (2) symbols used for carrying PDCCH signalling in the current sub-frame.

Channel	Description
PHICH	The PHICH [3] transmits HARQ to the UE in response to the reception of UL-SCH transmissions. Eight HARQ transmissions are code multiplexed onto one PHICH group. The number of PHICH groups in a cell is determined by the following equation: Groups = Ceiling [Ng x NDL_RB / 8] where Ng = 1
PDCCH	The PDCCH [4] carries downlink scheduling assignments and uplink scheduling grants. In addition, it may also be used for power control of a group of UE. The CRC [5] of the PDCCH message is scrambled with a value to indicate the unique cell user ID of the intended recipient. Specific scrambling codes indicate scheduling of paging, RA, and system information messages that are transmitted for all UE to read.

(1) Physical Control Format Indicator Channel
(2) Orthogonal Frequency Division Multiplexing
(3) Physical Hybrid-ARQ Indicator Channel
(4) Physical Downlink Control Channel
(5) Cyclic Redundancy Check

The PCFICH and PHICH channels have fixed modulation and coding formats that are defined in *3GPP TS36.211*.

Quadrature Phase Shift Keying (QPSK) is the modulation used for the PDCCH channel. Channel coding is adapted to allow UE at the edge of cell to decode information as required. This is especially important for PDCCH messages indicating the assignment of paging, RA, and system information messages.

3.4.3 Downlink Overhead Messages

A number of overhead message are transmitted in the downlink by each cell, as described in the following table:

Table 9 Overhead Messages Transmitted on Downlink

Message	Description
System Information	System Information messages contain the information required by UE to gain access to the cell.

Message	Description
Paging	Paging messages alert the UE of incoming calls and to notify the UE of changes in system information. A detailed description of paging can be found in *Paging*.
Random Access	The RA message 2 is transmitted on the downlink shared channel and responds to user equipment RA attempts. A detailed description of RA can be found in *Random Access*.

The modulation format and channel coding of downlink overhead messages is configured in LTE RAN to ensure that the coverage of these messages matches the downlink control signalling coverage.

3.4.4 Cell Range

The Cell Range defines the maximum distance from the RBS that a connection to a UE can be established and maintained. For the RBS 6401 the default cell range is 1 km.

Table 10 Maximum Cell Range Parameter

Parameter	Description
cellRange	Defines the maximum distance from the base station where a connection to a UE can be setup and/or maintained. The parameter is contained in the *EUtranCellFDD* MO.

3.5 System Information

System information distribution is an essential and basic feature of LTE RAN. The UE requires system information to:

- Perform idle mode tasks
  - PLMN selection
  - Cell selection and reselection
  - Conformity to Cell Reservations and Access Restrictions
  - Tracking Area registration
- Originate access to the network
- Terminate access including reception of paging messages
- Maintain the LTE connection
- Perform handover

System Information (SI) comprises the MasterInformationBlock (MIB), the SystemInformationBlock1 (SIB1) to SIB8. SIB1 is contained in an own RRC message, SystemInformationBlockType1 and cannot be combined with any other SIB, while one or more of SIB2-SIB8 can be combined in the same SI message.

The MIB is broadcast on the Physical Broadcast Channel (PBCH). SIB1 messages and SI messages are broadcast on the Physical Downlink Shared Channel (PDSCH) at regular intervals. One or more of SIB 2 - SIB 8 can be combined in the same SI message.

Table 11, Table 12, and Table 13 provide an overview of the information contained in the system information broadcast by LTE RAN and includes information on the regular broadcast interval of the messages:

Table 11 MasterInformationBlock Message Broadcast by RAN

SI Block	Description
MIB	The MIB defines essential physical layer information about the cell required before receiving further system information. This includes the system bandwidth and frame numbering information. The MIB is always broadcast in a separate message and is not concatenated with any SIB. The MIB is transmitted on the PBCH (1) in subframe 0 of every frame in the first four OFDM symbols of second slot. The message is located in the six center resource blocks.

(1) Physical Broadcast Channel

Table 12 SystemInformationBlock1 Message Broadcast by RAN

SI Block	Description
SIB1	SIB1 message contains data required by the UE to evaluate if it is allowed to access a cell. This includes information such as the cell global identity number, PLMN and TAC. It also defines the scheduling of other SIB messages. The SIB1 message is transmitted every of 80 ms in sub-frame 5 on the PDSCH (1) The message is repeated 4 times during the 80 ms period. SIB 1 is always sent in a separate message and is not concatenated with other SIBs.

(1) Physical Downlink Shared Channel

The operator can configure the periodicity and content of each SI message by means of contained/mapped SIBs (SIB2-SIB8).

