

ETSI TS 128 301 V16.0.0 (2020-08)



**LTE;  
Telecommunication management;  
Licensed Shared Access (LSA) Controller (LC)  
Integration Reference Point (IRP);  
Requirements  
(3GPP TS 28.301 version 16.0.0 Release 16)**



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Reference

RTS/TSGS-0528301vg00

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Keywords

LTE

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# Foreword

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# Introduction

The present document is part of a TS-family covering the 3<sup>rd</sup> Generation Partnership Project; Technical Specification Group Services and System Aspects; Telecommunication management; as identified below:

- 28.301 LSA Controller (LC) Integration Reference Point (IRP); Requirements**
- 28.302 LSA Controller (LC) Integration Reference Point (IRP); Information Service (IS)
- 28.303 LSA Controller (LC) Integration Reference Point (IRP); Solution Set (SS) definitions

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# 1 Scope

The present document specifies the requirements of the Licensed Shared Access (LSA) Controller (LC) Integration Reference Point (IRP). This IRP allows the NM to interact with the LC. This interaction with the LC enables the NM to configure NEs utilizing LSA spectrum resources.

The following two deployment scenarios are supported:

- one scenario in which the LC communicates LSA spectrum resource availability information to the NM, and
- one scenario in which the LC determines and communicates to the NM constraints on parameters of cells liable to use LSA spectrum resources.

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# 2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

- [1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".
- [2] 3GPP TS 32.101: "Telecommunication management; Principles and high level requirements".
- [3] ETSI TS 103 235 (V1.1.1): "Reconfigurable Radio Systems (RRS); system architecture and high level procedures for operation of Licensed Shared Access (LSA) in the 2300 MHz-2400 MHz band".
- [4] ETSI TS 103 379 (V1.1.1): "Reconfigurable Radio Systems (RRS); Information elements and protocols for the interface between LSA Controller (LC) and LSA Repository (LR) for operation of Licensed Shared Access (LSA) in the 2 300 MHz - 2 400 MHz band".
- [5] ETSI TS 103 154 (V1.1.1): "Reconfigurable Radio Systems (RRS); System requirements for operation of Mobile Broadband Systems in the 2 300 MHz - 2 400 MHz band under Licensed Shared Access (LSA)".
- [6] ETSI TR 103 113 (V1.1.1): "Electromagnetic compatibility and Radio spectrum Matters (ERM); System Reference document (SRdoc); Mobile broadband services in the 2 300 MHz - 2 400 MHz frequency band under Licensed Shared Access regime".

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# 3 Definitions and abbreviations

## 3.1 Definitions

For the purposes of the present document, the terms and definitions given in TR 21.905 [1] and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in TR 21.905 [1].

## 3.2 Abbreviations

For the purposes of the present document, the abbreviations given in TR 21.905 [1] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in TR 21.905 [1].

CEPT	Conference of Postal and Telecommunications Administrations
LC	LSA Controller
LR	LSA Repository
LSA	Licensed Shared Access
LSRAI	LSA Spectrum Resource Availability Information
NE	Network Element
NM	Network Manager
NMLS	Network Management Layer Service

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## 4 Concepts and background

### 4.1 General

ETSI TS 103 235 [3], ETSI TS 103 379 [4], ETSI TS 103 154 [5] and ETSI TR 103 113 [6] describe a system architecture for operation of mobile broadband services in the 2 300 MHz - 2 400 MHz band under Licensed Shared Access (LSA), aimed at enabling access for mobile/fixed communication networks (MFCNs) in those CEPT countries where access to the band is foreseen but cannot be provided without restrictions due to incumbent usage.

This specification series describes the interface between the NM and LC.

### 4.2 Architecture

The LC is a kind of NMLS (see TS 32.101 [2]). The interface between the NM and LC is a Type 7 interface.

### 4.3 Functionality

Two deployment scenarios are considered and different functionality is specified for the interface between the LC and NM.

**Deployment scenario 1:** In this scenario the LC is a relay for the LSRAI received from the LR. The LC forwards it to the NM.

**Deployment scenario 2:** In this scenario the LSRAI is not forwarded to the NM. The LC computes radio configuration constraints based on the LSRAI received from the LR and radio planning parameters received from the NM. These radio configuration constraints are sent to the NM.

