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**TECHNICAL SPECIFICATION**

LTE;
Telecommunication management;
Licensed Shared Access (LSA) Controller (LC)
Integration Reference Point (IRP);
Information Service (IS)
(3GPP TS 28.302 version 14.0.0 Release 14)

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# Contents

# Foreword

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# Introduction

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

TS 28.301:   Telecommunication management; LSA controller (LC) Integration Reference Point (IRP); Requirements

**TS 28.302:   Telecommunication management; LSA controller (LC) Integration Reference Point (IRP); Information Service (IS)**

TS 28.303:   Telecommunication management; LSA controller (LC) Integration Reference Point (IRP); Solution Set (SS) definitions

# 1 Scope

The present document specifies the LSA controller (LC) Integration Reference Point (IRP) management operations and notifications that can be communicated between an IRPAgent and one or several IRPManagers.

The present document specifies the semantics and behaviour of operations, notifications and their parameters visible across the reference point in a protocol and technology neutral way. It does not define their syntax and encoding.

# 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]     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 2300 MHz-2400 MHz band".

[3]     3GPP TS 25.105: "Base Station (BS) radio transmission and reception (TDD)".

[4]     3GPP TS 23.032: "Technical Specification Group Services and System Aspects; Universal Geographical Area Description (GAD)".

[5]     3GPP TS 28.668: "Telecommunication management; Radio Planning Tool Access (RPTA) Integration Reference Point (IRP); Information Service (IS)".

[6]     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".

[7]     3GPP TS 28.301: "Telecommunication Management; Licensed Shared Access (LSA) Controller (LC) Integration Reference Point (IRP); Requirements".

# 3 Definitions and abbreviations

## 3.1 Definitions

For the purposes of the present document, the terms and definitions given in 3GPP 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 3GPP TR 21.905 [1].

**LSRAI Context:** See definition in ETSI TS 103 379 [2].
**LSA$_1$:** See definition in ETSI TS 103 235 [6].

## 3.2 Abbreviations

For the purposes of the present document, the abbreviations given in 3GPP 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 3GPP TR 21.905 [1].

| | |
|---|---|
| EIRP | Equivalent Isotropic Radiated Power |
| LC | LSA Controller |
| LR | LSA Repository |
| LSRAI | LSA Spectrum Resource Availability Information |
| NM | Network Manager |

# 4 System overview

## 4.1 System Context

### 4.1.1 System Context for scenario 1

Figure 4.1.1.1 shows the System Context for scenario 1. The LC and NM can play both the roles of IRPAgent and IRPManager for operations and notifications of the LSA IRP.
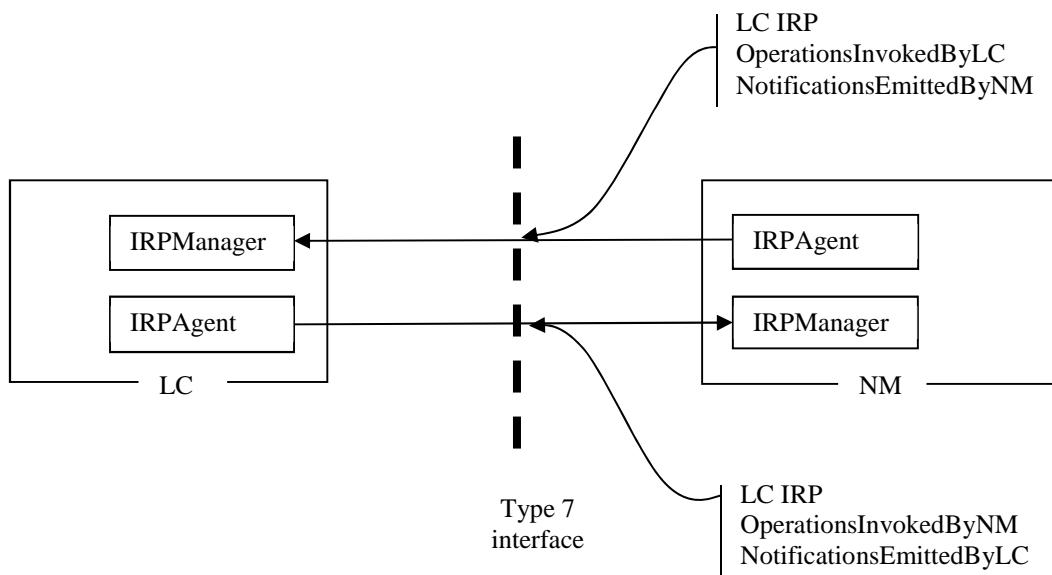


**Figure 4.1.1.1: System Context for LC IRP (scenario 1)**

### 4.1.2 System Context for scenario 2

Figure 4.1.2.1 shows the System Context for scenario 1. The LC and NM can play both the roles of IRPAgent and IRPManager for operations and notifications of the LSA IRP.

