3GPP TS 29.276 V16.0.0 (2020-07)

Technical Specification

3rd Generation Partnership Project;

Technical Specification Group Core Network and Terminals;

3GPP Evolved Packet System (EPS);  
 Optimized Handover Procedures and Protocols between   
E-UTRAN access and cdma2000 HRPD Access;  
Stage 3

(Release 16)

** 

The present document has been developed within the 3rd Generation Partnership Project (3GPP TM) and may be further elaborated for the purposes of 3GPP..  
The present document has not been subject to any approval process by the 3GPPOrganizational Partners and shall not be implemented.  
This Specification is provided for future development work within 3GPPonly. The Organizational Partners accept no liability for any use of this Specification.  
Specifications and reports for implementation of the 3GPP TM system should be obtained via the 3GPP Organizational Partners' Publications Offices.

Keywords

EPS, S101

***3GPP***

Postal address

3GPP support office address

650 Route des Lucioles - Sophia Antipolis

Valbonne - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Internet

http://www.3gpp.org

***Copyright Notification***

No part may be reproduced except as authorized by written permission.  
The copyright and the foregoing restriction extend to reproduction in all media.

© 2020, 3GPP Organizational Partners (ARIB, ATIS, CCSA, ETSI, TSDSI, TTA, TTC).

All rights reserved.

UMTS™ is a Trade Mark of ETSI registered for the benefit of its members

3GPP™ is a Trade Mark of ETSI registered for the benefit of its Members and of the 3GPP Organizational Partners  
LTE™ is a Trade Mark of ETSI registered for the benefit of its Members and of the 3GPP Organizational Partners

GSM® and the GSM logo are registered and owned by the GSM Association

Contents

Foreword [5](#__RefHeading___Toc517480180)

1 Scope [6](#__RefHeading___Toc517480181)

2 References [6](#__RefHeading___Toc517480182)

3 Definitions, symbols and abbreviations [7](#__RefHeading___Toc517480183)

3.1 Definitions [7](#__RefHeading___Toc517480184)

3.2 Abbreviations [7](#__RefHeading___Toc517480185)

4 General [7](#__RefHeading___Toc517480186)

5 Transmission Order and Bit Definitions [8](#__RefHeading___Toc517480187)

6 S101 Message Header [8](#__RefHeading___Toc517480188)

6.1 Introduction [8](#__RefHeading___Toc517480189)

6.2 S101 Message Header [8](#__RefHeading___Toc517480190)

6A S121 Message Header [9](#__RefHeading___Toc517480191)

6A.1 Introduction [9](#__RefHeading___Toc517480192)

6A.2 S121 Message Header [9](#__RefHeading___Toc517480193)

7 S101 Messages and Message Formats [10](#__RefHeading___Toc517480194)

7.1 Introduction [10](#__RefHeading___Toc517480195)

7.2 Path Management Messages [10](#__RefHeading___Toc517480196)

7.2.1 Introduction [10](#__RefHeading___Toc517480197)

7.2.2 Echo Request message [11](#__RefHeading___Toc517480198)

7.2.3 Echo Response message [11](#__RefHeading___Toc517480199)

7.2.4 Version Not Supported Indication message [11](#__RefHeading___Toc517480200)

7.3 S101 Messages [11](#__RefHeading___Toc517480201)

7.3.1 Introduction [11](#__RefHeading___Toc517480202)

7.3.2 Direct Transfer Request message [11](#__RefHeading___Toc517480203)

7.3.3 Direct Transfer Response message [13](#__RefHeading___Toc517480204)

7.3.4 Notification Request message [13](#__RefHeading___Toc517480205)

7.3.5 Notification Response message [14](#__RefHeading___Toc517480206)

7.4 Reliable Delivery of Signalling Messages [14](#__RefHeading___Toc517480207)

7.5 Information Elements [14](#__RefHeading___Toc517480208)

7.5.1 Information Element Assignments [14](#__RefHeading___Toc517480209)

7.5.2 Session ID [15](#__RefHeading___Toc517480210)

7.5.2A Session ID2 [15](#__RefHeading___Toc517480211)

