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TECHNICAL SPECIFICATION

**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**

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Foreword

This Technical Specification (TS) has been produced by ETSI Technical Committee Reconfigurable Radio Systems (RRS).

Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the ETSI Drafting Rules (Verbal forms for the expression of provisions).

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1 Scope

The present document defines the application protocol on the LSA_1 interface, between LSA Controller (LC) and LSA Repository (LR) [i.2] (LSA_1 protocol), and the content of the LSA Spectrum Resource Availability Information (LSRAI) conveyed by this protocol. It is based on the System Requirements defined in ETSI TS 103 154 [i.1] and the System Architecture and High Level Procedures defined in ETSI TS 103 235 [i.2].

The present document supports the operation of mobile broadband service 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, as documented in ETSI TR 103 113 [i.3]. Application to other bands is not precluded and depends on future regulatory decisions.

2 References

2.1 Normative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

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The following referenced documents are necessary for the application of the present document.

Not applicable.

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NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

[i.1] ETSI TS 103 154: "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)".

[i.2] ETSI TS 103 235: "Reconfigurable Radio Systems (RRS); System architecture and high level procedures for operation of Licensed Shared Access (LSA) in the 2 300 MHz - 2 400 MHz band".

[i.3] 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".

[i.4] ECC Report 205 (February 2014): "Licensed Shared Access (LSA)".

[i.5] CEPT Report 58 (July 2015): "Technical sharing solutions for the shared use of the 2300-2400 MHz band for WBB and PMSE".

3   Definitions and abbreviations

3.1   Definitions

For the purposes of the present document, the following terms and definitions apply:

idle zone: zone which has been defined but which is not currently operational

LSA Licensee: entity operating a MFCN, which holds individual rights of use to an LSA spectrum resource

LSA spectrum resource: spectrum resource which is to be shared between an Incumbent and a LSA Licensee on a static or dynamic basis according to the Sharing Framework defined by the Administration/NRA

LSA spectrum resource availability information: information provided to a Licensee, which conveys the LSA spectrum resource that may be used by the Licensee, and the respective operational conditions or restrictions

LSRAI context: set of zones and their parameters that are to be maintained by the nodes (LC and LR) in an instance of the LSA_1 interface

LSRAI synchronization process: process to synchronize the LSRAI context between LC and LR

operational zone: zone to be taken into account by the Licensee, when making use of the LSA spectrum resource

sharing arrangement: set of practical details for sharing an LSA spectrum resource

sharing framework: set of sharing rules or sharing conditions that will materialize the change, if any, in the spectrum rights of the Incumbent(s) and define the spectrum, with corresponding technical and operational conditions, that can be made available for alternative usage under LSA

spectrum resource: resource or set of resources defined in time, space and frequency domains

3.2   Abbreviations

For the purposes of the present document, the following abbreviations apply:

ACLR	Adjacent Channel Leakage power Ratio
ACS	Adjacent Channel Selectivity
ECC	Electronic Communications Committee of the CEPT
EIRP	Equivalent Isotopic Radiated Power
IE	Information Element
LC	LSA Controller
LR	LSA Repository
LSA	Licensed Shared Access
LSRAI	LSA Spectrum Resource Availability Information
MFCN	Mobile/Fixed Communications Network
NRA	National Regulatory Authority
PMSE	Program Making and Special Events
RF	Radio Frequency
UTC	Co-ordinated Universal Time

4   LSA Spectrum Resource Availability Information: Description and Supported Functionality on LSA_1

4.1   Introduction

Clause 4 contains a high level description of the LSA Spectrum Resource Availability Information (LSRAI), and LSRAI-related functionality supported by the nodes (LC and LR), and the interface (LSA_1). This clause expands the related material in the stage 2 specification of ETSI TS 103 235 [i.2], and describes detailed requirements for the LSA_1 protocol and its operation.

4.2   LSRAI Scope

LSA Spectrum Resource Availability Information (LSRAI) is information provided to a LSA Licensee, which conveys information on the LSA spectrum resource that may be used by the LSA Licensee. As described in ETSI TS 103 235 [i.2], LSRAI is generated in the LR, and sent to the LC over the LSA1 interface, using LSA_1 protocol messages.

Under LSA operation ECC Report 205 [i.4], it is assumed that the terms of a license will contain a description of the spectrum resource which is allocated to the respective LSA Licensee, and therefore such information is not required to be conveyed over LSA_1 as part of LSRAI. LSRAI therefore includes any additional operational conditions or restrictions that the Licensee shall apply, and which may be subject to change.

NOTE: It is a deployment choice whether permanent restrictions contained in the sharing framework or sharing arrangement, ETSI TS 103 154 [i.1], are conveyed to the LC as part of LSRAI.

The conditions or restrictions within LSRAI may apply to the licensed spectrum resource, or to a subset (described in frequency, space, time or a combination of these).

4.3   LSRAI Definition

LSRAI has the following characteristics:

- It contains one or more *Zones*. A *Zone* is an information object which describes a set of operational conditions or restrictions to be applied by the LSA Licensee.

- A *Zone* has a *Zone Type* associated to it (e.g. restriction, protection, exclusion).

- A *Zone* contains space, frequency, radio and time parameters:

    - Space parameters describing the geographical area to which the restriction applies.

    - Frequency parameters describing the frequency range to which the restriction applies.

    - Time parameters describing when the restriction applies.

    - Radio parameters describing the RF restrictions to be applied within the space/frequency/time combination defined by the above parameters.

- A *Zone* has a *Zone ID* and a *Zone Configuration Index* associated to it.

NOTE: When LSRAI is conveyed over the LSA_1 interface, each *Zone* is associated to a *Zone Action*.

4.4 LSRAI Handling Functionality

4.4.1 Introduction

As described in ETSI TS 103 235 [i.2], the LSA Information Exchange Function supports communication mechanisms to exchange LSRAI and related acknowledgement information between LR and LC. Clauses 4.4.2 and 4.4.3 further specify the related functional split between LR and LC in support of this high level function.

4.4.2 LR Support

The LR supports the LSA Information Exchange Function by:

- Constructing zone information including type and parameters for each Zone.

- Assigning a *Zone ID*, which uniquely identifies a Zone over all instances of the LSA_1 interface for a given LR.

- Assigning a *Zone Configuration Index*, which uniquely identifies the particular configuration (set of zone parameters).

- Conveying the zone information towards concerned LCs.

- Monitoring the status of LSRAI conveyed to the LC (e.g. per-zone acknowledgment and confirmation).

- Conveying a modification of Zone parameters towards the LC (with corresponding *Zone Configuration Index*).

- Conveying deletion of a Zone towards the LC.

- Synchronizing LSRAI with the LC.

4.4.3 LC Support

The LC supports the LSA Information Exchange Function by:

- Receiving and acknowledging LSRAI (including checking of parameters).

- Confirming LSRAI.

- Synchronizing LSRAI with the LR.

4.5 LSRAI Context

The LSRAI Context is the complete set of zones and their parameters that are to be maintained by the nodes (LC and LR) in an instance of the LSA_1 interface. The LR determines the LSRAI Context and informs the LC of any changes in the Context due to creation, modification or deletion of zones.

When receiving zone information, the LC shall consider that:

- a zone with a *Zone Action* set to "Create" is to be added to the LSRAI Context (including its parameters);

- a zone with a *Zone Action* set to "Modify" is to be kept in the LSRAI Context (including modified parameter set);

- a zone with a *Zone Action* set to "Delete" is to be removed from the LSRAI Context.

There is no relationship between the current status of a zone (idle/operational), and whether the zone is part of the LSRAI Context. The LSRAI Context may therefore include both idle and operational zones at any moment in time.

NOTE: The LR may define a zone in such a way that it is idle (at the time that it is conveyed to the LC), and has no future idle-operational transition. During operation of the LSA_1 interface, the LR may modify the time parameters of the zone such that it will trigger an idle-operational transition at any desired point in time.

4.6   LSRAI Synchronization

As described in ETSI TS 103 235 [i.2], see e.g. clause 5.6.4, the LSA Information Exchange Function supports means for maintaining and restoring LSRAI Synchronization between LR and LC.

In the present document, LSRAI Synchronization is the process by which it is ensured that the LR provides the LSRAI context to the LC. An LSRAI Synchronization process may be triggered by either LC or LR. The provision of the LSRAI Context towards the LC uses the LR-initiated LSRAI Notification procedure (clause 6.5). The LSRAI Context may optionally be segmented over two or more instances of this procedure.

All procedures that are part of an LSRAI Synchronization process shall be identified by a specific synchronization process identity.