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## 5 Business level requirements

### 5.1 Requirements

#### 5.1.1 Requirements for scenario 1

**REQ-LC-IRP-SC1-CON-001:** The LSA licensee shall be able to use LSA spectrum resources.

#### 5.1.2 Requirements for scenario 2

**REQ-LC-IRP-SC2-CON-001:** The LSA licensee shall be able to use LSA spectrum resources.

## 5.2 Actor roles

See detailed description of actor roles in clause 5.4.

## 5.3 Telecommunications resources

See detailed description of telecommunication resources in clause 5.4.

## 5.4 High-level use cases

### 5.4.1 High-level use cases for scenario 1

#### 5.4.1.1 Use Case: LSA spectrum resources usage

Use case stage	Evolution/Specification	<<Uses>> Related use
<b>Goal</b>	The goal is to enable usage of LSA spectrum resources by the LSA licensee.	
<b>Actors and Roles</b>	MFCN, NM, LC, LR	
<b>Telecom resources</b>	MFCN, NM, LC, LR	
<b>Assumptions</b>	Connectivity between NM and LC Connectivity between LR and LC	
<b>Pre-conditions</b>	LSA spectrum resources are available. The LR, LC and MFCN are set up and running.	
<b>Begins when</b>	The LC registers with the LR	
<b>Step 1 (M)</b>	The LC receives LSRAI from the LR and forwards this information to the NM.	
<b>Step 2 (M)</b>	The NM informs the LC that necessary configuration changes in the MFCN have been applied. The LC forwards this information to the LR	
<b>Step 3 (M)</b>	The LC receives LSRAI updates and forwards these to the NM. When the necessary configuration changes have been applied in the MFCN the LC is notified. The LC forwards this information to the LR.	
<b>Ends when</b>	The LC deregisters from the LR, and forwards this information to the NM.	
<b>Exceptions</b>		
<b>Post-conditions</b>	The LC is deregistered from the LR, and LSA spectrum resources cannot be used any more by the LSA licensee.	
<b>Traceability</b>	REQ-LC-IRP-CON-001	



## 5.4.2 High-level use cases for scenario 2

### 5.4.2.1 Use Case: LSA spectrum resources usage

Use case stage	Evolution/Specification	<<Uses>> Related use
<b>Goal</b>	The mobile network uses LSA spectrum resources within the constraints provided by the LC.	
<b>Actors and Roles</b>	The LC providing constraints on parameters of cells operating on LSA frequencies to the NM The NM providing ranges for cells parameters to the LC	
<b>Telecom resources</b>	NM, LC	
<b>Assumptions</b>	Connectivity between NM and LC is established. Connectivity between LR and LC is established.	
<b>Preconditions</b>	LSA spectrum resources are available. The LR, LC and MFCN are set up and running.	
<b>Begins when</b>	The LC receives information on LSA spectrum resource usage by incumbents from the LR.	
<b>Step 1 (M)</b>	The LC requests to the NM the cell parameters range suitable for the mobile network.	
<b>Step 2 (M)</b>	The LC determines the constraints on the mobile network that need to be fulfilled taking into account the ranges provided by the NM.	
<b>Step 3 (M)</b>	The LC provides the NM with the constraints on the mobile network.	
<b>Step 4 (M)</b>	The NM applies the constraints and confirms to the LC when constraints are fulfilled.	
<b>Ends when</b>	The LC has received a confirmation from the mobile network that the constraints are fulfilled.	
<b>Traceability</b>	REQ-LC-IRP-CON-001	

## 6 Specification level requirements

### 6.1 Requirements

#### 6.1.1 Requirements for scenario 1

**REQ-LC-IRP-SC1-FUN-001:** The LC shall support a capability allowing the NM to trigger the registration of the LC with the LR.

**REQ-LC-IRP-SC1-FUN-002:** The LC shall support a capability allowing to inform the NM about completion of the registration with the LR.

**REQ-LC-IRP-SC1-FUN-003:** The LC shall support a capability allowing the NM to trigger the de-registration of the LC with the LR.

**REQ-LC-IRP-SC1-FUN-004:** The LC shall support a capability allowing to inform the NM about completion of the de-registration with the LR.

**REQ-LC-IRP-SC1-FUN-005:** The LC shall support a capability allowing the NM to read the LSRAI that the LC has received from the LR.

**REQ-LC-IRP-SC1-FUN-006:** The LC shall support a capability allowing to inform the NM about changes of the LSRAI that the LC has received from the LR.