LC IRP
OperationsInvokedByLC
NotificationsEmittedByNM

IRPManager

IRPAgent

IRPAgent

IRPManager

LC

NM

Type 7
interface

LC IRP
OperationsInvokedByNM
NotificationsEmittedByLC
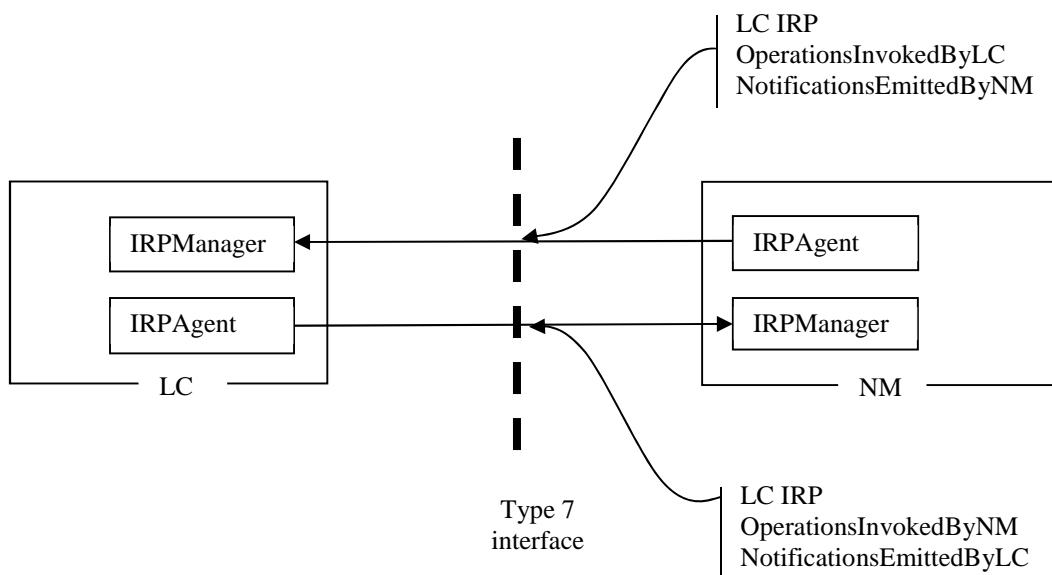
**Figure 4.1.2.1: System Context for LC IRP (scenario 2)**

# 5 Model

## 5.1 Imported and associated information entities

### 5.1.1 Imported information entities and local labels

None.

### 5.1.1 Associated information entities and local labels

None.

# 5.2 Class diagram

## 5.2.1 Relationships

### 5.2.1.1 Relationships for scenario 1
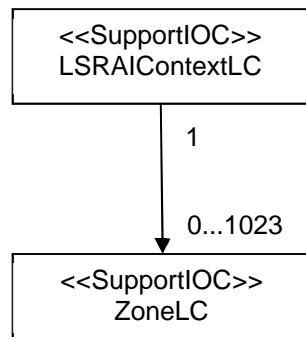


**Figure 5.2.1.1.1: Information Model of the LSA controller IRP for the interface OperationsInvokedByNM and the interface NotificationsEmittedByLC (scenario 1)**
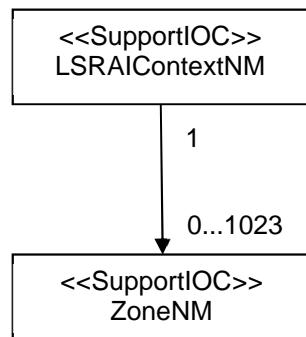


**Figure 5.2.1.1.2: Information Model of the LSA controller IRP for the interface OperationsInvokedByLC and the interface NotificationsEmittedByNM (scenario 1)**

An instance of this model is always related to a particular instance of the Type 7 interface between a LC and a LR. Identifiers are unique within this scope. In case the NM has multiple instances of the Type 7 interface to multiple LCs, identifiers for zones as allocated by the LR may be overlapping. The NM may have to add prefixes to identifiers of zones, whose value depends on the interface instance on which information is exchanged with the LC, to integrate these (extended) identifiers into its namespace or make them globally unique.

### 5.2.1.2 Relationships for scenario 2
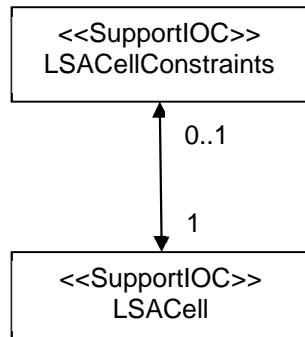


**Figure 5.2.1.2.1: Information Model of the LSA controller IRP (scenario 2)**

## 5.2.2 Inheritance

### 5.2.2.1 Inheritance for scenario 1

There is no inheritance.

### 5.2.2.2 Inheritance for scenario 2

There is no inheritance.

# 5.3 Class definitions

## 5.3.1 Class definitions for scenario 1

### 5.3.1.1 `LSRAIContextLC`

#### 5.3.1.1.1 Definition

This Support IOC represents the LSRAI context as seen by the NM in the LC.

#### 5.3.1.1.2 Attributes

| Attribute name | Support Qualifier | isReadable | isWritable | isInvariant | isNotifyable |
|---|---|---|---|---|---|
| licenseeId | M | M | - | - | M |
| lRId | M | M | - | - | M |
| lCId | M | M | - | - | M |

### 5.3.1.2 `ZoneLC`

#### 5.3.1.2.1 Definition

This Support IOC represents a zone as seen by the NM in the LC.

5.3.1.2.2        Attributes

| Attribute name | Support Qualifier | isReadable | isWritable | isInvariant | isNotifyable |
|---|---|---|---|---|---|
| zoneId | M | M | - | - | M |
| zoneType | M | M | - | - | M |
| frequency | M | M | - | - | M |
| radioConstraints | M | M | - | - | M |
| space | M | M | - | - | M |
| time | M | M | - | - | M |

### 5.3.1.3        LSRAIContextNM

5.3.1.3.1        Definition

This Support IOC represents the LSRAI context as seen by the LC in the NM.