7.5.3 Cause [15](#__RefHeading___Toc517480212)

7.5.4 Recovery [16](#__RefHeading___Toc517480213)

7.5.5 HRPD Sector ID [16](#__RefHeading___Toc517480214)

7.5.6 S101 Transparent Container [17](#__RefHeading___Toc517480215)

7.5.7 Handover Indicator [17](#__RefHeading___Toc517480216)

7.5.8 Private Extension [18](#__RefHeading___Toc517480217)

7.5.9 PDN GW PMIP GRE Tunnel Info [18](#__RefHeading___Toc517480218)

7.5.10 S103 GRE Tunnel Info [18](#__RefHeading___Toc517480219)

7.5.11 S103 HSGW IP Address [18](#__RefHeading___Toc517480220)

7.5.12 Void [19](#__RefHeading___Toc517480221)

7.5.13 Unauthenticated IMSI [19](#__RefHeading___Toc517480222)

7.5.14 EUTRAN Round Trip Delay [19](#__RefHeading___Toc517480223)

7A S121 Messages and Message Formats [19](#__RefHeading___Toc517480224)

7A.1 Introduction [19](#__RefHeading___Toc517480225)

7A.2 Path Management Messages [20](#__RefHeading___Toc517480226)

7A.2.1 Introduction [20](#__RefHeading___Toc517480227)

7A.2.2 Echo Request message [20](#__RefHeading___Toc517480228)

7A.2.3 Echo Response message [20](#__RefHeading___Toc517480229)

7A.2.4 Version Not Supported Indication message [20](#__RefHeading___Toc517480230)

7A.3 S121 Messages [21](#__RefHeading___Toc517480231)

7A.3.1 Introduction [21](#__RefHeading___Toc517480232)

7A.3.2 RIM Information Transfer [21](#__RefHeading___Toc517480233)

7A.4 Reliable Delivery of Signalling Messages [21](#__RefHeading___Toc517480234)

7A.5 Information Elements [21](#__RefHeading___Toc517480235)

7A.5.1 Information Element Assignments [21](#__RefHeading___Toc517480236)

7A.5.2 S121 Transparent Container [22](#__RefHeading___Toc517480237)

7A.5.3 RIM Routing Address [22](#__RefHeading___Toc517480238)

7A.5.4 Private Extension [23](#__RefHeading___Toc517480239)

8 Path Protocols [23](#__RefHeading___Toc517480240)

9 Error Handling [23](#__RefHeading___Toc517480241)

9.1 Protocol Errors [23](#__RefHeading___Toc517480242)

9.2 Path Failure [23](#__RefHeading___Toc517480243)

9.3 Restoration and Recovery [23](#__RefHeading___Toc517480244)

10 Security provided to Communication over the S101/S121 Interface [23](#__RefHeading___Toc517480245)

11 IP - The Networking Technology used by S101/S121 [23](#__RefHeading___Toc517480246)

11.1 IP Version [23](#__RefHeading___Toc517480247)

11.2 IP Fragmentation [24](#__RefHeading___Toc517480248)

12 S101 Parameters [24](#__RefHeading___Toc517480249)

12.1 General [24](#__RefHeading___Toc517480250)

12.2 Timers [24](#__RefHeading___Toc517480251)

12.3 Others [24](#__RefHeading___Toc517480252)

13 S103 Interface Specification [24](#__RefHeading___Toc517480253)

13.1 Introduction [24](#__RefHeading___Toc517480254)

13.2 S103 Interface [24](#__RefHeading___Toc517480255)

Annex A (informative): Change history [25](#__RefHeading___Toc517480256)

# Foreword

This Technical Specification has been produced by the 3rd Generation Partnership Project (3GPP).

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of the present document, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

Version x.y.z

where:

x the first digit:

1 presented to TSG for information;

2 presented to TSG for approval;

3 or greater indicates TSG approved document under change control.

y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.

z the third digit is incremented when editorial only changes have been incorporated in the document.