**REQ-LC-IRP-SC1-FUN-007:** The NM shall support a capability allowing to inform the LC that configuration changes in the MFCN (if needed) have been applied according to previously received LSRAI.

**REQ-LC-IRP-SC1-FUN-008:** The NM shall support a capability allowing LC to read if configuration changes in the MFCN (if needed) have been applied according to previously received LSRAI.

## 6.1.2 Requirements for scenario 2

**REQ-LC-IRP-SC2-FUN-001:** see REQ-LC-IRP-SC1-FUN-001

**REQ-LC-IRP-SC2-FUN-002:** see REQ-LC-IRP-SC1-FUN-002

**REQ-LC-IRP-SC2-FUN-003:** see REQ-LC-IRP-SC1-FUN-003

**REQ-LC-IRP-SC2-FUN-004:** see REQ-LC-IRP-SC1-FUN-004

**REQ-LC-IRP-SC2-FUN-005:** The LC shall support a capability allowing the NM to obtain the constraints on cells parameters that need to be satisfied in order to use LSA spectrum resources.

**REQ-LC-IRP-SC2-FUN-006:** The NM shall support a capability allowing the LC to obtain ranges of acceptable parameters for the cells operating on LSA frequencies.

**REQ-LC-IRP-SC2-FUN-007:** The LC shall take into account LSRAI in the LSA cells constraints calculation.

**REQ-LC-IRP-SC2-FUN-008:** The LC shall take into account the range for cell parameters provided by NM in the LSA cells constraints calculation.

## 6.2 Actor roles

See detailed description of actor roles in clause 6.4.

## 6.3 Telecommunications resources

See detailed description of telecommunications resources in clause 6.4.

## 6.4 Use cases

### 6.4.1 Use cases for scenario 1

#### 6.4.1.1 Use case 1: Trigger LC registration

Use case stage	Evolution/Specification	<<Uses>> Related use
<b>Goal</b>	The goal is to trigger by the NM the registration of the LC with the LR	
<b>Actors and Roles</b>	NM, LC	
<b>Telecom resources</b>	NM, LC	
<b>Assumptions</b>	Connectivity between NM and LC Connectivity between LR and LC The actor triggering the LC registration is located at the NM.	
<b>Pre-conditions</b>	LSA spectrum resources are available. The LR, LC, NM and MFCN are set up and running.	
<b>Begins when</b>	The LSA licensee decides to use LSA spectrum resources	
<b>Step 1 (M)</b>	The NM triggers the LC to register with the LR.	
<b>Step 2 (M)</b>	The LC registers with the LR according to the registration procedure described in [3], clause 5.5.2.	
<b>Step 3 (M)</b>	The LC notifies the NM about the completion of the registration procedure with the LR.	
<b>Ends when</b>	The NM has received the information on the completion of the registration procedure.	
<b>Exceptions</b>	Connectivity between NM and LC, or LR and LC is lost.	
<b>Post-conditions</b>	The LSA licensee can use LSA spectrum resources.	
<b>Traceability</b>	REQ-LC-IRP-SC1-FUN-001	

## 6.4.1.2 Use case 2: LC registration

Use case stage	Evolution/Specification	<<Uses>> Related use
<b>Goal</b>	The goal is to register the LC with the LR, and to inform the NM about this.	
<b>Actors and Roles</b>	NM, LC	
<b>Telecom resources</b>	NM, LC	
<b>Assumptions</b>	Connectivity between NM and LC Connectivity between LR and LC The actor triggering the LC registration is located at the LC.	
<b>Pre-conditions</b>	LSA spectrum resources are available. The LR, LC, NM and MFCN are set up and running.	
<b>Begins when</b>	The LSA licensee decides to use LSA spectrum resources	
<b>Step 1 (M)</b>	The LC registers with the LR according to the registration procedure described in [3], clause 5.5.2.	
<b>Step 2 (M)</b>	The LC notifies the NM about the completion of the registration procedure with the LR.	
<b>Ends when</b>	The NM has received the information on the completion of the registration procedure.	
<b>Exceptions</b>	Connectivity between NM and LC, or LR and LC is lost.	
<b>Post-conditions</b>	The LSA licensee can use LSA spectrum resources.	
<b>Traceability</b>	REQ-LC-IRP-SC1-FUN-002	