5.3.1.3.2        Attributes

| Attribute name | Support Qualifier | isReadable | isWritable | isInvariant | isNotifyable |
|---|---|---|---|---|---|
| licenseeId | M | M | - | - | M |
| lRId | M | M | - | - | M |
| lCId | M | M | - | - | M |

### 5.3.1.4        ZoneNM

5.3.1.4.1        Definition

This Support IOC represents a zone as seen by the LC in the NM.

5.3.1.4.2        Attributes

| Attribute name | Support Qualifier | isReadable | isWritable | isInvariant | isNotifyable |
|---|---|---|---|---|---|
| zoneId | M | M | - | - | M |
| zoneStatus | M | M | - | - | M |

## 5.3.2        Class definitions for scenario 2

### 5.3.2.1   LSACell

5.3.2.1.1        Definition

This SupportIOC represents a cell.

| Referenced TS | Requirement label | Comment |
|---|---|---|
| 3GPP TS 28.301 | REQ-LC-IRP-SC2-FUN-002 | |

### 5.3.2.1.2    Attributes

| Attribute name | Support Qualifier | isReadable | isWritable | isInvariant | isNotifyable |
|---|---|---|---|---|---|
| cellId | M | M | O | - | - |
| geographicalArea | M | M | O | - | - |
| maxAllowedEIRP | M | M | O | - | - |
| minAllowedEIRP | M | M | O | - | - |
| maxAllowedAntennaAltitude | O | M | O | - | - |
| minAllowedAntennaAltitude | O | M | O | - | - |
| maxAllowedAntennaTilt | O | M | O | - | - |
| minAllowedAntennaTilt | O | M | O | - | - |
| antennaPatternLabel | O | M | O | - | - |
| antennaType | O | M | O | - | - |

### 5.3.2.1.3    Attribute constraints

None.

### 5.3.2.1.4    Notifications

None.

## 5.3.2.2    LSACellConstraints

### 5.3.2.2.1    Definition

This SupportIOC represents constraints on parameters of a cell operating on LSA frequencies.

| Referenced TS | Requirement label | Comment |
|---|---|---|
| 3GPP TS 28.301 [7] | REQ-LC-IRP-SC2-FUN-001 | |

### 5.3.2.2.2    Attributes

| Attribute name | Support Qualifier | isReadable | isWritable | isInvariant | isNotifyable |
|---|---|---|---|---|---|
| cellId | M | M | M | - | - |
| maxAllowedEIRP | M | M | M | - | - |
| maxLeadTime | O | M | M | - | - |

### 5.3.2.2.3    Attribute constraints

None.

### 5.3.2.2.4    Notifications

None.

# 5.4 Attribute definitions

## 5.4.1 Attribute definitions for scenario 1

### 5.4.1.1 Attribute properties

| Attribute Name | Documentation and Allowed Values | Properties |
|---|---|---|
| lCId | Identifier of the LC used on LSA1, as defined in ETSI TS 103 379 [2]<br><br>allowedValues: N/A | type: Integer<br>multiplicity: 1<br>isOrdered: N/A<br>isUnique: False<br>defaultValue: No default value<br>isNullable: False |
| lRId | Identifier of the LR used on LSA1, as defined in ETSI TS 103 379 [2]<br><br>allowedValues: N/A | type: Integer<br>multiplicity: 1<br>isOrdered: N/A<br>isUnique: False<br>defaultValue: No default value<br>isNullable: False |
| frequency | The frequency range of the zone. The type is a structure with the following fields<br><br>• lowerFrequency<br>• upperFrequency<br><br>The fields are defined in ETSI TS 103 379 [2].<br><br>allowedValues: N/A | type: <<dataType>><br>multiplicity: 1<br>isOrdered: N/A<br>isUnique: False<br>defaultValue: No default value<br>isNullable: False |
| licenseeId | Identifier of the licensee used on LSA1, as defined in ETSI TS 103 379 [2]<br><br>allowedValues: N/A | type: Integer<br>multiplicity: 1<br>isOrdered: N/A<br>isUnique: False<br>defaultValue: No default value<br>isNullable: False |
| radioConstraints | The description of the radio constraints applying to a zone. The type is a structure with the following fields:<br><br>• radioConstraintsProfileIdentifier<br>• protectionHeightAboveGround<br>• maximumFieldStrength<br>• frequencyInterval<br>• maximumApplicableAntennaHeight<br>• EIRPRestriction<br>• ACS<br><br>The fields are defined in ETSI TS 103 379 [2].<br><br>allowedValues: N/A | type: <<dataType>><br>multiplicity: 1<br>isOrdered: N/A<br>isUnique: False<br>defaultValue: No default value<br>isNullable: False |
| space | The description of the geographical area of a zone. The type is a structure with the following fields:<br><br>• switch<br>• circle<br>• polygon<br>• area descriptor<br><br>The value of switch indicates if the information in circle, polygon or area descriptor shall be used. Circle, polygon and area descriptor are defined in ETSI TS 103 379 [2].<br><br>allowedValues: N/A | type: <<dataType>><br>multiplicity: 1<br>isOrdered: N/A<br>isUnique: False<br>defaultValue: No default value<br>isNullable: False |