An LSRAI Synchronization process may be used to reset the LSRAI Context at the LC. In the case of LSRAI Synchronization with context reset, the LC shall immediately replace the LSRAI Context with the newly received context, and shall consider that all zones in the LSRAI Context require confirmation [i.2]. If no context reset is requested by the LR, the LC:

- shall use the information received to update the local LSRAI Context at the LC;

- shall consider that any existing zones not included in the received LSRAI Context are implicitly deleted;

- shall consider that confirmations are required for new or modified zones.

Once an LSRAI Synchronization process is initiated, any existing LSRAI-handling procedures shall be considered terminated. A node receiving an initiating message for a LSRAI-handling procedure while an LSRAI Synchronization process is ongoing shall fail such procedure with an appropriate cause e.g. "Synchronization ongoing", except if the new procedure indicates the initiation of a new LSRAI Synchronization process. In this case, the old LSRAI Synchronization process shall be considered to have been unsuccessfully terminated.

4.7   LSRAI Confirmation

As described in ETSI TS 103 235 [i.2], the LSA Information Exchange Function supports means for the LC to notify the LR once the necessary configuration changes in the MFCN have been applied according to the received LSRAI. This process is known as LSRAI Confirmation.

The LC shall explicitly provide confirmation for each zone within the LSRAI Context. Each zone shall be confirmed at least once. If the configuration of an existing zone is modified, the LC shall consider that a further confirmation is required for the zone (regardless of whether it had been previously confirmed, and regardless of the modification details). In order to identify the configuration that is confirmed, the LC shall include both the Zone ID and the Zone Configuration Index within the confirmation signalling.

If the LC receives a new or modified zone whose time configuration is such that the zone is operational at the time of reception, the LC shall consider that configurations changes shall be applied, if needed, and the corresponding confirmation shall be sent to the LR.

In the case of a zone whose time configuration includes multiple operational periods (i.e. scheduled or periodic zones), the LC shall provide confirmation at least once (in connection with its first operational period), and shall also provide confirmation after any modification (in connection with the first subsequent operational period after the modification is received by the LC). The LC is not required to provide confirmation for each idle-operational transition.

Confirmation may also be used by the LC to inform the LR that the configuration changes cannot be implemented ("negative confirmation").

NOTE: Confirmation messages may be sent by the LC more than once for a given combination of *Zone ID* and *Zone Configuration Index* (e.g. in the case of scheduled or periodic zones, an initial positive confirmation is sent by the LC; later the MFCN is not able to comply with a subsequent operational period, and a negative confirmation is sent). In all cases, the confirmation status of the last received message overwrites any previously received information.

For a particular zone, the time when the respective confirmation is sent depends on the timing of the required idle-operational transition for the zone, the timing of the change of configuration, and any associated requirements specific to the Sharing Framework or Sharing Arrangement.

Protocol confirmation messages support simultaneous confirmation of multiple zones. The multiplexing of zone confirmations is independent of the multiplexing of zones (and respective information) as previously sent by the LR towards the LC.

4.8 LC Handling of non-impacting Zones

The LC may receive a zone configuration such that the LC has identified that no MFCN resource is impacted by the zone. The LC shall however consider that the zone (and its information) forms part of the LSRAI Context.

The LC shall also act as if the necessary configuration changes have been applied, by sending an associated confirmation for any such zone towards the LR.

5 LSA$_1$ Protocol Principles

5.1 Specification Notation

For the purposes of the present document, the following notations apply:

Procedure   When referring to an elementary procedure in the specification the Procedure Name is written with the first letters in each word in upper case characters followed by the word "procedure", e.g. LSRAI Notification procedure.

Message   When referring to a message in the specification the MESSAGE NAME is written with all letters in upper case characters followed by the word "message", e.g. LSRAI NOTIFICATION ACK message.

IE   When referring to an information element (IE) in the specification the Information Element Name is written with the first letters in each word in upper case characters and all letters in Italic font followed by the abbreviation "IE", e.g. *Space* IE.

Value of an IE   When referring to the value of an information element (IE) in the specification, the value is written enclosed by quotation marks, e.g. "Value".

5.2 LSA$_1$ Protocol Procedures

The LSA$_1$ protocol procedures are classified in the following categories:

1)   LSRAI handling Procedures

2)   Interface management procedures

The LSRAI handling procedures are those procedures whose primary function is to convey LSRAI, or to exchange information directly related to the provision of LSRAI (e.g. confirmations).

The interface management procedures are those procedures whose primary function is to set up, maintain or discontinue an LSA$_1$ interface instance.

Tables 5.2-1 and 5.2-2 show the procedures and messages for each category:

Table 5.2-1: LSRAI Handling Procedures

LSA$_1$ Protocol Procedure	Initiating Message	Response Message
LSRAI Notification	LSRAI NOTIFICATION	LSRAI NOTIFICATION ACK
LSRAI Request	LSRAI REQUEST	LSRAI RESPONSE
LSRAI Confirmation	LSRAI CONFIRMATION REQUEST	LSRAI CONFIRMATION RESPONSE

Table 5.2-2: Interface Management Procedures

LSA$_1$ Protocol Procedure	Initiating Message	Response Message
Registration	REGISTRATION REQUEST	REGISTRATION RESPONSE
Deregistration	DEREGISTRATION REQUEST	DEREGISTRATION RESPONSE
Connectivity Check Notification	CONNECTIVITY CHECK NOTIFICATION	CONNECTIVITY CHECK NOTIFICATION ACK
Connectivity Check Request	CONNECTIVITY CHECK REQUEST	CONNECTIVITY CHECK RESPONSE

5.3   Identification of procedures and messages

Each message defined in the LSA$_1$ protocol (as listed in the tables of clause 5.2) includes a specific *Message Type* IE, allowing the receiver to identify the general procedure and message.

Each procedure instance is identified by a *Transaction ID* IE, which is mandatory in all messages of the LSA$_1$ protocol. The value of this IE is set by the node that initiates the procedure, and the same value shall be used by the responding node in the response message. The initiating node shall not assign this value to a new procedure during the period of execution of the original procedure.

5.4   Procedure Outcome

The node that receives the initiating message shall process the message and its IEs according to the requirements in clauses 6 and 7, and shall include in the response message an indication of whether it considers the procedure to be successful or unsuccessful.

The node that initiates the procedure shall also consider the procedure to be unsuccessful if it receives an unsuccessful indication from the receiver node, and in addition it may consider the procedure to be unsuccessful according to criteria such as:

- lack of response message after an implementation-dependent timer;

- response message indicates success, but IEs in the response message contain errors or are inconsistent with successful processing.

Subsequent to a procedure failure, the action from the initiating node is generally implementation dependent, except where specified in the present document or in ETSI TS 103 235 [i.2].

5.5   Principles for Protocol Development and Version Interworking

The LSA$_1$ protocol may be further developed in future specifications. Each new version will be distinguished by a version number. Protocol versions shall be sequentially numbered starting with V1 defined in the present document.

Table 5.5-1 provides the relationship between versions and specifications.

Table 5.5-1: Relationship between LSA$_1$ protocol versions and respective ETSI specifications

Version Number	ETSI Specification
Version 1	ETSI TS 103 379 (V1.1.1)

Backward compatibility between protocol versions shall not be guaranteed. A protocol peer supporting Version N of the protocol may (but is not mandated to) support lower numbered versions of the protocol (N-1, N-2, etc.). Interworking between protocol peers is based on explicitly negotiating the protocol version to be used in the specific LSA$_1$ instance. This negotiation takes place during the Registration procedure. During this procedure:

- The LC provides a list of supported versions in the initial REGISTRATION REQUEST message.

- The LR responds with the version to be used thereafter, selected from the list provided by the LC.

In order to enable that implementations provide support to multiple protocol versions, the following principles shall be applied concerning the development of the LSA_1 protocol:

- All messages in a particular protocol version shall be present in a higher numbered protocol version.

- All IEs in a particular message of a particular protocol version shall be present in the same message in a higher numbered protocol version.

5.6 Message Encoding and IE attributes

The message encoding is not specified in the present document.

Definitions of the messages and respective information elements are provided including presence, type and range for each IE, in order to enable translation into any particular encoding format.

For example:

1) The presence of the IE in a message is defined as either mandatory (M), optional (O) or conditional (C). In the latter case, a condition is provided (e.g., "if the procedure is successful").

2) The type of IEs include standard types used in abstract notation such as INTEGER and ENUMERATED.

5.7 Overview of the protocol specification

Clauses 6 and 7 provide the detailed specification of the LSA_1 protocol, as follows.

Clause 6 documents for each procedure:

1) The format of each message in the procedure, including:

   a) List of IEs in each message.

   b) Presence of the IE in the message.

   c) Type of the IE and range (if applicable).

   d) Description of the IE.

2) The behaviour of the nodes with respect to transmission and reception of the respective messages, and in relation to the values or presence of specific IEs (including conditions under which procedures are to be considered successful or unsuccessful).