# 1 Scope

The present document specifies the stage 3 of the Evolved Packet System S101and S121 reference points between the MME and the HRPD Access Network. The S101 interface supports procedures for Pre-Registration, Session Maintenance and Active handoffs between E-UTRAN and HRPD networks. The S121 interface supports procedures for RIM information exchange between the MME and the HRPD Access Network.

It also specifies the S103 interface between the Serving GW and HSGW. This User Plane interface is used to forward DL data to minimize packet losses in mobility from E-UTRAN to HRPD. Signalling procedures on the S101 interface are used to set up tunnels on the S103 interface.

# 2 References

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

- References are either specific (identified by date of publication, edition number, version number, etc.) or non‑specific.

- For a specific reference, subsequent revisions do not apply.

- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

[1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[2] 3GPP TS 23.402: "Architecture enhancements for non-3GPP accesses".

[3] IETF RFC 3232: "Assigned Numbers".

[4] IETF RFC 2784: "Generic Routing Encapsulation (GRE)".

[5] IETF RFC 2890: "Key and Sequence Number Extensions to GRE".

[6] 3GPP TS 29.274: "Evolved GPRS Tunnelling Protocol for Control Plane (GTPv2-C); Stage 3".

[7] 3GPP2 C.S0024-B: "cdma2000 High Rate Packet Data Air Interface Specification".

[8] 3GPP TS 23.007: "Restoration procedures".

[9] 3GPP2 C.S0087-0 v2.0: "E-UTRAN - HRPD and CDMA2000 1x Connectivity and Interworking: Air Interface Aspects".

[10] 3GPP TS 24.301: "Non-Access-Stratum (NAS) protocol for Evolved Packet System (EPS); Stage 3".

[11] 3GPP TS 33.402: "3GPP System Architecture Evolution: Security Architecture".

[12] 3GPP TS 36.413: "Evolved Universal Terrestrial Radio Access (E-UTRA) ; S1 Application Protocol (S1AP)".

[13] 3GPP TS 24.008: " Mobile radio interface Layer 3 specification; Core network protocols; Stage 3".

[14] 3GPP TS 29.280: "3GPP EPS Sv interface (MME to MSC) for SRVCC".

[15] 3GPP TS 48.018: "General Packet Radio Service (GPRS); Base Station System (BSS) - Serving GPRS Support Node (SGSN); BSS GPRS protocol (BSSGP)".

# 3 Definitions, symbols and abbreviations

## 3.1 Definitions

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

**HRPD Access:** Combination of the eAN - PCF of the cdma2000 access

## 3.2 Abbreviations

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

AN Access Network

eAN enhanced AN

eNodeB enhanced Node B

E-UTRAN Enhanced UMTS Terrestial Radio Access Network

GRE Generic Routing Encapsulation

GW Gateway

HO HandOver

HRPD High Rate Packet Data

HSGW HRPD Serving GateWay

IMSI International Mobile Station Identity

IP Internet Protocol

MME Mobility Management Entity

PCF Packet Control Function

PDN Packet data Network

PMIP Proxy Mobile IP

RIM RAN Information Management

TEID Tunnel End Point Identifier

UDP User Datagram Protocol

VS Vendor Specific

# 4 General

The S101 and S121 reference points are defined between the MME and the HRPD access, enabling interactions between E-UTRAN Access and cdma2000 HRPD Access. The S101 interface is required to perform procedures related to optimise HO from the E-UTRAN Access to cdma2000 HRPD Access to allow for pre-registration and handover signalling with the target system. The S121 interface is required to perform procedures related to RIM information exchange between the E-UTRAN Access and cdma2000 HRPD Access.

The S103 interface is defined between the Serving GW and HSGW and supports the forwarding of DL data during mobility from E-UTRAN to HRPD. Signalling procedures on the S101 interface are used to set up tunnels on the S103 interface.

The requirements for these interfaces are defined in 3GPP TS 23.402 [2].

The protocol stack used for the S101 and S121 interfaces shall be based on GTPv2-C, see 3GPP TS 29.274 [6] Figure 4.2.0-1.