## 6.4.1.3 Use case 3: Trigger LC de-registration

Use case stage	Evolution/Specification	<<Uses>> Related use
<b>Goal</b>	The goal is to de-register the LC with the LR, and to inform the NM about this.	
<b>Actors and Roles</b>	NM, LC	
<b>Telecom resources</b>	NM, LC	
<b>Assumptions</b>	Connectivity between NM and LC Connectivity between LR and LC The actor triggering the LC de-registration is located at the NM.	
<b>Pre-conditions</b>	The LR, LC, NM and MFCN are set up and running. The LC has registered with the LR. The LSA licensee is using LSA spectrum resources.	
<b>Begins when</b>	The LSA licensee decides to not use LSA spectrum resources any more, and stops using them.	
<b>Step 1 (M)</b>	The NM triggers the LC to de-register with the LR.	
<b>Step 2 (M)</b>	The LC de-registers with the LR according to the de-registration procedure described in [3], clause 5.5.3.	
<b>Step 3 (M)</b>	The LC notifies the NM about the completion of the de-registration procedure with the LR.	
<b>Ends when</b>	The NM has received the information on the completion of the de-registration procedure.	
<b>Exceptions</b>	Connectivity between NM and LC, or LR and LC is lost.	
<b>Post-conditions</b>	The LSA licensee cannot use LSA spectrum resources any more.	
<b>Traceability</b>	REQ-LC-IRP-SC1-FUN-003	

## 6.4.1.4 Use case 4: LC de-registration

Use case stage	Evolution/Specification	<<Uses>> Related use
<b>Goal</b>	The goal is to de-register the LC with the LR, and to inform the NM about this.	
<b>Actors and Roles</b>	NM, LC	
<b>Telecom resources</b>	NM, LC	
<b>Assumptions</b>	Connectivity between NM and LC Connectivity between LR and LC The actor triggering the LC de-registration is located at the LC.	
<b>Pre-conditions</b>	The LR, LC, NM and MFCN are set up and running. The LC has registered with the LR. The LSA licensee is using LSA spectrum resources.	
<b>Begins when</b>	The LSA licensee decides to not use LSA spectrum resources any more, and stops using them.	
<b>Step 1 (M)</b>	The LC de-registers with the LR according to the de-registration procedure described in [3], clause 5.5.3.	
<b>Step 2 (M)</b>	The LC notifies the NM about the completion of the de-registration procedure with the LR.	
<b>Ends when</b>	The NM has received the information on the completion of the de-registration procedure.	
<b>Exceptions</b>	Connectivity between NM and LC, or LR and LC is lost.	
<b>Post-conditions</b>	The LSA licensee cannot use LSA spectrum resources any more.	
<b>Traceability</b>	REQ-LC-IRP-SC1-FUN-004	

## 6.4.1.5 Use case 5: LSRAI request

Use case stage	Evolution/Specification	<<Uses>> Related use
<b>Goal</b>	The goal is to allow the NM to trigger synchronisation of the LSRAI in the NM with the LSRAI in the LR.	
<b>Actors and Roles</b>	NM, LC	
<b>Telecom resources</b>	NM, LC	
<b>Assumptions</b>	Connectivity between NM and LC Connectivity between LR and LC	
<b>Pre-conditions</b>	The LR, LC, NM and MFCN are set up and running. The LC has registered with the LR. The LSA licensee wants to start using LSA spectrum resources or is already using it.	
<b>Begins when</b>	The LSA licensee wants to synchronise the LSRAI in the NM with the LSRAI in the LC received from the LR.	
<b>Step 1 (M)</b>	The NM sends a LSRAI request message to the LC	
<b>Step 2 (M)</b>	The LC processes this request and forwards it to the LR according to the LSRAI request procedure described in [3], clause 5.5.4.	
<b>Step 3 (M)</b>	The LR sends the LSRAI response message to the LC according to the LSRAI request procedure described in [3], clause 5.5.4.	
<b>Step 4 (M)</b>	The LC processes the LSRAI response message and forwards it to the NM.	
<b>Ends when</b>	The NM has received the updated LSRAI.	
<b>Exceptions</b>	Connectivity between NM and LC, or LR and LC is lost.	
<b>Post-conditions</b>	The LSA licensee can use updated LSRAI.	
<b>Traceability</b>	REQ-LC-IRP-SC1-FUN-005	