Clause 7 provides a detailed tabular representation of IEs.

6 LSA_1 Protocol: Procedures and Messages

6.1 Registration procedure

6.1.1 General

The purpose of the Registration procedure is to register an LC with an LR. This is the first procedure executed on the LSA_1 interface. After successful completion of this procedure, the LC is able to initiate requests or receive notifications concerning LSRAI.
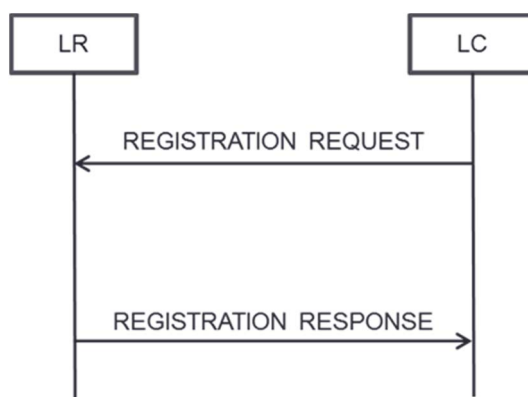
Figure 6.1-1: Registration Procedure

The LC initiates the procedure by sending a REGISTRATION REQUEST message. Upon receiving the REGISTRATION REQUEST message, the LR checks the message contents. If the message check is successful and the LR decides to accept the registration, it shall answer with a REGISTRATION RESPONSE message indicating successful registration, otherwise it shall answer with a REGISTRATION RESPONSE message indicating registration failure. In case of successful registration, the REGISTRATION RESPONSE message shall also include an indication of whether the initial LSRAI is sent via notification by LR or triggered by request from LC.

The LR shall fail the registration and include an appropriate cause in the response message if:

- either the *Licensee ID* or *LR ID* (if included) in the REGISTRATION REQUEST message are incorrect or unknown; or

- none of the versions provided by the LC in the *Protocol Version List* IE is supported by the LR.

Upon successful registration, the LR and LC shall store the information received from the peer node and shall consider the LSA_1 interface to be operational.

6.1.2 REGISTRATION REQUEST

This message is sent by the LC in order to request registration from the LR.

The parameter list contained in the message is as follows.

Table 6.1-1

Name	Presence	Type or reference	Description
Message Type	M	7.30	Identifies the message type (procedure code, initiating message).
Transaction ID	M	7.31	Uniquely identifies the transaction (shall be unique for all ongoing procedures initiated by LC, or LR, in a particular instance of the LSA_1).
LC ID	M	7.33	Uniquely identifies the LC.
Licensee ID	M	7.34	Uniquely identifies the LSA Licensee.
LR ID	O	7.32	Uniquely identifies the LR.
Protocol Version List	M	7.41	Indicates the protocol versions supported by the LC.

6.1.3 REGISTRATION RESPONSE

This message is sent by the LR in order to respond to a REGISTRATION REQUEST message from the LC.

The parameter list contained in the message is as follows.

Table 6.1-2

Name	Presence	Type or reference	Description
Message Type	M	7.30	Identifies the message type (procedure code, response message).
Transaction ID	M	7.31	Uniquely identifies the transaction (shall be unique for all ongoing procedures initiated by LC, or LR, in a particular instance of the LSA$_1$).
LC ID	M	7.33	Uniquely identifies the LC.
LR ID	M	7.32	Uniquely identifies the LR.
Result	M	7.35	Indicates success or failure of the registration request.
Initial LSRAI Indicator	C (if Result indicates success)	ENUMERATED (LR-initiated, LC-initiated)	Indicates whether the initial LSRAI is sent via notification by LR or triggered by request from LC.
Protocol version	C (if Result indicates success)	7.42	Indicates the protocol version selected by the LR; it shall be one of the versions proposed in the REGISTRATION REQUEST message.
Cause	O	7.39	Indicates cause of registration failure.

6.2 Deregistration procedure

6.2.1 General

The purpose of the Deregistration procedure is to allow the LC to deregister with the LR. After successful completion of this procedure, the LC and LR shall consider that connectivity is no longer available and no new procedures shall be initiated by either node (except for a new Registration procedure).
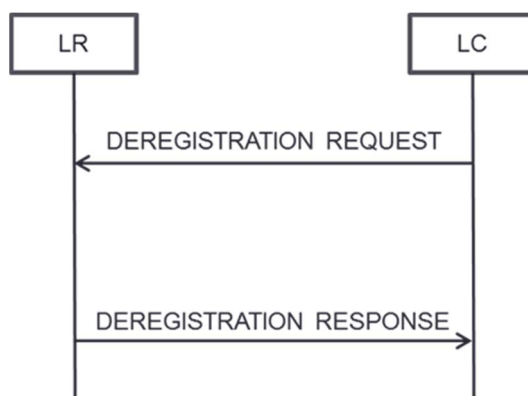
Figure 6.2-1: Deregistration Procedure

The LC initiates the procedure by sending a DEREGISTRATION REQUEST message, optionally including a cause value. Upon receiving the DEREGISTRATION REQUEST message, the LR checks the message contents. If the message check is successful, the LR shall accept the request and send a DEREGISTRATION RESPONSE message to the LC indicating successful deregistration, otherwise it shall answer with a DEREGISTRATION RESPONSE message indicating deregistration failure.

Upon successful deregistration, the LR and LC shall consider that the LSA$_1$ interface is no longer operational, and:

- The LR shall remove the LC from the list of registered LCs.

- The LC shall consider that stored LSRAI (previously received from the LR) is not valid.

NOTE: Depending on agreements within the Sharing Arrangement between Incumbent and LSA Licensee, the LC may fall back to a pre-determined operational mode after deregistration is complete. The examples of fall-back measures after failure, given in annex D of ETSI TS 103 235 [i.2], may also be applicable after deregistration.

6.2.2 DEREGISTRATION REQUEST

This message is sent by the LC in order to request deregistration from the LR.

The parameter list contained in the message is as follows.

Table 6.2-1

Name	Presence	Type or reference	Description
Message Type	M	7.30	Identifies the message type (procedure code, initiating message).
Transaction ID	M	7.31	Uniquely identifies the transaction (shall be unique for all ongoing procedures initiated by LC, or LR, in a particular instance of the LSA_1).
LC ID	M	7.33	Uniquely identifies the LC.
LR ID	M	7.32	Uniquely identifies the LR.
Cause	O	7.39	Provides information on cause of request.

6.2.3 DEREGISTRATION RESPONSE

This message is sent by the LR in order to respond to a DEREGISTRATION REQUEST message from the LC.

The parameter list contained in the message is as follows.

Table 6.2-2

Name	Presence	Type or reference	Description
Message Type	M	7.30	Identifies the message type (procedure code, response message).
Transaction ID	M	7.31	Uniquely identifies the transaction (shall be unique for all ongoing procedures initiated by LC, or LR, in a particular instance of the LSA_1).
LC ID	M	7.33	Uniquely identifies the LC.
LR ID	M	7.32	Uniquely identifies the LR.
Result	M	7.35	Indicates success or failure of the deregistration request.
Cause	O	7.39	Indicates cause of deregistration failure.

6.3 Connectivity Check Notification procedure

6.3.1 General

The purpose of the Connectivity Check Notification procedure is to enable the LR to test the connectivity with a registered LC.
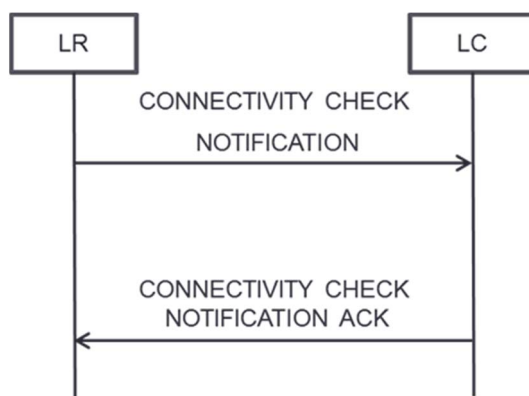
Figure 6.3-1: Connectivity Check Notification Procedure

The LR initiates the procedure by sending a CONNECTIVITY CHECK NOTIFICATION message to the LC.

Upon receiving the CONNECTIVITY CHECK NOTIFICATION message, the LC checks the message contents. The LC shall fail the Connectivity Check Notification procedure if either the *LC ID* or *LR ID* IEs in the CONNECTIVITY CHECK NOTIFICATION message are incorrect or unknown, and shall answer with a CONNECTIVITY CHECK NOTIFICATION ACK message indicating unsuccessful reception.

If the message includes the *Sync Zone List* IE, the LC shall compare the contents of this IE to the locally stored LSRAI context. If the IE matches the local context, and the message check is successful, the LC shall answer with a CONNECTIVITY CHECK NOTIFICATION ACK message indicating successful reception of the message, otherwise it shall answer with a CONNECTIVITY CHECK NOTIFICATION ACK message indicating unsuccessful reception, and including an appropriate cause value.