The UDP header and port numbers definitions shall be as defined in GTPv2-C, see 3GPP TS 29.274 [6] section 4. 2.1.

The IP header and IP addresses definitions shall be as defined in GTPv2-C, see 3GPP TS 29.274 [6] section 4.2.2.

Layer 1 and Layer 2 requirements shall as defined in GTPv2-C, see 3GPP TS 29.274 [6] sections 4.2.3 and 4.2.4.

# 5 Transmission Order and Bit Definitions

Transmission Order and Bit Definitions shall be as defined in GTPv2-C, see 3GPP TS 29.274 [6] section 4.3.

# 6 S101 Message Header

## 6.1 Introduction

The S101 Message Header is conformant to the GTPv2-C Message Header, see 3GPP TS 29.274 [6] section 5. All S101 messages shall have a header that includes specific parameters. The following list of header parameters are defined for the S101 interface:

- Version

- Flags (T = TEID Included)

- Message Type

- Length

## 6.2 S101 Message Header

The S101 header is a variable length header. The minimum length of the S101 header is eight octets. Space has been reserved for four flags that may be used in the future to signal the presence of additional optional header fields or utilities.

- Bit 4 (the T bit) may be set to one to indicate that a TEID is present in the header, as per 3GPP TS 29.274 [6]. The T bit shall be set to zero to indicate that the TEID field shall not be present in any message sent on the S101 interface.

If the header fields do not occupy a full eight octets, then spare octets shall be added after the last valid field in the S101 header to complete eight octets. Spare octets and bits shall be set to zero.

**Always present fields:**

- Version field: This field is used to determine the version of the S101 protocol. The version number shall be set to '010'.

- Message Type: This field indicates the type of S101 message. The valid values of the message type are defined in clause 7.1. Note that values chosen for Message Type shall be coordinated with and shall not overlap the Message Type values chosen for GTPv2-C in 3GPP TS 29.274 [6].

- Length: This field indicates the length in octets of the payload, i.e. the rest of the packet following the mandatory part of the S101 header (that is the first 4 octets).

- Sequence Number: This field enables the target system to identify any missing receipt of messages and is used also for acknowledgement of messages.

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | Bits | | | | | | | | | |
| Octets |  | 8 | 7 | 6 | 5 | 4 | 3 | 2 | | 1 | |
| 1 |  | Version=010 | | | (\*) | T=0 | (\*) | | (\*) | | (\*) |
| 2 |  | Message Type | | | | | | | | | |
| 3 |  | Length (1st Octet) | | | | | | | | | |
| 4 |  | Length (2nd Octet) | | | | | | | | | |
| 5 |  | Sequence Number (1st Octet) | | | | | | | | | |
| 6 |  | Sequence Number (2nd Octet) | | | | | | | | | |
| 7 |  | Sequence Number (3rd Octet) | | | | | | | | | |
| 8 |  | Spare | | | | | | | | | |

NOTE 0: (\*) This bit is a spare bit. It shall be sent as '0'. The receiver shall not evaluate this bit.

Figure 6.2-1: Layout of the S101 Message Header

# 6A S121 Message Header

## 6A.1 Introduction

The S121 Message Header is conformant to the GTPv2-C Message Header, see 3GPP TS 29.274 [6] section 5. All S121 messages shall have a header that includes specific parameters. The following header parameters are defined for the S121 interface:

- Version

- Flags (T = TEID Included)

- Message Type

- Length

## 6A.2 S121 Message Header

The S121 header is a variable length header. The minimum length of the S121 header is eight octets. Space has been reserved for four flags that may be used in the future to signal the presence of additional optional header fields or utilities.

- Bit 4 (the T bit) indicates whether a TEID is present in the header, as per 3GPP TS 29.274 [6]. The T bit shall be set to zero to indicate that the TEID field shall not be present in any message sent on the S121 interface.

If the header fields do not occupy a full eight octets, then spare octets shall be added after the last valid field in the S121 header to complete eight octets. Spare octets and bits shall be set to zero.

**Always present fields:**

- Version field: This field is used to determine the version of the S121 protocol. The version number shall be set to '010'.