Further information on configuration of SI messages can be found in *Radio Network*.

Table 13 Other SI Messages Broadcast by RAN

SI Block	Description
SIB2	SIB2 contains common and shared channel information used in the cell. This includes configuration information on the RA channel, shared uplink control channels and the paging channel.
SIB3	SIB3 contains cell reselection information, mainly related to serving cell frequency.
SIB4	SIB4 contains information about the intra-frequency neighboring cells. This message is sent if a cell reselection offset for a particular cell relationship is set to a non default value.
SIB5	SIB5 contains information relevant only for inter-frequency cell reselection, that is information about other E UTRA frequencies and inter-frequency neighboring cells relevant for cell reselection. It includes cell reselection parameters common for a frequency as well as cell specific reselection parameters.
SIB6	SIB6 is transmitted to support user equipment IRAT cell reselection to an associated WCDMA network. It is transmitted when a feature license is activated. The message contains information required by UE to find and access a WCDMA network.
SIB8	SIB8 is transmitted to support user equipment IRAT cell reselection to an associated CDMA2000 network. It is transmitted when a feature license is activated. The message contains information required by UE to find and access a CDMA2000 network.

Further details on message content are found in *3GPP TS36.300* and *3GPP TS36.331*.

SIB1 is scheduled to broadcast every 80 ms (message is repeated four times, once every 20 ms). SI messages can be scheduled dynamically within a time window. This allows the downlink scheduler flexibility in determining when to transmit the message. The modulation format and channel coding of SIB messages is configured in LTE RAN to ensure that the coverage of SIB messages matches the coverage of other common channel messages.

Information on how to configure the SI messages can be found in *Radio Network*.

Table 14 System Information Message Parameters

Parameter	Description
`mappingInfo`	The System Information (SI) message to which each System Information Block (SIB) is mapped. The parameter is contained in the `EUtranCellFDD` MO.

Parameter	Description
modificationPeriodCoeff	The modification period, expressed in number of radio frames = modificationPeriodCoeff * defaultPagingCycle. The parameter is contained in the *EUtranCellFDD* MO.
siPeriodicity	The periodicity of System Information (SI) messages. If a System Information Block (SIB) is not mapped to a SI message, the SI message is not transmitted. The parameter is contained in the *EUtranCellFDD* MO.
siWindowLength	Length of the System Information (SI) window within which each SI message is transmitted. Applies to all SI messages. The parameter is contained in the *EUtranCellFDD* MO.

3.5.1 SIB1 Parameters

The following parameters can be used to control the behavior of SIB1.

Table 15 SIB1 Parameters

SIB1 Parameter	MO Class
tac	*EUtranCellFDD*
cellBarred	*EUtranCellFDD*
qRxLevMin	*EUtranCellFDD*
qRxLevMinOffset	*EUtranCellFDD*
pMaxServingCell	*EUtranCellFDD*
qQualMin	*EUtranCellFDD*
qQualMinOffset	*EUtranCellFDD*

3.5.2 SIB2 Parameters

The following parameters can be used to control the behavior of SIB2.

Table 16 SIB2 Parameters

SIB2 Parameter	MO Class
acBarringInfoPresent	*EUtranCellFDD*
acBarringForEmergency	*EUtranCellFDD*
acBarringForMoSignallingPresent	*EUtranCellFDD*
acBarringForMoSignalling	*EUtranCellFDD*
acBarringForMoDataPresent	*EUtranCellFDD*
acBarringForMoData	*EUtranCellFDD*
ssacBarringForMMTELVoicePresent	*EUtranCellFDD*
ssacBarringForMMTELVoice	*EUtranCellFDD*
ssacBarringForMMTELVideoPresent	*EUtranCellFDD*
ssacBarringForMMTELVideo	*EUtranCellFDD*
acBarringFactor	*ACBarringConfig* struct in the MO class *EUtranCellFDD*

SIB2 Parameter	MO Class
acBarringTime	*ACBarringConfig* struct in the MO class *EUtranCellFDD*
acBarringForSpecialAC	*ACBarringConfig* struct in the MO class *EUtranCellFDD*

3.5.3 SIB3 Parameters

The following parameters can be used to control the behavior of SIB3 and can be changed without cell lock/unlock.