6.3.2 CONNECTIVITY CHECK NOTIFICATION

This message is sent by the LR in order to initiate a connectivity check with the LC.

The parameter list contained in the message is as follows.

Table 6.3-1

Name	Presence	Type or reference	Description
Message Type	M	7.30	Identifies the message type (procedure code, initiating message).
Transaction ID	M	7.31	Uniquely identifies the transaction (shall be unique for all ongoing procedures initiated by LC, or LR, in a particular instance of the LSA_1).
LC ID	M	7.33	Uniquely identifies the LC.
LR ID	M	7.32	Uniquely identifies the LR.
Sync Zone List	O	7.37	Full list of zones in the LR's LSRAI Context.
Cause	O	7.39	Indicates cause of connectivity check.

6.3.3 CONNECTIVITY CHECK NOTIFICATION ACK

This message is sent by the LC in order to respond to a CONNECTIVITY CHECK NOTIFICATION message from the LR.

The parameter list contained in the message is as follows.

Table 6.3-2

Name	Presence	Type or reference	Description
Message Type	M	7.30	Identifies the message type (procedure code, response message).
Transaction ID	M	7.31	Uniquely identifies the transaction (shall be unique for all ongoing procedures initiated by LC, or LR, in a particular instance of the LSA_1).
LC ID	M	7.33	Uniquely identifies the LC.
LR ID	M	7.32	Uniquely identifies the LR.
Result	M	7.35	Indicates success or failure of the connectivity request.
Cause	O	7.39	Indicates cause of connectivity failure.

6.4 Connectivity Check Request procedure

6.4.1 General

The purpose of the Connectivity Check Request procedure is to enable the LC to test the connectivity with the LR with which it is registered.
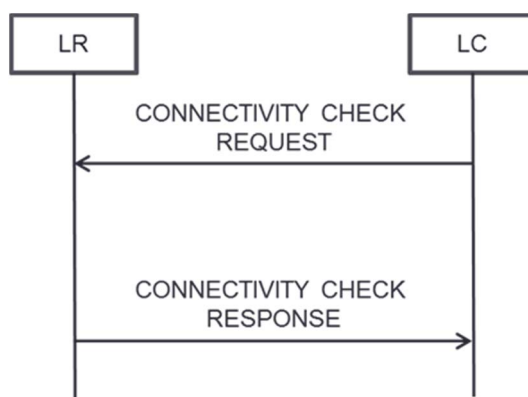
Figure 6.4-1: Connectivity Check Request Procedure

The LC initiates the procedure by sending a CONNECTIVITY CHECK REQUEST message to the LR. The LR shall fail the Connectivity Check Request procedure if either the *LC ID* or *LR ID* IEs in the CONNECTIVITY CHECK REQUEST message are incorrect or unknown, and shall answer with a CONNECTIVITY CHECK RESPONSE message indicating unsuccessful reception.

If the message includes the *Sync Zone List* IE, the LR shall compare the contents of this IE to the locally stored LSRAI context. If the IE matches the local context and the message check is successful, the LR shall answer with a CONNECTIVITY CHECK RESPONSE message indicating successful reception of the message, otherwise it shall answer with a CONNECTIVITY CHECK RESPONSE message indicating unsuccessful reception, and including an appropriate cause value.

6.4.2   CONNECTIVITY CHECK REQUEST

This message is sent by the LC in order to initiate a connectivity check with the LR.

The parameter list contained in the message is as follows.

Table 6.4-1

Name	Presence	Type or reference	Description
Message Type	M	7.30	Identifies the message type (procedure code, initiating message).
Transaction ID	M	7.31	Uniquely identifies the transaction (shall be unique for all ongoing procedures initiated by LC, or LR, in a particular instance of the LSA_1).
LC ID	M	7.33	Uniquely identifies the LC.
LR ID	M	7.32	Uniquely identifies the LR.
Sync Zone List	O	7.37	Full list of zones in the LC's LSRAI Context.
Cause	O	7.39	Indicates cause of connectivity check request.

6.4.3   CONNECTIVITY CHECK RESPONSE

This message is sent by the LR in order to respond to a CONNECTIVITY CHECK REQUEST message from the LC.

The parameter list contained in the message is as follows.

Table 6.4-2

Name	Presence	Type or reference	Description
Message Type	M	7.30	Identifies the message type (procedure code, response message).
Transaction ID	M	7.31	Uniquely identifies the transaction (shall be unique for all ongoing procedures initiated by LC, or LR, in a particular instance of the LSA_1).
LC ID	M	7.33	Uniquely identifies the LC.
LR ID	M	7.32	Uniquely identifies the LR.
Result	M	7.35	Indicates success or failure of the connectivity request.
Cause	O	7.39	Indicates cause of connectivity failure.

6.5 LSRAI Notification procedure

6.5.1 General

The purpose of the LSRAI Notification procedure is to enable the LR to convey LSRAI to the LC.
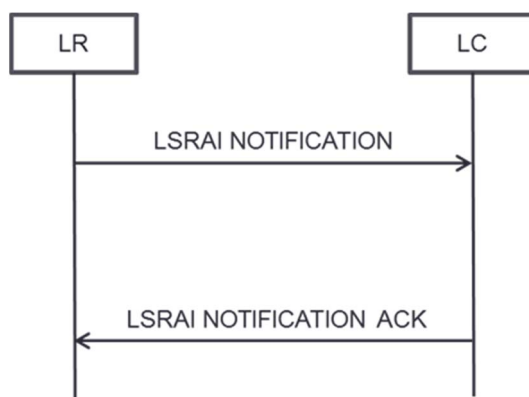
Figure 6.5-1: LSRAI Notification Procedure

The LR initiates the procedure by sending a LSRAI NOTIFICATION message to the LC.

Upon receiving the LSRAI NOTIFICATION message, the LC shall check the contents of the message, store the received LSRAI, and send a LSRAI NOTIFICATION ACK message indicating successful reception of the message including the LSRAI; otherwise it shall ignore the received LSRAI and answer with a LSRAI NOTIFICATION ACK message indicating unsuccessful reception.

The LC shall fail the LSRAI Notification procedure if either the *LC ID* or *LR ID* IEs in the LSRAI NOTIFICATION message are incorrect or unknown, or if any of the zone definitions in the *LSRAI* IE is invalid or cannot be understood by the LC.

The LC shall process the zone definitions irrespective of whether or not it controls resources impacted by the corresponding zones.

If the *Synchronization Information* IE is included in the LSRAI NOTIFICATION message, the LC shall:

- ignore the *Zone Action* IE contained in the *LSRAI* IE;

- use the LSRAI included to construct the LSRAI context, together with LSRAI received in other messages/procedures, if applicable; and

- provide the corresponding *Synchronization Ack Information* IE in the LSRAI NOTIFICATION ACK message.

If the *Reset Indicator* IE is included in the *Synchronization Information* IE, the LC shall replace the existing LSRAI context with the newly received one, and assume that all zones in the LSRAI context require confirmation.

6.5.2   LSRAI NOTIFICATION

This message is sent by the LR in order to convey LSRAI to the LC.

The parameter list contained in the message is as follows.

Table 6.5-1

Name	Presence	Type or reference	Description
Message Type	M	7.30	Identifies the message type (procedure code, initiating message).
Transaction ID	M	7.31	Uniquely identifies the transaction (shall be unique for all ongoing procedures initiated by LC, or LR, in a particular instance of the LSA_1).
LC ID	M	7.33	Uniquely identifies the LC.
LR ID	M	7.32	Uniquely identifies the LR.
LSRAI	M	7.1	Identifies the LSRAI information element.

6.5.3   LSRAI NOTIFICATION ACK

This message is sent by the LC in order to respond to a LSRAI NOTIFICATION message from the LR.

The parameter list contained in the message is as follows.

Table 6.5-2

Name	Presence	Type or reference	Description
Message Type	M	7.30	Identifies the message type (procedure code, response message).
Transaction ID	M	7.31	Uniquely identifies the transaction (shall be unique for all ongoing procedures initiated by LC, or LR, in a particular instance of the LSA_1).
LC ID	M	7.33	Uniquely identifies the LC.
LR ID	M	7.32	Uniquely identifies the LR.
Result	M	7.35	Indicates success or failure of the notification.
Cause	C (if notification result indicates failure)	7.39	Indicates cause of LSRAI notification failure (e.g. "unknown or incorrect LR", "unknown or incorrect LC", "Incomplete zone parameters", etc.).
Synchronization Ack Information	O	7.10	Provides acknowledgment information related to the ongoing synchronization process.