- Message Type: This field indicates the type of S121 message. The valid values of the message type are defined in clause 7A.1. Note that values chosen for Message Type shall be coordinated with and shall not overlap the Message Type values chosen for GTPv2-C in 3GPP TS 29.274 [6].

- Length: This field indicates the length in octets of the payload, i.e. the rest of the packet following the mandatory part of the S121 header (that is the first 4 octets).

- Sequence Number: This field enables the target system to identify any missing receipt of messages and is used also for acknowledgement of messages.

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | Bits | | | | | | | | | |
| Octets |  | 8 | 7 | 6 | 5 | 4 | 3 | 2 | | 1 | |
| 1 |  | Version=010 | | | (\*) | T=0 | (\*) | | (\*) | | (\*) |
| 2 |  | Message Type | | | | | | | | | |
| 3 |  | Length (1st Octet) | | | | | | | | | |
| 4 |  | Length (2nd Octet) | | | | | | | | | |
| 5 |  | Sequence Number (1st Octet) | | | | | | | | | |
| 6 |  | Sequence Number (2nd Octet) | | | | | | | | | |
| 7 |  | Sequence Number (3rd Octet) | | | | | | | | | |
| 8 |  | Spare | | | | | | | | | |

NOTE 0: (\*) This bit is a spare bit. It shall be sent as '0'. The receiver shall not evaluate this bit.

Figure 6A.2-1: Layout of the S121 Message Header

# 7 S101 Messages and Message Formats

## 7.1 Introduction

This section is divided into path management which defines the general messages for the pre-configured tunnel and a section for the specific messages used for information transfer over the control plane.

Table 7.1 specifies GTPv2-C message types that are used across the S101 interface.

Table 7.1: Message types for S101

| Message Type value (Decimal) | Message | Reference |
| --- | --- | --- |
| 0 | Reserved | 3GPP TS 29.274 [6] |
| 1 | Echo Request | 3GPP TS 29.274 [6] |
| 2 | Echo Response | 3GPP TS 29.274 [6] |
| 3 | Version Not Supported Indication | 3GPP TS 29.274 [6] |
| 4 | Direct Transfer Request message | 7.3.2 |
| 5 | Direct Transfer Response message | 7.3.3 |
| 6 | Notification Request message | 7.3.4 |
| 7 | Notification Response message | 7.3.5 |
| 8-16 | For future S101 interface use |  |
| 17-24 | Reserved for S121 interface | 7A |
| 25-31 | Reserved for Sv interface | 3GPP TS 29.280 [14] |
| 32-239 | Reserved for GTPv2-C spec | 3GPP TS 29.274 [6] |
| 240 to 247 | Reserved for Sv interface | 3GPP TS 29.280 [14] |
| 248 to 255 | Reserved for GTPv2-C spec | 3GPP TS 29.274 [6] |

### 7.2 Path Management Messages

### 7.2.1 Introduction

The path from the MME to the non-3GPP Access Network operationally requires management capabilities. The following GTPv2-C messages support path management for the S101 interface:

- Echo Request

- Echo Response

- Version Not Supported Indication

These messages are defined for GTPv2-C and the handling and definition shall also be as defined in GTPv2-C, see 3GPP TS 29.274 [6].

### 7.2.2 Echo Request message

An MME or an HRPD access node may send an Echo Request to find out if the peer HRPD access node or MME is alive (see section Path Failure). When and how often an Echo Request message may be sent is implementation specific but an Echo Request shall not be sent more often than every 60 s on each path.

An MME or an HRPD access node shall be prepared to receive an Echo Request at any time and it shall reply with an Echo Response. The optional Private Extension contains vendor or operator specific information.

3GPP TS 29.274 [6] specifies the information elements included in the Echo Request message.

### 7.2.3 Echo Response message

The message shall be sent as a response to a received Echo Request.

3GPP TS 29.274 [6] specifies the information elements included in the Echo Response message.

The Recovery information element contains the local Restart Counter (see section Restoration and Recovery) value for the node that sends the Echo Response message.