| Attribute Name | Documentation and Allowed Values | Properties |
|---|---|---|
| time | The description of when the zone is operational. The type is a structure with the following fields:<br><br>• switch<br>• periodicSchedule<br>• aperiodicSchedule<br><br>The value of the switch indicates if the information periodicSchedule or aperiodicSchedule shall be used.<br><br>The schedule types are defined in ETSI TS 103 379 [2].<br><br>allowedValues: N/A | type: <<dataType>><br>multiplicity: 1<br>isOrdered: N/A<br>isUnique: False<br>defaultValue: No default value<br>isNullable: False |
| zoneId | The identifier of a zone, as defined in ETSI TS 103 379 [2].<br><br>allowedValues: N/A | type: Integer<br>multiplicity: 1<br>isOrdered: N/A<br>isUnique: False<br>defaultValue: No default value<br>isNullable: False |
| zoneStatus | The conformation status of a zone, as defined in ETSI TS 103 379 [2]. In a confirmed zone, configuration changes in the MFCN (if needed) have been applied according to previously received LSRAI.<br><br>allowedValues: confirmed, notConfirmed | type: <<enumeration>><br>multiplicity: 1<br>isOrdered: N/A<br>isUnique: False<br>defaultValue: notConfirmed<br>isNullable: False |
| zoneType | The type of a zone as defined in ETSI TS 103 379 [2]. The following values shall be used:<br><br>"0" - Exclusion Zone.<br>"1" - Restriction Zone.<br>"2" - Protection Zone.<br><br>allowedValues: 0,1,2 | type: Integer<br>multiplicity: 1<br>isOrdered: N/A<br>isUnique: False<br>defaultValue: No default value<br>isNullable: False |

### 5.4.1.2 Constraints

None.

## 5.4.2 Attribute definitions for scenario 2

### 5.4.2.1 Attribute properties

The following table defines the attributes that are present in the Support Object Classes of the present document.

| Attribute Name | Documentation and Allowed Values | Properties |
|---|---|---|
| cellId | NM defined cell identifier.<br><br>allowedValues: N/A | type: String<br>multiplicity: 1<br>isOrdered: N/A<br>isUnique: True<br>defaultValue: None<br>isNullable: False |
| geographicalArea | Geographical area, as defined in TS 23.032 [4]. It describes the area in which the antenna is located. The antenna can be located in any point inside this area. | type: Set types<br>multiplicity: 1<br>isOrdered: N/A<br>isUnique: N/A<br>defaultValue: None<br>isNullable: False |

| Attribute Name | Documentation and Allowed Values | Properties |
|---|---|---|
| maxAllowedEIRP | Maximum EIRP allowed, expressed in dBm.<br><br>allowedValues: N/A<br><br>For EIRP reference: TS 25.105 [3] | type: Integer<br>multiplicity: 1<br>isOrdered: N/A<br>isUnique: N/A<br>defaultValue: None<br>isNullable: False |
| minAllowedEIRP | Minimum EIRP allowed, expressed in dBm.<br><br>allowedValues: N/A<br><br>For EIRP reference: TS 25.105 [3] | type: Integer<br>multiplicity: 1<br>isOrdered: N/A<br>isUnique: N/A<br>defaultValue: None<br>isNullable: False |
| maxAllowedAntennaAltitude | The max elevation of the antenna above sea level.<br><br>allowedValues: An integral value representing a number of meters in 0.1 meter increments.<br><br>Reference: TS 28.668 [5] | type: Integer<br>multiplicity: 1<br>isOrdered: N/A<br>isUnique: N/A<br>defaultValue: None<br>isNullable: False |
| minAllowedAntennaAltitude | The min elevation of the antenna above sea level.<br><br>allowedValues: An integral value representing a number of meters in 0.1 meter increments.<br>Reference: TS 28.668 [5] | type: Integer<br>multiplicity: 1<br>isOrdered: N/A<br>isUnique: N/A<br>defaultValue: None<br>isNullable: False |
| maxAllowedAntennaTilt | The max tit of the antenna<br><br>allowedValues: (0..360)<br><br>Max value for antennaMechanicalOffset as described in TS 28.668 [5] | type: Integer<br>multiplicity: 1<br>isOrdered: N/A<br>isUnique: N/A<br>defaultValue: None<br>isNullable: False |
| minAllowedAntennaTilt | The min tit of the antenna<br><br>allowedValues: (0..360)<br><br>Min value for antennaMechanicalOffset as described in TS 28.668 [5] | type: Integer<br>multiplicity: 1<br>isOrdered: N/A<br>isUnique: N/A<br>defaultValue: None<br>isNullable: False |
| antennaPatternLabel | The radiation pattern of the antenna, also referred to as antenna pattern.<br><br>allowedValues: N/A<br><br>Reference: TS 28.668 [5] | type: String<br>multiplicity: 1<br>isOrdered: N/A<br>isUnique: N/A<br>defaultValue: None<br>isNullable: False |
| antennaType | The type of the antenna. Types are e.g. repeaters, remote antennas, power dividers.<br><br>allowedValues: N/A<br><br>Reference: TS 28.668 [5] | type: String<br>multiplicity: 1<br>isOrdered: N/A<br>isUnique: N/A<br>defaultValue: None<br>isNullable: False |

## 5.4.2.2 Constraints

None.