6.6   LSRAI Request procedure

6.6.1   General

The purpose of the LSRAI Request procedure is to enable the LC to request the LR to convey LSRAI.
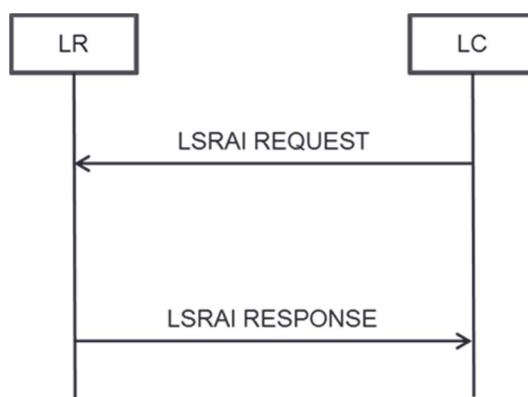
Figure 6.6-1: LSRAI Request procedure

The LC initiates the procedure by sending a LSRAI REQUEST message to the LR.

Upon receiving the LSRAI REQUEST message, the LR shall check the contents of the message. The LR shall fail the LSRAI Request procedure if either the *LC ID* or *LR ID* IEs in the LSRAI REQUEST message are incorrect or unknown.

If the *Request Type* IE is set to "Full Synchronization" or "Full Synchronization with Reset", the LR shall send a LSRAI RESPONSE message to the LC, and shall not include the *LSRAI* IE in this message. The LR should subsequently initiate a number N of LSRAI Notification procedures to convey the LSRAI Context (where N $\geq$ 1).

    NOTE: It is up to the LR whether to perform such segmentation.

If the *Request Type* IE is set to "Delta LSRAI", the LR proceeds according to clause 5.6.5 of ETSI TS 103 235 [i.2], and in particular, it shall send a LSRAI RESPONSE message to the LC, optionally including either the *Response Indicator* IE or the *LSRAI* IE. If the *LSRAI* IE is included, the LC shall update the LSRAI context accordingly. If the *Response Indicator* IE is included in the response message and set to "LR-initiated transmission", the LC shall be prepared to receive LSRAI in future LR-initiated procedure(s). If neither the *LSRAI* IE nor the *Response Indicator* IE are included in the response message, the LC shall consider that no update of the LSRAI context is necessary.

6.6.2   LSRAI REQUEST

This message is sent by the LC in order to request LSRAI from the LR.

The parameter list contained in the message is as follows.

Table 6.6-1

Name	Presence	Type or reference	Description
Message Type	M	7.30	Identifies the message type (procedure code, initiating message).
Transaction ID	M	7.31	Uniquely identifies the transaction (shall be unique for all ongoing procedures initiated by LC, or LR, in a particular instance of the LSA$_1$).
LC ID	M	7.33	Uniquely identifies the LC.
LR ID	M	7.32	Uniquely identifies the LR.
Request Type	M	ENUMERATED (Full Synchronization, Full Synchronization with Reset, Delta LSRAI)	The type of request. "Full Synchronization" is a request for the LSRAI context. "Full Synchronization with Reset" is a request for the LSRAI context which shall erase the existing context and trigger confirmations of all zones. "Delta LSRAI" is a request for zones (or zone configurations) that have not been sent (or successfully sent) to the LC.

6.6.3 LSRAI RESPONSE

This message is sent by the LR in order to respond to a LSRAI REQUEST message from the LC.

The parameter list contained in the message is as follows.

Table 6.6-2

Name	Presence	Type or reference	Description
Message Type	M	7.30	Identifies the message type (procedure code, response message).
Transaction ID	M	7.31	Uniquely identifies the transaction (shall be unique for all ongoing procedures initiated by LC, or LR, in a particular instance of the LSA_1).
LC ID	M	7.33	Uniquely identifies the LC.
LR ID	M	7.32	Uniquely identifies the LR.
Result	M	7.35	Indicates success or failure of the notification.
Cause	C (if request result indicates failure)	7.39	Indicates cause of LSRAI Request failure (e.g. "unknown or incorrect LR", "unknown or incorrect LC", "synchronization process ongoing", etc.).
LSRAI	O	7.1	Identifies the LSRAI information element. This IE shall not be included if the Request Type IE is set to "Full Synchronization" or "Full Synchronization with Reset", or if the Response Indicator IE is included in the LSRAI RESPONSE message.
Response Indicator	O	ENUMERATED (LR-initiated transmission)	The IE indicates whether the LR will initiate a LSRAI Notification procedure(s) for LSRAI transmission. This IE shall not be included if the Request Type IE is set to "Full Synchronization" or to "Full Synchronization with Reset", or if the LSRAI IE is included in the LSRAI RESPONSE message.

6.7 LSRAI Confirmation procedure

6.7.1 General

The purpose of the LSRAI Confirmation procedure is to enable the LC to notify the LR that configuration changes in the MFCN (if needed) have been applied according to previously received LSRAI.
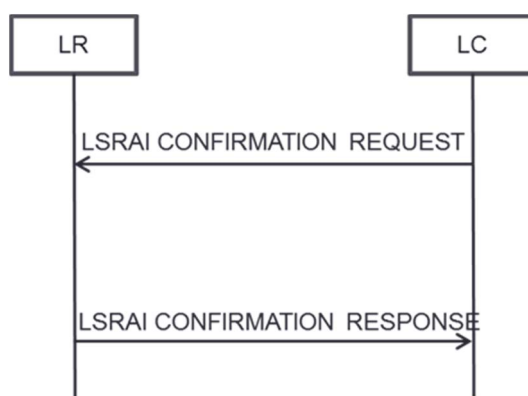
Figure 6.7-1: LSRAI Confirmation Procedure

The LC initiates the procedure by sending a LSRAI CONFIRMATION REQUEST message to the LR. The message shall include a list of Zone Identities corresponding to the zones that are being confirmed, and including, for each zone, the respective Zone Configuration Index.

NOTE: Successful confirmation by the LC implies that each of the identified Zones is being complied with by the LC, and any MFCN resources associated with the LC.

Upon receiving the LSRAI CONFIRMATION REQUEST message, the LR shall check the contents of the message, store the received confirmations, and send a LSRAI CONFIRMATION RESPONSE message indicating successful reception of the message, including the confirmation information; otherwise it shall answer with a LSRAI CONFIRMATION RESPONSE message indicating unsuccessful reception.

The LR shall fail the LSRAI Confirmation procedure if either the *LC ID* or *LR ID* IEs in the LSRAI CONFIRMATION REQUEST message are incorrect or unknown, or the LR detects inconsistencies in the LSRAI CONFIRMATION REQUEST message.

6.7.2   LSRAI CONFIRMATION REQUEST

This message is sent by the LC in order to notify the LR about processed configuration changes for a zone or zones.

The parameter list contained in the message is as follows.

Table 6.7-1

Name	Presence	Type or reference	Description
Message Type	M	7.30	Identifies the message type (procedure code, initiating message).
Transaction ID	M	7.31	Uniquely identifies the transaction (shall be unique for all ongoing procedures initiated by LC, or LR, in a particular instance of the LSA_1).
LC ID	M	7.33	Uniquely identifies the LC.
LR ID	M	7.32	Uniquely identifies the LR.
Confirmed Zone List	M	7.27	Includes the list of zones to be confirmed.

6.7.3   LSRAI CONFIRMATION RESPONSE

This message is sent by the LR in order to respond to a LSRAI CONFIRMATION REQUEST message from the LC.

The parameter list contained in the message is as follows.

Table 6.7-2

Name	Presence	Type or reference	Description
Message Type	M	7.30	Identifies the message type (procedure code, response message).
Transaction ID	M	7.31	Uniquely identifies the transaction (shall be unique for all ongoing procedures initiated by LC, or LR, in a particular instance of the LSA_1).
LC ID	M	7.33	Uniquely identifies the LC.
LR ID	M	7.32	Uniquely identifies the LR.
Result	M	7.35	Indicates success or failure of the confirmation.
Cause	C (if confirmation result indicates failure)	7.39	Indicates cause of LSRAI confirmation failure (e.g. "unknown or incorrect LR", "unknown or incorrect LC", "incorrect parameters for confirmed zone", etc.).

7   LSA₁ Protocol: Information Elements

7.1   LSRAI

The *LSRAI* IE is used to convey zone descriptions (i.e. exclusion zones, restriction zones, protection zones).

Table 7.1-1

Name	Presence	Type or reference	Description
Number of zones	M	INTEGER (0.. 1 023)	Identifies the number of zones N included in the LSRAI IE. If set to "0", it indicates that the following IEs should not be included, and if included, shall be ignored.
Zone Description (zone 1)	O	7.2	Includes zone parameters for zone 1.
Zone Description (zone 2)	O	7.2	Includes zone parameters for zone 2.
…	…	…	…
Zone Description (zone N)	O	7.2	Includes zone parameters for zone N.