The MME or an HRPD access node that receives an Echo Response from a peer MME or an HRPD access node shall compare the Restart Counter value received with the previous Restart Counter value stored for that peer MME or HRPD access node. If no previous value was stored, the Restart Counter value received in the Echo Response shall be stored for the peer MME or HRPD access node.

The value of a Restart Counter previously stored for a peer MME or HRPD access node may differ from the Restart Counter value received in the Echo Response from that peer MME or HRPD access node. In this case, the MME or HRPD access node shall handle the Restart Counter as specified in clause 18 of 3GPP TS 23.007 [3].

The optional Private Extension contains vendor or operator specific information.

### 7.2.4 Version Not Supported Indication message

This message contains only the S101 header and indicates the latest S101 version that the MME or HRPD access node entity on the identified UDP/IP address can support (see 3GPP TS 29.274 [6] subclause 7.1.3).

3GPP TS 29.274 [6] specifies the detailed handling and information elements included in the Version Not Supported Indication message.

## 7.3 S101 Messages

### 7.3.1 Introduction

The following messages are used to support interworking between the MME and the non-3GPP access network:

- Direct Transfer Request

- Direct Transfer Response

- Notification Request

- Notification Response

### 7.3.2 Direct Transfer Request message

A Direct Transfer Request shall be sent from an MME or HRPD access node to transport an HRPD or an E-UTRAN message to the peer HRPD access node or MME.

One of the IEs Session ID or Session ID2 but not both shall be included in the message.

Table 7.3.2-1 specifies the information elements included in the Direct Transfer message.

Table 7.3.2-1: Information Elements in a Direct Transfer Request

|  |  |  |  |
| --- | --- | --- | --- |
| Information elements | Presence Requirement | Reference | Instance |
| Session ID | Conditional | 7.5.2 | 0 |
| Session ID2 | Conditional | 7.5.2A | 0 |
| HRPD Sector ID | Conditional | 7.5.5 | 0 |
| S101 Transparent Container | Mandatory | 7.5.6 | 0 |
| PDN GW PMIP GRE Tunnel Info | Conditional | 7.5.9 | 0 |
| S103 GRE Tunnel Info | Conditional | 7.5.10 | 0 |
| S103 HSGW IP Address | Conditional | 7.5.11 | 0 |
| Handover Indicator | Conditional | 7.5.7 | 0 |
| EUTRAN Round Trip Delay | Conditional | 7.5.14 | 0 |
| Unauthenticated IMSI | Conditional | 7.5.13 | 0 |
| Recovery | Conditional | 7.5.4 | 0 |
| Private Extension | Optional | 7.5.8 | VS |

The HRPD Sector ID parameter shall be included if this message is being sent from the MME to the HRPD access node in case of handover from E-UTRAN to HRPD.

If an HRPD message is being tunnelled between an MME and an HRPD access node, the S101 Transparent Container shall contain the HRPD message.

If the MME receives the EUTRAN Round Trip Delay Estimation Info IE in a message from the eNodeB, the MME shall copy that round trip delay estimation value into the EUTRAN Round Trip Delay parameter and shall include the EUTRAN Round Trip Delay parameter in this message.

If an E-UTRAN message is being tunnelled between an MME and an HRPD access node, the S101 Transparent Container shall contain the E-UTRAN message.

If the Direct Transfer Request message is sent from the MME to the HRPD AN and the MME has the PDN GW IP Address and the PDN GW GRE Key for a PDN Connection, the PDN GW PMIP GRE Tunnel Info IE shall be included when the MME receives CDMA2000 HO Required Indication from the eNodeB, see 3GPP TS 36.413 [12]. The PDN GW PMIP GRE Tunnel Info shall include the PDN Identity and the PDN GW GRE Key for the PDN connection. For each PDN Connection of the UE, there shall be a PDN GW PMIP GRE Tunnel Info Information Element included in the message. The Handover Indicator shall indicate Handover Required in this case. For each PDN GW PMIP GRE Tunnel of the UE, there shall be a PDN GW PMIP GRE Tunnel Info Information Element included in the message.