# 6 Interface Definition

## 6.1 Class diagram representing interfaces

## 6.1.1 Class diagram representing interfaces for scenario 1

```
+----------------------------------+    +----------------------------------+
|          <<Interface>>           |    |          <<Interface>>           |
|       OperationsInvokedByNM      |    |      NotificationsEmittedByLC    |
+----------------------------------+    +----------------------------------+
+----------------------------------+    +----------------------------------+
| requestLcRegistration()          |    | notifyLCRegistration             |
| requestLcDeregistration()        |    | notifyLCDeRegistration           |
| getLSRAI()                       |    | notifyZoneCreation               |
|                                  |    | notifyZoneDeletion               |
|                                  |    | notifyZoneModification           |
+----------------------------------+    +----------------------------------+
```
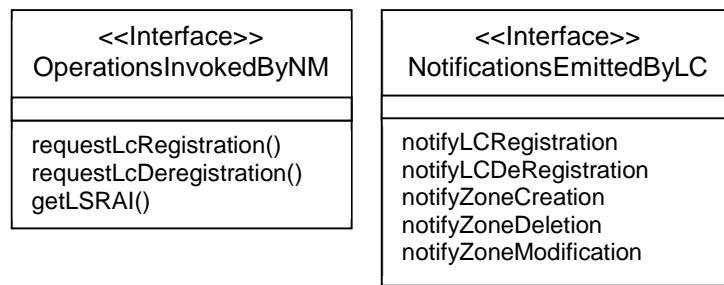
**Figure 6.1.1-1: Class diagram representing the interface OperationsInvokedByNM and the interface NotificationsEmittedByLC (scenario 1)**

```
+----------------------------------+    +----------------------------------+
|          <<Interface>>           |    |          <<Interface>>           |
|       OperationsInvokedByLC      |    |      NotificationsEmittedByNM    |
+----------------------------------+    +----------------------------------+
+----------------------------------+    +----------------------------------+
| getLSRAIConfirmation()           |    | notifyLSRAIConfirmation          |
+----------------------------------+    +----------------------------------+
```
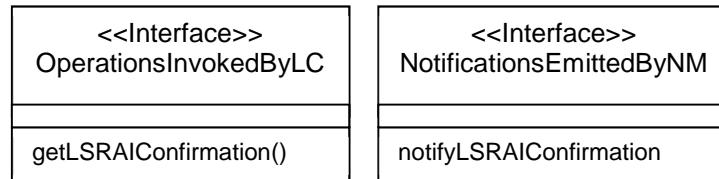
**Figure 6.1.1-2: Class diagram representing the interface OperationsInvokedByLC and the interface NotificationsEmittedByNM (scenario 1)**

## 6.1.2      Class diagram representing interfaces for scenario 2

```
+----------------------------------+    +----------------------------------+
|          <<Interface>>           |    |          <<Interface>>           |
|       OperationsInvokedByNM      |    |      NotificationsEmittedByLC    |
+----------------------------------+    +----------------------------------+
+----------------------------------+    +----------------------------------+
| cellsUpdate()                    |    | notifyLCRegistration             |
| cellsConstraintsSatisfied()      |    | notifyLCDeRegistration           |
+----------------------------------+    +----------------------------------+
```
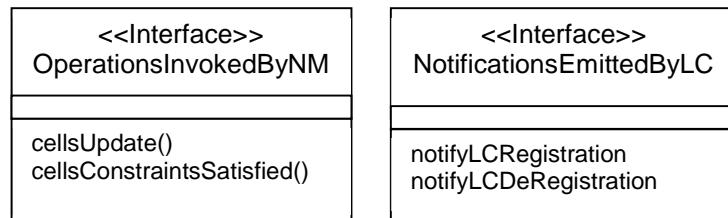
**Figure 6.1.2-1: Class diagram representing the interface OperationsInvokedByNM and the interface NotificationsEmittedByLC (scenario 2)**

```
┌─────────────────────────────┐   ┌─────────────────────────────┐
│        <<Interface>>        │   │        <<Interface>>        │
│     OperationsInvokedByLC   │   │   NotificationsEmittedByNM  │
├─────────────────────────────┤   ├─────────────────────────────┤
│                             │   │                             │
├─────────────────────────────┤   ├─────────────────────────────┤
│   cellsConstraintsUpdate()  │   │                             │
└─────────────────────────────┘   └─────────────────────────────┘
```
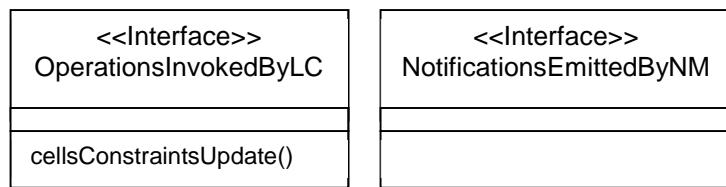
**Figure 6.1.2-2: Class diagram representing the interface OperationsInvokedByLC and the interface NotificationsEmittedByNM (scenario 2)**

# 6.3 OperationsInvokedByNM Interface (M)

## 6.3.1 OperationsInvokedbyNM Interface (M) for scenario 1

### 6.3.1.1 Operation requestLcRegistration (M)

#### 6.3.1.1.1 Definition

The NM invokes this operation to request the LC to register with the LR.

| Referenced TS | Requirement label | Comment |
|---|---|---|
| 3GPP TS 28.301 [7] | REQ-LC-IRP-SC1-FUN-001 | |

#### 6.3.1.1.2 Input parameters

| Parameter Name | Support Qualifier | Information Type / Legal Values | Comment |
|---|---|---|---|
| licenseeId | M | LSRAIContextNM.licenseeId | Uniquely identifies the LSA Licensee |
| lCId | M | LSRAIContextNM.lCId | Uniquely identifies the LC |
| lRId | M | LSRAIContextNM.lRId | Uniquely identifies the LR |