7.2   Zone Description

The *Zone Description* IE contains information about the parameters of a zone.

If the *Zone Action* IE is set to "Create", the *Frequency*, *Radio Constraints*, *Space* and *Time* IEs shall be included in the *Zone Description* IE, except in the case of exclusion zones (*Zone Type* IE set to "0"), for which the *Radio Constraints* IE should be omitted.

If the *Zone Action* IE is set to "Modify", at least one of the *Frequency*, *Radio Constraints*, *Space* and *Time* IEs shall be included in the *Zone Description* IE.

If the *Zone Action* IE is set to "Delete", all parameters apart from *Zone ID* shall be ignored by the LC.

Table 7.2-1

Name	Presence	Type or reference	Description
Zone ID	M	7.40	Identifies the zone ID.
Zone Configuration Index	M	7.29	Identifies the configuration of the zone. The configuration index is set by the LR, and should be changed (from the previous value) if the Zone Action IE is set to "Modify".
Zone Type	M	7.3	Identifies the zone type. The Zone Type IE is a static zone parameter which cannot be changed (i.e. when the Zone Action IE is set to "Modify").
Zone Action	M	7.4	Identifies the action for the zone. The Zone Action IE should be ignored if the Zone Description IE is contained within a LSRAI NOTIFICATION message which is part of a synchronization process.
Frequency	O	7.5	Includes the frequency range of the zone.
Radio Constraints	O	7.6	Identifies zone type specific radio constraint.
Space	O	7.7	Includes geographic information about the zone.
Time	O	7.8	Includes time information about the zone.

7.3   Zone Type

The *Zone Type* IE contains information about the zone type.

Table 7.3-1

Name	Presence	Type or reference	Description

Zone Type	M	INTEGER (0..255)	The following values shall be used:
			    "0" - Exclusion Zone.
			    "1" - Restriction Zone.
			    "2" - Protection Zone.
			Other values are reserved for future use.

7.4   Zone Action

The *Zone Action* IE contains information about the action to be performed on the zone.

Table 7.4-1

Name	Presence	Type or reference	Description
Zone Action	M	INTEGER (0..7)	The following values shall be used: "0" - Create (zone does not exist and is to be created). "1" - Modify (zone exists and some of its parameters are to be modified). "2" - Delete (zone is to be deleted).

7.5   Frequency

The *Frequency* IE contains information about the frequency span within which the zone constraints should be applied.

Table 7.5-1

Name	Presence	Type or reference	Description
Lower frequency	M	7.15	Zone applies to frequencies above the signalled value.
Upper frequency	M	7.15	Zone applies to frequencies below the signalled value.

7.6   Radio Constraints

7.6.1   Introduction

The *Radio Constraints* IE contains information on the radio constraints that need be satisfied by the MFCN, for a given zone.

7.6.2   Radio Constraints parameters

This clause describes the parameters that can be used to define radio constraints of a zone.

Table 7.6-1

Name	Presence	Type or reference	Description
Radio Constraints Profile identifier	M	INTEGER (0..1 023)	Uniquely identifies a Radio Constraints Profile. For each Radio Constraints Profile, a set of mandatory and optional parameters is defined in clause 7.6.3.
Protection height above ground level	O	INTEGER (0..4 095)	Height above ground level, in meters, at which the radio constraints specified in this *Radio Constraints* IE should be satisfied, at every location within the zone specified in the *Space* IE.
Maximum field strength	O	INTEGER (-512..510)	Maximum allowed field strength (in dB microvolts/meter), at every location within of the zone specified in the *Space* IE, when integrated for each *Frequency Interval*, over the bandwidth specified in *Frequency* IE.
Frequency Interval	O	INTEGER (1..1 000 000)	Indicates an amount of KHz.

Name	Presence	Type or reference	Description
Maximum applicable antenna height above ground level	O	INTEGER (0..4 095)	Maximum height above ground level, in meters, of an actively transmitting antenna up to which the EIRP restriction specified in the Radio Constraints Profile containing this parameter is applicable.
EIRP restriction	O	INTEGER (-512..510)	Maximum EIRP (in dBm per "*Frequency Interval*") allowed for a transmitter deployed by the MFCN at any location within the zone specified in the *Space* IE, over the bandwidth specified in *Frequency* IE.
ACS	O	INTEGER (0..511)	Adjacent channel selectivity (in dB).

7.6.3   Radio Constraints profiles

This clause describes, for each Radio Constraints Profile, the set of parameters that are allowed.

For a particular Zone, the Radio Constraints Profile identifier shall be consistent with the *Zone Type* IE, as specified for each identifier below.

NOTE 1: The precise usage of a radio constraints parameter, for a given Radio Constraints Profile, will be further refined outside of the present document whenever needed, as part of a Sharing Arrangement.

Radio Constraints Profile identifier = 0

This profile defines a protection zone for PMSE as defined in section 3.2.2 of CEPT Report 58 [i.5]. This profile may be used when the *Zone Type* IE is set to "2". For this profile, the following parameters are used.

Table 7.6-2

Name	Presence
Protection height above ground level	M
Maximum field strength	M
Frequency Interval	M
ACS	O

NOTE 2: The ACLR, that can be used to compute the maximum allowed field strength in adjacent channel situations as described in section 3.2.2 of CEPT Report 58 [i.5], is a parameter of the MFCN and assumed to be known by the LC. It is therefore not included as a parameter.

Radio Constraints Profile identifier = 1

This profile defines a restriction zone based on EIRP. This profile may be used when the *Zone Type* IE is set to "1". For this profile, the following parameters are used.

Table 7.6-3

Name	Presence
Maximum applicable antenna height above ground level	M
EIRP restriction	M
Frequency Interval	M

7.7   Space

The *Space* IE contains information about the space parameters of a zone. Only one of the options in table 7.7-1 may be present in a particular instance of this IE.

Table 7.7-1

Name	Presence	Type or reference	Description
Circle	O	7.11	Zone is to become operational within the defined circle area.
Polygon	O	7.12	Zone is to become operational within the defined polygon.
Area Descriptor	O	7.13	Zone is to become operational over area associated with the Area Descriptor.

7.8   Time

The *Time* IE contains information about the time parameters of a zone. Only one of the options in table 7.8-1may be present in a particular instance of this IE. The *Aperiodic* IE shall be used for all cases of non-periodic operation, including simple start, stop or schedules (see details in clause 7.17).

Table 7.8-1

Name	Presence	Type or reference	Description
Periodic	O	7.16	Includes periodic parameters for zone operation.
Aperiodic	O	7.17	Includes unconstrained schedule parameters for zone operation (can be used for basic start or stop commands).

7.9   Synchronization Information

The *Synchronization Information* IE contains information about an ongoing synchronization process.

Table 7.9-1

Name	Presence	Type or reference	Description
Sync ID	M	7.36	Identifies the synchronization process.
Sync Status	M	ENUMERATED (ongoing, last message)	Indicates whether further procedures will be initiated for this synchronization process.
Reset Indicator	O	ENUMERATED (reset)	Indicates whether the LC shall perform a full LSRAI reset as a result of this synchronization process.

7.10   Synchronization Ack Information

The *Synchronization Ack Information* IE contains acknowledgement information about an ongoing synchronization process.

Table 7.10-1

Name	Presence	Type or reference	Description
Sync ID	M	7.36	Identifies the synchronization process.
Sync Zone List	O	7.37	For each zone received as part of the synchronization process, includes the Zone ID and Zone Configuration Index. This IE shall be included if the Sync Status in the Synchronization Information IE is set to "last message".

7.11   Circle

The *Circle* IE contains the parameters defining a circle.

> NOTE: A Radius parameter set to 0 indicates that the zone consists of a single point whose location is specified by the *Centre coordinates* IE.

Table 7.11-1

Name	Presence	Type or reference	Description
Centre coordinates	M	7.14	Geographical coordinates.
Radius	M	INTEGER (0..223-1)	The relation between the value (N) and the radius (r) in meters it describes is $5N \leq r < 5(N+1)$, except for $N=2^{23}-1$ for which the range is extended to include all greater values of (r).

7.12   Polygon

The *Polygon* IE contains the parameters defining a polygon.

Table 7.12-1

Name	Presence	Type or reference	Description
Number of points	M	INTEGER (3..15)	Identifies the number N of points in the polygon
Point 1	M	7.14	Geographical coordinates
Point 2	M	7.14	Geographical coordinates
Point 3	M	7.14	Geographical coordinates
Point 4	O	7.14	Geographical coordinates
…	…	…	…
Point N	O	7.14	Geographical coordinates

7.13   Area Descriptor

The *Area Descriptor* IE contains text strings that may be interpreted as identifying an area (e.g. postcodes).