If the Handover Indicator IE indicates HO Ready during optimized active handover from E-UTRAN to HRPD, the S101 Transparent Container shall contain the HRPD message (=HRPD TCA message). If data forwarding applies, the S103 GRE Tunnel Info IE shall be included. The S103 GRE Tunnel Info IE shall include the PDN Identity and the HSGW GRE Key for a PDN connection. The S103 HSGW IP Address IE shall also be included in this case in the message but only one occurrence. For each PDN connection of the UE which requires data forwarding towards the HSGW, there shall be a S103 GRE Tunnel Info Information Element included in the message.

The Handover Indicator parameter shall be included, if the encapsulated message being carried will cause the UE to leave the source system and tune its radio to the target system. It shall also be included for the case of LTE to HRPD handover, if a Direct Transfer Request message is sent from the MME to the HRPD AN, the MME shall include a Handover Required indication in the Handover Indicator IE, if a Handover Required was received by the MME from the eNodeB.

If the node is contacting its peer for the first time or if the node has restarted recently and the new Restart Counter value has not yet been indicated to the peer, the Recovery IE shall be included.

If the Handover is for an emergency attached UE and the IMSI is available but not authenticated, then unauthenticated IMSI IE shall be included which shall contain the unauthenticated IMSI of the UE.

### 7.3.3 Direct Transfer Response message

The message shall be sent from an MME or HRPD access node to its peer HRPD access node or MME as a response to a Direct Transfer Request.

One of the IEs Session ID or Session ID2 but not both shall be included in the message.

Table 7.3.3-1 specifies the information elements included in the Direct Transfer Response message.

Table 7.3.3-1: Information Elements in a Direct Transfer Response message

|  |  |  |  |
| --- | --- | --- | --- |
| Information elements | Presence Requirement | Reference | Instance |
| Session ID | Conditional | 7.5.2 | 0 |
| Session ID2 | Conditional | 7.5.2A | 0 |
| Cause | Mandatory | 7.5.3 | 0 |
| Recovery | Optional | 7.5.4 | 0 |
| Private Extension | Optional | 7.5.8 | VS |

The Cause value indicates that the encapsulated message was received. Possible Cause values are:

- "Request Accepted".

- "System failure".

- "Mandatory IE incorrect".

- "Mandatory IE missing".

- "Invalid message format".

- "Conditional IE missing".

'No resources available' indicates that not enough resources are available within the receiving system.

### 7.3.4 Notification Request message

A Notification Request message shall be sent from an MME or HRPD access node to its peer HRPD access node or MME to notify its peer of a fact or event.

One of the IEs Session ID or Session ID2 but not both shall be included in the message.

Table 7.3.4-1 specifies the information elements included in the Notification Request message.

Table 7.3.4-1: Information Elements in a Notification Request

|  |  |  |  |
| --- | --- | --- | --- |
| Information elements | Presence Requirement | Reference | Instance |
| Session ID | Conditional | 7.5.2 | 0 |
| Session ID2 | Conditional | 7.5.2A | 0 |
| Handover Indicator | Conditional | 7.5.7 | 0 |
| Recovery | Conditional | 7.5.4 | 0 |
| Private Extension | Optional | 7.5.8 | VS |

The Handover Indicator information element (=HO Complete) shall be included if the sending system needs to notify the receiving system of the completion of a handover.

The Handover Indicator information element (=Redirection) shall be included if the sending system needs to notify the receiving system of the S101 tunnel end point redirection.

The optional Private Extension contains vendor or operator specific information.

If the Handover Indicator IE (= Redirection) and the node is contacting its peer for the first time or if the node has restarted recently and the new Restart Counter value has not yet been indicated to the peer , the Recovery IE shall be included.

### 7.3.5 Notification Response message

A Notification Response message shall be sent from an MME or HRPD access node to its peer HRPD access node or MME to acknowledge receipt of a Notification Request message.

One of the IEs Session ID or Session ID2 but not both shall be included in the message.

Table 7.3.5-1 specifies the information elements included in the Notification Response message.