#### 6.3.1.1.3 Output parameters

| Parameter Name | Support Qualifier | Matching Information / Information Type / Legal Values | Comment |
|---|---|---|---|
| licenseeId | M | LSRAIContextLC.licenseeId | Uniquely identifies the LSA Licensee |
| lCId | M | LSRAIContextLC.lCId | Uniquely identifies the LC |
| lRId | M | LSRAIContextLC.lRId | Uniquely identifies the LR |
| cause | O | INTEGER | Indicates cause of registration failure. Cause values are specified in ETSI TS 103 379 [2]. |
| result | M | ENUM (OperationSucceeded, OperationFailed) | Indicates success or failure |

### 6.3.1.2 Operation requestLcDeregistration (M)

#### 6.3.1.2.1 Definition

The NM invokes this operation to request the LC to deregister from the LR.

| Referenced TS | Requirement label | Comment |
|---|---|---|
| 3GPP TS 28.301 [7] | REQ-LC-IRP-SC1-FUN-003 | |

### 6.3.1.2.2 Input parameters

| Parameter Name | Support Qualifier | Information Type / Legal Values | Comment |
|---|---|---|---|
| lCId | M | LSRAIContextNM.lCId | Uniquely identifies the LC |
| lRId | M | LSRAIContextNM.lRId | Uniquely identifies the LR |

### 6.3.1.2.3 Output parameters

| Parameter Name | Support Qualifier | Matching Information / Information Type / Legal Values | Comment |
|---|---|---|---|
| lCId | M | LSRAIContextLC.lCId | Uniquely identifies the LC |
| lRId | M | LSRAIContextLC.lRId | Uniquely identifies the LR |
| cause | O | INTEGER | Indicates cause of deregistration failure. Cause values are specified in ETSI TS 103 379 [2]. |
| result | M | ENUM (OperationSucceeded, OperationFailed) | Indicates success or failure |

## 6.3.1.3 Operation getLSRAI (M)

### 6.3.1.3.1 Definition

The NM invokes this operation to get LSRAI for the scoped subset of zones in an LSRAI context.

| Referenced TS | Requirement label | Comment |
|---|---|---|
| 3GPP TS 28.301 [7] | REQ-LC-IRP-SC1-FUN-005 | |

### 6.3.1.3.2 Input parameters

| Parameter Name | Support Qualifier | Information Type / Legal Values | Comment |
|---|---|---|---|
| scope | M | LIST OF zoneId | This parameter defines the subset of zones to be returned. The absence of an input parameter is equivalent to all zones under LSRAI. |

### 6.3.1.3.3 Output parameters

| Parameter Name | Support Qualifier | Matching Information / Information Type / Legal Values | Comment |
|---|---|---|---|
| lSRAI | M | LIST OF Zone instances | This parameter returns the scoped Zone instances under LSRAI. The data structure is described by the information model specified in subclause 5. |
| status | M | ENUM (OperationSucceeded, OperationFailed) | If allScopedPlannedDataReturned is true, status = OperationSucceeded. If operation_failed is true, status = OperationFailed. |

## 6.3.2 `OperationsInvokedByNM` Interface (M) for scenario 2

## 6.3.2.1 Operation `cellsUpdate` (M)

### 6.3.2.1.1 Definition

The NM invokes this operation to provide the LC with information about created, deleted or modified cells operating on LSA frequencies.

NOTE:    it is assumed that prior to invoking this operation:

- cells operating on LSA frequencies have been identified by the operator, and

- the LC is connected to the LR and has received up-to-date LSRAI information from the LR.

| Referenced TS | Requirement label | Comment |
|---|---|---|
| 3GPP TS 28.301 [7] | REQ-LC-IRP-SC2-FUN-006 | |

### 6.3.2.1.2 Input parameters

| Parameter Name | Support Qualifier | Information Type / Legal Values | Comment |
|---|---|---|---|
| addedLSACells | O | LIST OF LSACell | This parameter contains a list of instances of the LSACell class. |
| modifiedLSACells | O | LIST OF LSACell | This parameter contains a list of instances of the LSACell class.<br><br>Each LSACell instance within this list contains only the parameters and corresponding values that need to be updated by the LC, and the attribute cellId. |
| removedLSACells | O | LIST OF LSACell.cellId | This parameter contains a list of cellId(s), indicating which cells to delete. |

### 6.3.2.1.3 Output parameters

| Parameter Name | Support Qualifier | Matching Information / Information Type / Legal Values | Comment |
|---|---|---|---|
| status | M | ENUM (OperationSucceeded, OperationFailed) | The LC returns OperationSucceded if all requested changes have been executed by the LC.<br><br>Otherwise (e.g., in case of a missing parameter or of an unknown cellId), the LC returns OperationFailed. In that case, the LC has not modifed, added or deleted any LSACell. |

## 6.3.2.2   Operation `cellsConstraintsSatisfied` (M)

### 6.3.2.2.1   Definition

The NM invokes this operation to indicate to the LC that the constraints on cells parameters provided in the message `cellsConstraintsUpdate` are accepted and satisfied.

For each confirmed cell, the NM shall include a LSACellConstraints instance in the `cellsConstraintsUpdate` operation. After receiving a response to this operation with the status parameter set to OperationSucceeded, the NM is allowed to activate each confirmed cell.

NOTE 1:   The NM may invoke this operation multiple times to confirm constraints on different cells at different points in time.

NOTE 2:   The NM does not need to invoke this operation for cells on which the LC did not provide any constraint.