### 6.4.1.6 Use case 6: LSRAI notification

Use case stage	Evolution/Specification	<<Uses>> Related use
<b>Goal</b>	The goal is to allow the LR to trigger synchronisation of the LSRAI in the NM with the LSRAI in the LR	
<b>Actors and Roles</b>	NM, LC	
<b>Telecom resources</b>	NM, LC	
<b>Assumptions</b>	Connectivity between NM and LC Connectivity between LR and LC	
<b>Pre-conditions</b>	The LR, LC, NM and MFCN are set up and running. The LC has registered with the LR. The LSA licensee wants to start using LSA spectrum resources or is already using it.	
<b>Begins when</b>	The LR wants to synchronise the LSRAI in the LC (and NM) with the LSRAI in the LR.	
<b>Step 1 (M)</b>	The LR sends a LSRAI notification to the LC according to the LSRAI notification procedure described in [3], clause 5.5.5.	
<b>Step 2 (M)</b>	The LC processes the notification and forwards it to the NM.	
<b>Step 3 (M)</b>	The NM acknowledges reception of the notification to the LC.	
<b>Step 4 (M)</b>	An LSRAI notification ack is sent back to the LR according to the LSRAI notification procedure described in [3], clause 5.5.5.	
<b>Ends when</b>	The LR has received the LSRAI notification ack.	
<b>Exceptions</b>	Connectivity between NM and LC, or LR and LC is lost.	
<b>Post-conditions</b>	The LSA licensee can use updated LSRAI.	
<b>Traceability</b>	REQ-LC-IRP-SC1-FUN-006	

## 6.4.2 Use cases for scenario 2

### 6.4.2.1 Use case 1: Trigger LC registration

See clause 6.4.1.1.

### 6.4.2.2 Use case 2: LC registration

See clause 6.4.1.2.

### 6.4.2.3 Use case 3: Trigger LC de-registration

See clause 6.4.1.3.

### 6.4.2.4 Use case 4: LC de-registration

See clause 6.4.1.4.

## 6.4.2.5 Use case 5: LC initialization

Use case stage	Evolution/Specification	<<Uses>> Related use
<b>Goal</b>	The mobile network can start using LSA spectrum resources.	
<b>Actors and Roles</b>	The function in the NM providing ranges for the parameters of cells operating on LSA frequencies to the LC. The function in the LC providing constraints on parameters of cells operating on LSA frequencies to the NM, taking into account the related ranges provided by NM and the LSRAI provided by LR	
<b>Telecom resources</b>	NM, LC	
<b>Assumptions</b>	Connectivity between NM and LC is established. Connectivity between LR and LC is established. The LC has the functionality to convert LSRAI and parameters ranges provided by NM to constraints on some parameters of cells operating on LSA frequencies and to inform the NM about changes on those constraints.	
<b>Pre-conditions</b>	The LR, LC, NM and MFCN are set up and running. The NM has access to the list of cells operating on LSA frequencies.	
<b>Begins when</b>	The LC has received up-to-date information on current LSA spectrum resource usage by LSA incumbent from the LR.	
<b>Step 1 (M)</b>	The LC asks to the NM the list of geographical areas containing the cells operating on LSA frequencies to the LC, as well as related ranges for cells parameters.	
<b>Step 2 (M)</b>	The LC computes, for each geographical area provided by NM, the constraints on parameters, taking into the LSRAI provided by LR in order to satisfy current LSA spectrum resource usage by incumbents and also taking into account the ranges on parameters provided by NM in order to satisfy the LSA Licensee requirements.  NOTE: The LSA Licensee requirements are useful in order to find a suitable solution (LSA cell configuration parameters) by LC to minimize the probability of LSA cell switch off event (in the case in which the new LSA cell configuration parameters, calculated by LC, introduce a coverage or capacity or QoS degradation in the whole LSA licensee network).	
<b>Step 3 (M)</b>	The LC provides the NM with the constraints on cells parameters for cells operating on LSA frequencies.	
<b>Step 4 (M)</b>	The NM applies the necessary configuration changes	
<b>Step 5 (M)</b>	The NM confirms to the LC that the necessary configuration changes have been applied or not.	
<b>Ends when</b>	Ends when all steps identified above are completed or when an exception occurs.	
<b>Exceptions</b>	LC loses connectivity with the LR.	6.4.2.4
<b>Post-conditions</b>	The NM is able to properly configure and activate cells operating on LSA frequencies, using the constraints on cells parameters provided by the LC.	
<b>Traceability</b>	REQ-LC-IRP-SC2-FUN-005, REQ-LC-IRP-SC2-FUN-006, REQ-LC-IRP-SC2-FUN-007, REQ-LC-IRP-SC2-FUN-008	