Table 7.13-1

Name	Presence	Type or reference	Description
Number of strings	M	INTEGER (1..1 000)	Identifies the number N of text strings in the Area Descriptor
String 1	M	PrintableString(SIZE(1..150))	Text string describing an area
String 2	O	PrintableString(SIZE(1..150))	Text string describing an area
String 3	O	PrintableString(SIZE(1..150))	Text string describing an area
String 4	O	PrintableString(SIZE(1..150))	Text string describing an area
…	…	…	…
String N	O	PrintableString(SIZE(1..150))	Text string describing an area

7.14   Geographical coordinates

The *Geographical Coordinates* IE contains the geographical coordinates.

Table 7.14-1

Name	Presence	Type or reference	Description
Latitude Sign	M	ENUMERATED (North, South)	
Degrees of Latitude	M	INTEGER (0..223-1)	The IE value (N) is derived using this formula: $N \leq 2^{23} X /90 < N+1$ X being the latitude in degree (0°.. 90°)
Degrees of Longitude	M	INTEGER (-223..223-1)	The IE value (N) is derived by this formula: $N \leq 2^{24} X /360 < N+1$ X being the longitude in degree (-180°.. +180°)

7.15   Frequency value

The *Frequency Value* IE contains a frequency value.

Table 7.15-1

Name	Presence	Type or reference	Description
Frequency value	M	INTEGER (0..100 000)	The IE value (N) is derived from the following formula: F = (N/10) Where F is the frequency in MHz

7.16   Periodic

The *Periodic* IE contains the times when a zone is to be operational within a period (day/week/month/year).

Table 7.16-1

Name	Presence	Type or reference	Description
CHOICE Period Length	M		
>Day			
>>Day schedule	M	7.19	One day schedule to be repeated every 24 hours
>Week			
>>Week schedule	M	7.20	One week schedule to be repeated every week
>Month			
>>Month schedule	M	7.21	One month schedule to be repeated every month
>Year			
>>Year schedule	M	7.22	One year schedule to be repeated every year

7.17   Aperiodic

The *Aperiodic* IE contains the parameters defining an unconstrained time schedule with multiple idle-operational transitions for a given zone. This structure is also used to indicate simpler operations e.g.:

- A start-only indication may be signalled by setting N to "1" and including a single Start Time.

- A stop-only indication may be signalled by setting N to "2", and including Start Time 1 and Stop Time 2, where Start Time 1 indicates a past value.

The Start and Stop Times shall be in order, i.e. Start Time 1 < Stop Time 2 < Start Time 3 < Stop Time 4 < ….

Table 7.17-1

Name	Presence	Type or reference	Description
Number of time values	M	INTEGER (1..1 024)	Identifies the number N of time values.
Start Time 1	M	7.18	Time value for first transition to operational.
Stop Time 2	O	7.18	Time value for first transition to idle.
Start Time 3	O	7.18	Time value for next transition to operational.
Stop Time 4	O	7.18	Time value for next transition to idle.
…	…	…	…
Start Time (N-1)	O	7.18	Time value for last transition to operational.
Stop Time N	O	7.18	Time value for last transition to idle.

7.18   Time

The *Time* IE contains date and time information. It is assumed to be based on UTC unless otherwise agreed within a deployed system.

Table 7.18-1

Name	Presence	Type or reference	Description
Year	M	INTEGER (0..9 999)	
Month	M	INTEGER (1..12)	
Date	M	INTEGER (1..31)	
Hour	M	INTEGER (0..23)	
Minute	M	INTEGER (0..59)	
Second	O	INTEGER (0..59)	

7.19   Day Schedule

The *Day Schedule* IE contains the parameters defining an unconstrained time schedule within one day (to be repeated on a daily basis).

Table 7.19-1

Name	Presence	Type or reference	Description
Number of time of day values	M	INTEGER (1..1 024)	Identifies the number N of time of day values.
Time of day value 1	M	7.23	Time of day value for first transition to operational.
Time of day value 2	O	7.23	Time of day value for first transition to idle.
Time of day value 3	O	7.23	Time of day value for next transition to operational.
Time of day value 4	O	7.23	Time of day value for next transition to idle.
…	…	…	…
Time of day value N-1	O	7.23	Time of day value for last transition to operational.
Time of day value N	O	7.23	Time of day value for last transition to idle.

7.20   Week Schedule

The *Week Schedule* IE contains the parameters defining an unconstrained time schedule within one week (to be repeated on a weekly basis).

Table 7.20-1

Name	Presence	Type or reference	Description
Number of time of week values	M	INTEGER (1..1 024)	Identifies the number N of time of week values.
Time of week value 1	M	7.24	Time of week value for first transition to operational.
Time of week value 2	O	7.24	Time of week value for first transition to idle.
Time of week value 3	O	7.24	Time of week value for next transition to operational.
Time of week value 4	O	7.24	Time of week value for next transition to idle.
…	…	…	…
Time of week value N-1	O	7.24	Time of week value for last transition to operational.
Time of week value N	O	7.24	Time of week value for last transition to idle.

7.21   Month Schedule

The Month Schedule IE contains the parameters defining an unconstrained time schedule within one month (to be repeated on a monthly basis).

Table 7.21-1

Name	Presence	Type or reference	Description
Number of time of month values	M	INTEGER (1..1 024)	Identifies the number N of time of month values.
Time of month value 1	M	7.25	Time of month value for first transition to operational.
Time of month value 2	O	7.25	Time of month value for first transition to idle.
Time of month value 3	O	7.25	Time of month value for next transition to operational.
Time of month value 4	O	7.25	Time of month value for next transition to idle.
…	…	…	…
Time of month value N-1	O	7.25	Time of month value for last transition to operational.
Time of month value N	O	7.25	Time of month value for last transition to idle.

7.22   Year Schedule

The *Year Schedule* IE contains the parameters defining an unconstrained time schedule within one year (to be repeated on a yearly basis).

Table 7.22-1

Name	Presence	Type or reference	Description
Number of time of year values	M	INTEGER (1..1 024)	Identifies the number N of time of year values.
Time of year value 1	M	7.26	Time of year value for first transition to operational.
Time of year value 2	O	7.26	Time of year value for first transition to idle.
Time of year value 3	O	7.26	Time of year value for next transition to operational.
Time of year value 4	O	7.26	Time of year value for next transition to idle.
…	…	…	…
Time of year value N-1	O	7.26	Time of year value for last transition to operational.
Time of year value N	O	7.26	Time of year value for last transition to idle.

7.23   Time of Day

The Time of Day IE contains time information within a 24 hour period.

Table 7.23-1

Name	Presence	Type or reference	Description
Hour	M	INTEGER (0..23)	
Minute	M	INTEGER (0..59)	
Second	O	INTEGER (0..59)	

7.24   Time of Week

The *Time of Week* IE contains time information within a 7 day period.

Table 7.24-1

Name	Presence	Type or reference	Description
Day	M	INTEGER (1..7)	Value "1" represents Monday.
Hour	M	INTEGER (0..23)	
Minute	M	INTEGER (0..59)	
Second	O	INTEGER (0..59)	

7.25   Time of Month

The *Time of Month* IE contains time information within a month's period. Any events occurring after month end in a particular month (e.g. on the 30th day of February) are deemed to happen on the last minute of the month.

Table 7.25-1

Name	Presence	Type or reference	Description
Date	M	INTEGER (1..31)	
Hour	M	INTEGER (0..23)	
Minute	M	INTEGER (0..59)	
Second	O	INTEGER (0..59)	

7.26   Time of Year

The *Time of Year* IE contains time information within a year's period.

Table 7.26-1

Name	Presence	Type or reference	Description
Month	M	INTEGER (1..12)	
Date	M	INTEGER (1..31)	
Hour	M	INTEGER (0..23)	
Minute	M	INTEGER (0..59)	
Second	O	INTEGER (0..59)	

7.27   Confirmed Zone List

The *Confirmed Zone List* IE contains a list of Zone confirmations.

Table 7.27-1

Name	Presence	Type or reference	Description
Number of zones	M	INTEGER (1.. 1 024)	Identifies the number of zones N in the Confirmed Zone List IE.
Zone Confirmation 1	M	7.28	Confirmation information for first zone.
Zone Confirmation 2	O	7.28	Confirmation information for second zone.
…	…	…	…
Zone Confirmation N	O	7.28	Confirmation information for the nth zone.

7.28   Zone Confirmation

The *Zone Confirmation* IE contains the Zone ID and Configuration Index of a zone to be confirmed, and associated confirmation information.

Table 7.28-1

Name	Presence	Type or reference	Description
Zone ID	M	7.40	Identifies the zone ID.
Zone Configuration Index	M	7.29	Identifies the specific configuration of the zone that is being confirmed.
LC Confirmation Status	M	ENUMERATED (successful confirmation, confirmation not possible)	Provides the confirmation status at the LC.