Table 17 SIB3 Parameters

SIB3 Parameter	MO Class
tEvaluation	*SIB3* struct in the MO class *EUtranCellFDD*
tHystNormal	*SIB3* struct in the MO class *EUtranCellFDD*
nCellChangeMedium	*SIB3* struct in the MO class *EUtranCellFDD*
nCellChangeHigh	*SIB3* struct in the MO class *EUtranCellFDD*
qHystSfMedium	*SIB3* struct in the MO class *EUtranCellFDD*
qHystSfHigh	*SIB3* struct in the MO class *EUtranCellFDD*
sNonIntraSearch	*SIB3* struct in the MO class *EUtranCellFDD*
threshServingLow	*SIB3* struct in the MO class *EUtranCellFDD*
cellReselectionPriority	*EUtranFreqRelation*
qRxLevMin	*EUtranFreqRelation*
pMax	*EUtranFreqRelation*
sIntraSearch	*SIB3* struct in the MO class *EUtranCellFDD*
allowedMeasBandwidth	*EUtranFreqRelation*
tReselectionEutra	*EUtranFreqRelation*
tReselectionEutraSfMedium	*EUtranFreqRelation*
tReselectionEutraSfHigh	*EUtranFreqRelation*
qQualMin	*EUtranFreqRelation*
sIntraSearchP	*SIB3* struct in the MO class *EUtranCellFDD*
sIntraSearchQ	*SIB3* struct in the MO class *EUtranCellFDD*
sNonIntraSearchP	*SIB3* struct in the MO class *EUtranCellFDD*
sNonIntraSearchQ	*SIB3* struct in the MO class *EUtranCellFDD*
threshServingLowQ	*SIB3* struct in the MO class *EUtranCellFDD*
sIntraSearchv920Active	*SIB3* struct in the MO class *EUtranCellFDD*
sNonIntraSearchv920Active	*SIB3* struct in the MO class *EUtranCellFDD*

3.5.4 SIB4 Parameters

The following parameters can be used to control the behavior of SIB4. All parameters do not require cell lock/unlock.

Table 18 SIB4 Parameters

SIB4 Parameter	MO Class	Comment
physicalLayerCellIdGroup	*ExternalEUtranCellFDD*	*physicalLayerCellIdGroup* and *physicalLayerSubCellId* together build physCellId for neighbor cells in other eNBs. Part of IntraFreqNeighCellInfo.
physicalLayerSubCellId	*ExternalEUtranCellFDD*	
qOffsetCellEUtran	*EUtranCellRelation*	Part of IntraFreqNeighCellInfo.
isHoAllowed	*EUtranCellRelation*	This attribute is not included in SIBs, but if its value is False, then the cell is included in the blackCellList.

3.5.5 SIB5 Parameters

The following parameters can be used to control the behavior of SIB4. All parameters do not require cell lock/unlock.

Table 19 SIB5 Parameters

SIB5 Parameter	MO Class	Comment
qRxLevMin	*EUtranFreqRelation*	
pMax	*EUtranFreqRelation*	
tReselectionEutra	*EUtranFreqRelation*	
tReselectionEutraSfMedium	*EUtranFreqRelation*	
tReselectionEutraSfHigh	*EUtranFreqRelation*	
threshXHigh	*EUtranFreqRelation*	
threshXLow	*EUtranFreqRelation*	
allowedMeasBandwidth	*EUtranFreqRelation*	
cellReselectionPriority	*EUtranFreqRelation*	
qOffsetFreq	*EUtranFreqRelation*	
qQualMin	*EUtranFreqRelation*	
threshXHighQ	*EUtranFreqRelation*	
threshXLowQ	*EUtranFreqRelation*	
physicalLayerCellIdGroup	*ExternalEUtranCellFDD*	*physicalLayerCellIdGroup* and *physicalLayerSubCellId* together build physCellId for neighbor cells in other eNBs. Part of IntraFreqNeighCellInfo.
physicalLayerSubCellId	*ExternalEUtranCellFDD*	
isHoAllowed	*EUtranCellRelation*	This attribute is not included in SIBs, but if its value is False, then the cell is included in the blackCellList.

3.5.6 SIB6 Parameters

The following parameters can be used to control the behavior of SIB6.

Table 20 SIB6 Parameters

SIB6 Parameter	MO Class	Comment
arfcnValueUtranDl	*UtranFrequency*	CarrierFreq/ARFCN-ValueUTRA
cellReselectionPriority	*UtranFreqRelation*	
threshXHigh	*UtranFreqRelation*	
threshXLow	*UtranFreqRelation*	
qRxLevMin	*UtranFreqRelation*	
pMaxUtra	*UtranFreqRelation*	
qQualMin	*UtranFreqRelation*	
threshXHighQ	*UtranFreqRelation*	
threshXLowQ	*UtranFreqRelation*	
tReselectionUtra	*SIB6* struct in the MO class *EUtranCellFDD*	
tReselectionUtraSfMedium	*SIB6* struct in the MO class *EUtranCellFDD*	
tReselectionUtraSfHigh	*SIB6* struct in the MO class *EUtranCellFDD*	

3.5.7 SIB8 Parameters

The following parameters can be used to control the behavior of SIB8.