### 6.3.2.2.2   Input parameters

| Parameter Name | Support Qualifier | Information Type / Legal Values | Comment |
|---|---|---|---|
| cellsConstraints | M | LIST OF LSACellConstraints | This parameter contains a list of instances of the LSACellConstraints class. |

### 6.3.2.2.3   Output parameters

| Parameter Name | Support Qualifier | Matching Information / Information Type / Legal Values | Comment |
|---|---|---|---|
| status | M | ENUM (OperationSucceeded, OperationFailed) | The LC returns OperationSucceded if the operation was successfully handled.<br><br>Otherwise (e.g., in case of a missing parameter or of an unknown cellId), the LC returns OperationFailed. |

## 6.4   `OperationsInvokedByLC` Interface (M)

### 6.4.1   `OperationsInvokedByLC` Interface (M) for scenario 1

#### 6.4.1.1   Operation `getLSRAIConfirmation` (M)

The LC invokes this operation to get confirmation from the NM that configuration changes in the MFCN (if needed) have been applied according to previously received LSRAI.

| Referenced TS | Requirement label | Comment |
|---|---|---|
| 3GPP TS 28.301 [8] | REQ-LC-IRP-SC1-FUN-007 | |

##### 6.4.1.1.1   Input parameters

| Parameter Name | Support Qualifier | Information Type / Legal Values | Comment |
|---|---|---|---|
| | | | |

### 6.4.1.1.2    Output parameters

| Parameter Name | Support Qualifier | Matching Information / Information Type / Legal Values | Comment |
|---|---|---|---|
| `confirmedZoneList` | M | LIST OF `LSRAIContextNM.zoneId` | This parameter contains a list of `zoneId`'s with confirmed LSRAI. |

## 6.4.2    `OperationsInvokedByLC` Interface (M) for scenario 2

## 6.4.2.1    Operation `cellsConstraintsUpdate` (M)

### 6.4.2.1.1    Definition

The LC invokes this operation to provide the NM with constraints on parameters of cells operating on LSA frequencies.

The LC shall initiate a `cellsConstraintsUpdate` operation upon one of the following events:

- a change in LSA spectrum resource availability (e.g., LSRAI received from the LR), or

- a successful `cellUpdate` operation.

Following a successful `cellUpdate` operation, the LC shall provide constraints for all cells that were added or modified by the NM. In case the LC does not define any constraints on a given cell, the `LSACellConstraints` instance associated with this cell only includes the attribute `cellId`. This information enables the NM to know that this given cell can be activated.

If the parameter `maxLeadTime` is included in a given `LSACellConstraints` instance, the NM shall confirm that the constraints provided in this instance are satisfied within `maxLeadTime` seconds.

| Referenced TS | Requirement label | Comment |
|---|---|---|
| 3GPP TS 28.301 [7] | REQ-LC-IRP-SC1-FUN-005 | |

### 6.4.2.1.2    Input parameters

| Parameter Name | Support Qualifier | Information Type / Legal Values | Comment |
|---|---|---|---|
| `cellsConstraints` | M | LIST OF `LSACellConstraints` | This parameter contains a list of instances of the `LSACellConstraints` class. |

### 6.4.2.1.3    Output parameters

| Parameter Name | Support Qualifier | Matching Information / Information Type / Legal Values | Comment |
|---|---|---|---|
| `status` | M | ENUM (OperationSucceeded, OperationFailed) | The NM returns `OperationSucceded` if all requested changes have been executed by the NM.<br><br>Otherwise (e.g., in case of a missing parameter or an unknown `cellId`), the NM returns `OperationFailed`. In that case the NM has not modified any constraints. |

# 6.5 `NotificationsEmittedByNM` Interface (M)

## 6.5.1 `NotificationsEmittedByNM` Interface (M) for scenario 1

### 6.5.1.1 Notification `notifyLSRAIConfirmation` (M)

#### 6.5.1.1.1 Definition

The NM emits this notification to notify the LC that configuration changes in the MFCN (if needed) have been applied according to previously received LSRAI. Each notification can carry information about one or more confirmed zones. Information about a confirmed zone is sent only once in a notification. It is up to the implementation of the IRPAgent to decide how to group information about confirmed zones in notifications.

| Referenced TS | Requirement label | Comment |
|---|---|---|
| 3GPP TS 28.301 [7] | REQ-LC-IRP-SC1-FUN-007 | |

#### 6.5.1.1.2 Input parameters

| Parameter Name | Support Qualifiers | Matching Information / Information Type / Legal Values | Comment |
|---|---|---|---|
| confirmedZoneList | M | LIST OF LSRAIContextNM.zoneId | This parameter contains a list of zoneId's with confirmed LSRAI. |

## 6.5.2 `NotificationsEmittedByNM` Interface (M) for scenario 2

None.

# 6.6 `NotificationsEmittedByLC` Interface (M)

## 6.6.1 `NotificationsEmittedByLC` Interface (M) for scenario 1

### 6.6.1.1 Notification `notifyLCRegistration`

#### 6.6.1.1.1 Definition

The LC emits this notification to notify the NM about the completion of the registration of the LC with the LR.

| Referenced TS | Requirement label | Comment |
|---|---|---|
| 3GPP TS 28.301 [7] | REQ-LC-IRP-SC1-FUN-002 | |

#### 6.6.1.1.2 Input parameters

| Parameter Name | Support Qualifier | Matching Information / Information Type / Legal Values | Comment |
|---|---|---|---|
| licenseeId | M | LSRAIContextLC.licenseeId | Uniquely identifies the LSA Licensee |
| lCId | M | LSRAIContextLC.lCId | Uniquely identifies the LC |
| lRId | M | LSRAIContextLC.lRId | Uniquely identifies the LR |