7.29   Zone Configuration Index

The *Zone Configuration Index* IE contains the Zone Configuration Index of a zone.

Table 7.29-1

Name	Presence	Type or reference	Description
Zone Configuration Index	M	INTEGER (0..127)	Identifies the configuration of the zone.

7.30   Message Type

The *Message Type* IE contains information used to identify the message.

Table 7.30-1

Name	Presence	Type or reference	Description
Message Type	M	INTEGER (0..1 023)	The following values shall be used: "0" - REGISTRATION REQUEST message "1" - REGISTRATION RESPONSE message "2" - DEREGISTRATION REQUEST message "3" - DEREGISTRATION RESPONSE message "4" - CONNECTIVITY CHECK NOTIFICATION message "5" - CONNECTIVITY CHECK NOTIFICATION ACK message "6" - CONNECTIVITY CHECK REQUEST message "7" - CONNECTIVITY CHECK RESPONSE message "8" - LSRAI NOTIFICATION message "9" - LSRAI NOTIFICATION ACK message "10" - LSRAI REQUEST message "11" - LSRAI RESPONSE message "12" - LSRAI CONFIRMATION REQUEST message "13" - LSRAI CONFIRMATION RESPONSE message

7.31   Transaction ID

The *Transaction ID* IE contains information used to identify the specific instance of a procedure which the message belongs to do.

Table 7.31-1

Name	Presence	Type or reference	Description
Transaction ID	M	INTEGER (0..4 095)	Indicates the specific instance of the procedure. Transaction IDs may be reused after the completion of a procedure.

7.32   LR ID

The *LR ID* IE enables the LC to identify the LR involved in the message exchange via LSA_1.

Table 7.32-1

Name	Presence	Type or reference	Description
LR ID	M	INTEGER (0..4 095)	Indicates the LR.

7.33   LC ID

The *LC ID* IE enables the LR to identify the LC involved in the message exchange via LSA_1.

Table 7.33-1

Name	Presence	Type or reference	Description
LC ID	M	INTEGER (0..4 095)	Indicates the LC.

7.34   Licensee ID

The *Licensee ID* IE enables the LR to identify the Licensee involved in the message exchange via LSA_1.

Table 7.34-1

Name	Presence	Type or reference	Description
Licensee ID	M	INTEGER (0..4 095)	Indicates the Licensee.

7.35   Result

The *Result* IE is included in a response message and indicates whether the procedure is successful.

Table 7.35-1

Name	Presence	Type or reference	Description
Result	M	ENUMERATED (Successful, Unsuccessful)	Indicates the result of the procedure.

7.36   Sync ID

The *Sync ID* IE is used to identify the specific synchronization process.

Table 7.36-1

Name	Presence	Type or reference	Description
Sync ID	M	INTEGER (0..255)	Indicates that the message is part of the synchronization process associated with this ID. Sync IDs may be reused after the completion of the respective synchronization process.

7.37   Sync Zone List

The *Sync Zone List* IE contains information about the zones received during a synchronization process.

Table 7.37-1

Name	Presence	Type or reference	Description
Number of zones	M	INTEGER (0..65 535)	Identifies the number of zones N received during the synchronization process. If set to "0", it indicates that the following IEs should not be included, and if included, shall be ignored.
Synched Zone 1	O	7.38	Includes zone parameters for zone 1.
Synched Zone 2	O	7.38	Includes zone parameters for zone 2.
…	…	…	…
Synched Zone N	O	7.38	Includes zone parameters for zone N.

7.38   Synched Zone

The *Synched Zone* IE contains information about a zone received during the synchronization process.

Table 7.38-1

Name	Presence	Type or reference	Description
Zone ID	M	7.40	Identifies the zone ID.
Zone Configuration Index	M	7.29	Identifies the configuration of the zone.

7.39   Cause

The *Cause* IE indicates the reason for a particular event associated with the message that includes the IE.

Table 7.39-1

Name	Presence	Type or reference	Description
Cause Type	M	INTEGER (0..1 023)	The following values shall be used: "0" - unspecified "1" - Message not compatible with receiver state "2" - Incorrect parameter combination "3" - Duplicate transaction ID "4" - Unknown or incorrect LR ID "5" - Unknown or incorrect LC ID "6" - Unknown Licensee ID "7" - Normal connectivity check "8" - Previous messages not acknowledged, or not correctly received "9" - Incomplete zone parameters "10" - Unknown Zone ID "11" - Modification of Zone Type Not Allowed "12" - New Zone ID already allocated "13" - Inconsistent zone configuration index "14" - Radio constraints profile error "15" - Inconsistent zone parameters (time) "16" - Inconsistent zone parameters (frequency) "17" - Inconsistent zone parameters (radio constraints) "18" - Inconsistent zone parameters (geographical) "19" - LSRAI Request Type not understood "20" - Incorrect parameters for Confirmed zone "21" - Incorrect zone list "22" - Protocol version(s) not supported "23" - Synchronization process ongoing "24" - Radio Constraints Profile identifier not consistent with the zone type

Table 7.39-2 provides explanations for the above values of the *Cause* IE.

Table 7.39-2

Cause Value	Explanation
Unspecified	Sent when none of the specified cause values apply.
Message not compatible with receiver state	The received message was not compatible with the receiver state.
Incorrect parameter combination	The combination of parameters provided in the message is not correct.
Duplicate transaction ID	The transaction ID is already being used by another ongoing procedure initiated by the same node.
Unknown or incorrect LR ID	The LR ID received is not known or there is no operational interface towards it.
Unknown or incorrect LC ID	The LC ID received is not known or there is no operational interface towards it.
Unknown Licensee ID	The received Licensee ID is not known or supported by the LR.
Normal connectivity check	The connectivity check is triggered under normal conditions.
Previous messages not acknowledged, or not correctly received	The connectivity check is triggered due to protocol errors.
Incomplete zone parameters	A received zone has missing parameters.
Unknown Zone ID	The Zone ID to be modified or deleted is not known.
Modification of Zone Type Not Allowed	The LC has received a request for a modification of the Zone Type.
New Zone ID already allocated	The Zone ID (for a Zone that is to be created) is already allocated.
Inconsistent zone configuration index	The Zone Configuration Index is not consistent (e.g. for a zone modification, it has the same or lower value than the stored Index for the same Zone).
Radio constraints profile error	The radio constraints profile is not known, or radio parameters are missing for the profile.
Inconsistent zone parameters (time)	Time parameters of a zone are incorrect or inconsistent.
Inconsistent zone parameters (frequency)	Frequency parameters of a zone are incorrect or inconsistent.
Inconsistent zone parameters (radio constraints)	Radio constraint parameters of a zone are incorrect or inconsistent.
Inconsistent zone parameters (geographical)	Geographical parameters of a zone are incorrect or inconsistent.
LSRAI Request Type not understood	LSRAI Request type uses unknown value.
Incorrect parameters for Confirmed zone	Zone ID or Confirmation Index are not consistent with current LSRAI context at LR.
Incorrect zone list	The received zone list does not match the locally stored list (LSRAI Context).
Protocol version(s) not supported	The LR does not support any of the protocol versions previously signalled by the LC.
Synchronization process ongoing	The procedure failed because there is an ongoing synchronization process.
Radio Constraints Profile identifier not consistent with the zone type	The Radio Constraints Profile identifier is not consistent with the zone type.

7.40   Zone ID

The *Zone ID* IE is used to identify a zone uniquely over all instances of the LSA$_1$ interface for a given LR.

Table 7.40-1

Name	Presence	Type or reference	Description
Zone ID	M	INTEGER (0..16 777 215)	Identifies the zone.

7.41   Protocol Version List

The *Protocol Version List* IE contains information about the protocol versions supported by a protocol endpoint.

Table 7.41-1

Name	Presence	Type or reference	Description
Number of versions	M	INTEGER (1..63)	Identifies the number N of versions supported by the endpoint
Protocol Version 1	M	7.42	Supported protocol version 1
Protocol Version 2	O	7.42	Supported protocol version 2
…	…	…	…
Protocol Version N	O	7.42	Supported protocol version N

7.42   Protocol Version

The *Protocol Version* IE is used to identify the protocol version.

Table 7.42-1

Name	Presence	Type or reference	Description
Protocol Version	M	INTEGER (1..255)	Indicates the protocol version.

Annex A (informative):
Change History

Date	Version	Information about changes
October 2015	0.0.1	First draft (includes skeleton, scope, references and some definitions and abbreviations)
October 2016	0.0.9	Stable draft
November 2016	0.0.13	Final draft for approval
December 2016	0.0.14	Final corrections on approved draft

History

Document history		
V1.1.1	January 2017	Publication