Table 21 SIB8 Parameters

SIB8 Parameter	MO Class	Comment
cellReselectionPriority	*Cdma2000FreqBandRelation*	
FreqCdma	*Cdma2000Freq*	arfcn under NeighCellsPerBandclassCDMA2000
hrpdBandClass	*Cdma2000FreqBand*	
searchWindowSizeCdma	*SIB8* struct in the MO class *EUtranCellFDD*	
pnOffset	*ExternalCdma2000Cell*	PhysCellIdCDMA2000 in physCellIdList under NeighCellsPerBandclassCDMA2000
threshXHighHrpd	*Cdma2000FreqBandRelation*	
threshXLowHrpd	*Cdma2000FreqBandRelation*	
tReselectionCdma1xRtt	*SIB8* struct in the MO class *EUtranCellFDD*	
tReselectionCdma1xRttSfHigh	*SIB8* struct in the MO class *EUtranCellFDD*	

SIB8 Parameter	MO Class	Comment
tReselectionCdma1xRttSfMedium	*SIB8* struct in the MO class *EUtranCellFDD*	
tReselectionCdmaHrpd	*SIB8* struct in the MO class *EUtranCellFDD*	
tReselectionCdmaHrpdSfHigh	*SIB8* struct in the MO class *EUtranCellFDD*	
tReselectionCdmaHrpdSfMedium	*SIB8* struct in the MO class *EUtranCellFDD*	

3.6 IP Transport

This chapter provides an overview of the IP transport structure of LTE RAN. Full details are provided in *Transport Network Configuration*.

The 3GPP standard indicates that the LTE RBS terminates two interfaces:

- The S1 interface towards the Access Gateway
- The X2 interface between LTE RBSs

An additional interface is terminated towards OSS-RC.

Connectivity to and from the LTE RBS is provided by an Ethernet connection using IP protocol. The following table lists the logical connections carried over this interface:

Table 22 Logical Connections on IP Transport Interface

Interface	Description
S1-UP	S1-User Plane. The RBS is connected to the LTE core network via the S1 interface. The user plane part of the S1 interface, S1-UP, connects the RBS with the SGW.
S1-CP	S1-Control Plane. The S1 interface control plane, S1-CP, connects the RBS with the MME in the LTE Core Network.
X2-UP	X2-User Plane. The RBSs are interconnected with the X2 interface. The user plane part of the X2 interface, X2-UP, is primarily used for data forwarding at handover.
X2-CP	X2-Control Plane provides signalling between RBS to facilitate handover.
Mul	The Mul is the management interface towards the RBS. It is used only for O&M purposes, such as downloading new software to the RBS or obtaining performance management files.

3.7 RBS Synchronization

As standard, LTE RBS synchronization is provided by a GPS receiver. The GPS receiver provides synchronization signals used for frame synchronization and local oscillator stability in the RUs. For more details refer to *Clock Source over GPS*.

In deployment scenarios when it is not possible to install a GPS receiver, synchronization can be provided by an NTP server connected to the transport network. For more details refer to *Clock Source over NTP*.

Synchronization can also be achieved through the following features:

- IEEE 1588 Frequency Synchronization
- IEEE 1588 Time and Phase Synchronization

For more details refer to *IEEE 1588 Frequency Synchronization* and *IEEE 1588 Time and Phase Synchronization*.

3.8 Intra-LTE Mobility

Intra-LTE mobility is controlled by the following licensed features:

- Intra-LTE Handover
- Automated Neighbor Relations

3.8.1 Intra-LTE Handover

The Intra-LTE Handover feature activates basic inter-cell handover for UE in active mode. Following call setup, the RBS provides information to UE used for measuring neighboring cells to detect a cell giving better service. The UE routinely measures the signal strength, quality, or both, of surrounding cells and informs the serving RBS via an event triggered measurement report when it detects one or more cells that can potentially offer a superior radio connection. The RBS makes handover decisions are based on these measurements.

For more details refer to *Intra-LTE Handover*.

3.8.2 Automated Neighbor Relations

The Automated Neighbor Relations (ANR) feature removes the need for the manual configuration of neighbor cell lists for intra-LTE handover. The feature automatically constructs and maintains a list of the best neighbor cells to use for inter-cell handover based on measurement reports from UE. The ANR feature can be activated on a cell by cell basis.

For more details refer to *Automated Neighbor Relations*.

3.9 Mobility IRAT

The following features are available to control IRAT mobility:

- *Coverage-Triggered WCDMA Session Continuity*

4 Key Performance Indicators

Key Performance Indicators (KPIs), counters, and event information relating to RBS and cell performance is detailed in *Performance Management*.