## 6.4.2.6 Use case 6: LSA spectrum resource availability change

Use case stage	Evolution/Specification	<<Uses>> Related use
<b>Goal</b>	The mobile network operates according to the changed LSRAI given to the LC from the LR and according to the ranges for cell parameters given to the LC from the NM.	
<b>Actors and Roles</b>	The function in the NM providing parameters ranges for the parameters of cells operating on LSA frequencies to the LC. The function in the LC providing constraints on parameters of cells operating on LSA frequencies to the NM, taking into account the related ranges provided by NM and the LSRAI provided by LR	
<b>Telecom resources</b>	NM, LC	
<b>Assumptions</b>	Connectivity between NM and LC is established. Connectivity between LR and LC is established. The LC has the functionality to convert LSRAI and parameters ranges provided by NM to constraints on some parameters of cells operating on LSA frequencies and to inform the NM about changes on those constraints.	
<b>Pre-conditions</b>	The LR, LC, NM and MFCN are set up and running. The LC has the knowledge of which cells are operating on LSA frequency and what constraints are applied in the network. Cells are working according to previously provided constraints from the LC via the NM.	
<b>Begins when</b>	The LC has received up-to-date information on current LSA spectrum resource usage by incumbents from the LR.	
<b>Step 1 (M)</b>	The LC determines, also taking into account the validity ranges for cell parameters provided by NM, if the constraints on cells parameters need to be updated in order to satisfy the changes in LSA spectrum resources availability	
<b>Step 2 (M)</b>	If required, the LC provides the NM with the new constraints on parameters, for each cell impacted by the changes in LSA spectrum resources availability.	
<b>Step 3 (M)</b>	The NM configures the impacted cells according to the new constraints.	
<b>Step 4 (M)</b>	The NM confirms to the LC that the necessary configuration changes have been applied.	
<b>Ends when</b>	The LC has received a confirmation from the NM that the necessary configuration changes have been applied.	
<b>Exception</b>	The LC loses connectivity with the LR.	6.4.2.4
<b>Exception</b>	The configuration of the affected cells is not successful.	
<b>Post-conditions</b>	The affected cells are working according to the new constraints.	
<b>Traceability</b>	REQ-LC-IRP-SC2-FUN-005, REQ-LC-IRP-SC2-FUN-007, REQ-LC-IRP-SC2-FUN-008	

## 6.4.2.7 Use case 7: Network deployment update

Use case stage	Evolution/Specification	<<Uses>> Related use
<b>Goal</b>	The mobile network can start using LSA spectrum resources according to the new constraints on parameters, following a change in network deployment.	
<b>Actors and Roles</b>	The function in the NM providing ranges for the parameters of cells operating on LSA frequencies to the LC. The function in the LC providing constraints on parameters of cells operating on LSA frequencies to the NM, taking into account the related ranges provided by NM and the LSRAI provided by LR	
<b>Telecom resources</b>	NM, LC	
<b>Assumptions</b>	Connectivity between NM and LC is established. Connectivity between LR and LC is established. The LC has the functionality to convert LSRAI and parameters ranges provided by NM to constraints on some parameters of cells operating on LSA frequencies and to inform the NM about changes on those constraints.	
<b>Pre-conditions</b>	The LR, LC, NM and MFCN are set up and running. The NM has access to the list of cells operating on LSA frequencies. The LC has received up-to-date information on current LSA spectrum resource usage by incumbents from the LR.	
<b>Begins when</b>	The NM detects a change in the deployment of cells operating on LSA frequencies (e.g., a cell has been added to the network, removed from the network or updated).  Editor's note: it is FFS whether details need to be described on how the NM detects a change in the deployment of cells operating on LSA frequencies.	
<b>Step 1 (M)</b>	The NM provides the LC with the geographical areas related to the new cells, if any, as well as cells range parameters.  The NM provides the LC with the geographical areas related to the cells operating on LSA frequencies that have been removed from the network, if any.  The NM provides the LC with the geographical areas related to the cells operating on LSA frequencies and whose parameters have been modified, if any.  NOTE: The NM does not need to inform the LC when parameters of cells operating on LSA frequencies have been modified within the constraints provided by the LC.	
<b>Step 2 (M)</b>	The LC computes the constraints on parameters of cells operating on LSA frequencies that need to be satisfied in order to satisfy current LSA spectrum resource usage by incumbents and taking into account the ranges on parameters provided by the NM to satisfy LSA Licensee requirements.	
<b>Step 3 (M)</b>	The LC provides the NM with the constraints on cells parameters.	
<b>Step 4 (M)</b>	The NM reconfigures cells utilizing LSA spectrum resources, if necessary.	
<b>Step 5 (M)</b>	The NM confirms to the LC that the necessary configuration changes have been applied.	
<b>Ends when</b>	The NM has received the constraints on cells parameters and applied the necessary configuration changes.	
<b>Exception</b>	The LC loses connectivity with the LR.	6.4.2.4
<b>Exception</b>	The configuration of the affected cells is not successful.	
<b>Post-conditions</b>	The NM is able to properly configure and activate new cells that are using LSA spectrum resources, using the constraints on cells parameters provided by the LC.  The NM is able to properly reconfigure existing cells that are using LSA spectrum resources, using the updated constraints on cells parameters provided by the LC.	
<b>Traceability</b>	REQ-LC-IRP-SC2-FUN-005, REQ-LC-IRP-SC2-FUN-006, REQ-LC-IRP-SC2-FUN-007, REQ-LC-IRP-SC2-FUN-008	