## 6.6.1.2 Notification `notifyLCDeRegistration`

### 6.6.1.2.1 Definition

The LC emits this notification to notify the NM about the completion of the de-registration of the LC with the LR.

| Referenced TS | Requirement label | Comment |
|---|---|---|
| 3GPP TS 28.301 [7] | REQ-LC-IRP-SC1-FUN-004 | |

### 6.6.1.2.2 Input parameters

| Parameter Name | Support Qualifier | Matching Information / Information Type / Legal Values | Comment |
|---|---|---|---|
| licenseeId | M | LSRAIContextLC.licenseeId | Uniquely identifies the LSA Licensee |
| lCId | M | LSRAIContextLC.lCId | Uniquely identifies the LC |
| lRId | M | LSRAIContextLC.lRId | Uniquely identifies the LR |

## 6.6.1.3 Notification `notifyZoneCreation` (M)

### 6.6.1.3.1 Definition

The LC emits this notification to notify the NM about created `ZoneLC` instances. Each notification can carry information about one or more `ZoneLC` instances. Information about a created `ZoneLC` instance is sent only once in a notification. It is up to the implementation of the IRPAgent to decide how to group information about `Zone` instances in notifications.

| Referenced TS | Requirement label | Comment |
|---|---|---|
| 3GPP TS 28.301 [7] | REQ-LC-IRP-SC1-FUN-006 | |

### 6.6.1.3.2 Input parameters

| Parameter Name | Support Qualifier | Matching Information / Information Type / Legal Values | Comment |
|---|---|---|---|
| lSRAI | M | LIST OF `ZoneLC` instances | This parameter contains information about `Zone` instances that have been created. |

## 6.6.1.4 Notification `notifyZoneDeletion` (M)

### 6.6.1.4.1 Definition

The LC emits this notification to notify the NM about deleted `ZoneLC` instances. Each notification can carry information about one or more `Zone` instances. Information about a deleted `ZoneLC` instance is sent only once in a notification. It is up to the implementation of the IRPAgent to decide how to group information about `ZoneLC` instances in notifications.

| Referenced TS | Requirement label | Comment |
|---|---|---|
| 3GPP TS 28.301 [7] | REQ-LC-IRP-SC1-FUN-006 | |

6.6.1.4.2        Input parameters

| Parameter Name | Support Qualifier | Matching Information / Information Type / Legal Values | Comment |
|---|---|---|---|
| lSRAI | M | LIST OF ZoneLC instances | This parameter contains information about Zone instances that have been deleted. |

## 6.6.1.5        Notification notifyZoneModification (M)

### 6.6.1.5.1        Definition

The LC emits this notification to notify the NM about modified ZoneLC instances. Each notification can carry information about one or more Zone instances. Information about a modified ZoneLC instance is sent only once in a notification. It is up to the implementation of the IRPAgent to decide how to group information about ZoneLC instances in notifications.

| Referenced TS | Requirement label | Comment |
|---|---|---|
| 3GPP TS 28.301 [7] | REQ-LC-IRP-SC1-FUN-006 | |

### 6.6.1.5.2        Input parameters

| Parameter Name | Support Qualifier | Matching Information / Information Type / Legal Values | Comment |
|---|---|---|---|
| lSRAI | M | LIST OF ZoneLC instances | This parameter contains information about Zone instances that have been modified. |

## 6.6.2        NotificationsEmittedByLC Interface (M) for scenario 2

### 6.6.2.1        Notification notifyLCRegistration (M)

#### 6.6.2.1.1        Definition

The LC emits this notification to notify the NM about the completion of the registration of the LC with the LR.

| Referenced TS | Requirement label | Comment |
|---|---|---|
| 3GPP TS 28.301 [7] | REQ-LC-IRP-SC2-FUN-002 | |

#### 6.6.2.1.2        Input parameters

| Parameter Name | Support Qualifier | Matching Information / Information Type / Legal Values | Comment |
|---|---|---|---|
| licenseeId | M | licenseeId | Uniquely identifies the LSA Licensee |
| lCId | M | lCId | Uniquely identifies the LC |
| lRId | M | lRId | Uniquely identifies the LR |

### 6.6.2.2        Notification notifyLCDeRegistration (M)

#### 6.6.2.2.1        Definition

The LC emits this notification to notify the NM about the completion of the de-registration of the LC with the LR.

| Referenced TS | Requirement label | Comment |
|---|---|---|
| 3GPP TS 28.301 [7] | REQ-LC-IRP-SC2-FUN-004 | |

### 6.6.2.2.2 Input parameters

| Parameter Name | Support Qualifier | Matching Information / Information Type / Legal Values | Comment |
|---|---|---|---|
| licenseeId | M | licenseeId | Uniquely identifies the LSA Licensee |
| lCId | M | lCId | Uniquely identifies the LC |
| lRId | M | lRId | Uniquely identifies the LR |

# Annex A (informative): Change history

<table>
<tr><th colspan="8">Change history</th></tr>
<tr><th>Date</th><th>Meeting</th><th>TDoc</th><th>CR</th><th>Rev</th><th>Cat</th><th>Subject/Comment</th><th>New version</th></tr>
<tr><td>2017-06</td><td>SA#76</td><td>SP-170470</td><td></td><td></td><td></td><td>Presented for information and approval</td><td>1.0.0</td></tr>
<tr><td>2017-06</td><td>SA#76</td><td></td><td></td><td></td><td></td><td>Upgrade to change control version</td><td>14.0.0</td></tr>
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# History

| Document history | | |
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