## 6.4.2.8 Use case 8: Loss of connectivity with the LR

Use case stage	Evolution/Specification	<<Uses>> Related use
<b>Goal</b>	To provide the NM with default constraints on parameters of cells operating on LSA frequencies, following a loss of connectivity with the LR.  The LC has received a confirmation from the NM that the necessary configuration changes have been applied.	
<b>Actors and Roles</b>	The function in the LC providing constraints on parameters of cells operating on LSA frequencies to the NM taking into account the related ranges provided by NM and the LSRAI provided by LR. The function in the NM providing a confirmation that the constraints are satisfied.	
<b>Telecom resources</b>	NM, LC	
<b>Assumptions</b>	Connectivity between NM and LC is established. Connectivity between LR and LC is established. The LC has the functionality to convert LSRAI and parameters ranges provided by NM to constraints on some parameters of cells operating on LSA frequencies and to inform the NM about changes on those constraints. The LC has been configured with a fall-back measure (such as one of the measures described in Annex D of [3]), to execute in case of loss of connectivity with the LR.	
<b>Pre-conditions</b>	The LR, LC, NM and MFCN are set up and running. The NM has access to the list of cells operating on LSA frequencies. The LC is configured with default LSA spectrum resource availability information, intended to be used when connectivity is lost with the LR.	
<b>Begins when</b>	The LC loses connectivity with the LR.	
<b>Step 1 (M)</b>	The LC asks to the NM the list of cells operating on LSA frequencies to the LC, as well as ranges for cells parameters.	
<b>Step 2 (M)</b>	The LC computes the default constraints on parameters of cells operating on LSA frequencies, according to the fall-back measure configured at the LC and taking into account the ranges on parameters provided by the NM.	
<b>Step 3 (M)</b>	The LC provides the NM with the new constraints on parameters.	
<b>Step 4 (M)</b>	The NM reconfigures cells operating on LSA frequencies, if necessary.	
<b>Step 5 (M)</b>	The NM confirms to the LC that the necessary configuration changes have been applied.	
<b>Ends when</b>	The LC has received a confirmation from the NM that the necessary configuration changes have been applied.	
<b>Exceptions</b>	The configuration of the affected cells is not successful.	
<b>Post-conditions</b>	The NM is able to use LSA spectrum resources according to the updates provided by the LC.	
<b>Traceability</b>	REQ-LC-IRP-SC2-FUN-005, REQ-LC-IRP-SC2-FUN-006, REQ-LC-IRP-SC2-FUN-007, REQ-LC-IRP-SC2-FUN-008	

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## Annex A (informative): Change history

Change history							
Date	Meeting	TDoc	CR	Rev	Cat	Subject/Comment	New version
2017-06	SA#76	SP-170469				Presented for information and approval	1.0.0
2017-06	SA#76					Upgrade to change control version	14.0.0
2018-06	-	-	-	-	-	Update to Rel-15 version (MCC)	<b>15.0.0</b>
2020-07	-	-	-	-	-	Update to Rel-16 version (MCC)	<b>16.0.0</b>

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# History

<b>Document history</b>		
V16.0.0	August 2020	Publication