Table 7.3.5-1: Information Elements in a Notification Response message

|  |  |  |  |
| --- | --- | --- | --- |
| Information elements | Presence Requirement | Reference | Instance |
| Session ID | Conditional | 7.5.2 | 0 |
| Session ID2 | Conditional | 7.5.2A | 0 |
| Cause | Mandatory | 7.5.3 | 0 |
| Recovery | Optional | 7.5.4 | 0 |
| Private Extension | Optional | 7.5.8 | VS |

If the MME or HRPD access node receives a Notification Response with a Cause value other than 'Notification Accepted', it should note and log the event and response.

Possible Cause values are:

- "Notification Accepted".

- "System failure".

- "Mandatory IE incorrect".

- "Mandatory IE missing".

- "Conditional IE missing".

- "Invalid message format".

## 7.4 Reliable Delivery of Signalling Messages

For the S101 interface protocol, the reliable delivery of signalling messages shall have the same handling as GTPv2-C. See 3GPP TS 29.274 [6] but with S101 node replacing GTPv2-C node as appropriate.

For certain types of messages, i.e. Direct Transfer messages, retransmission at this layer level would be harmful to the session so for Direct Transfer messages retransmissions shall not be allowed and their N3-REQUESTS value shall be set to one, i.e. message is only sent once.

## 7.5 Information Elements

### 7.5.1 Information Element Assignments

An S101 message may contain several information elements. The TLIV (Type, Length, Instance, Value) encoding format shall be used for all S101 information elements. See TS 29.274 [6] subclause 8.2 for the general encoding of the IEs.

Within information elements, certain fields may be described as spare. These bits shall be transmitted with the value defined for them. To allow for future features, the receiver shall not evaluate these bits.

Table 7.5-1: Information Elements

| IE Type Value | Information Element | Comment / Reference | Number of Fixed Octets |
| --- | --- | --- | --- |
| 1 | Session ID | Variable Length / 7.5.2 | Not Applicaple |
| 2 | Cause | Variable Length / 7.5.3 | Not Applicaple |
| 3 | Recovery | Variable Length / 7.5.4 | Not Applicaple |
| 4 | HRPD Sector ID | Fixed Length / 7.5.5 | 16 |
| 5 | S101 Transparent Container | Variable Length / 7.5.6 | Not Applicaple |
| 6 | Handover Indicator | Fixed Length / 7.5.7 | 1 |
| 7 | PDN GW PMIP GRE Tunnel Info | Variable Length / 7.5.9 | Not Applicaple |
| 8 | S103 GRE Tunnel Info | Variable Length / 7.5.10 | Not Applicaple |
| 9 | S103 HSGW IP Address | Variable Length / 7.5.11 | Not Applicaple |
| 10 | Reserved (NOTE 3) |  |  |
| 11 See NOTE 1 | Session ID2 | Variable Length / 7.5.2A | Not Applicaple |
| 12 | Unauthenticated IMSI | Variable Length / 7.5.13 | Not Applicaple |
| 13 | EUTRAN Round Trip Delay | Variable Length / 7.5.14 | Not Applicaple |
| 14-34 | For future use. Shall not be sent. If received, shall be treated as an Unknown IE. |  |  |
| 35-50 | Reserved for the S121 interface | 7A |  |
| 51-70 | Reserved for Sv interface. Shall not be sent. If received, shall be treated as an Unknown IE. | 3GPP TS 29.280 [14] | 3GPP TS 29.280 [14] |
| 71-254 | Reserved for GTPv2-C. Shall not be sent. If received, shall be treated as an Unknown IE. | 3GPP TS 29.274 [6] | 3GPP TS 29.274 [6] |
| 255 | Private Extension | 7.5.8 | 3GPP TS 29.274 [6] |
| NOTE 1: Although Session ID2 is encoded as per MEI IE in 3GPP TS 29.274 [6], the IE type value used is as defined here, i.e. not 75.  NOTE 2: The size of the TLI (Type, Length and Instance) fields, i.e "4" octets, has been subtracted from the number of the fixed octets of the "Fixed Length" and "Extendable" IEs.  NOTE 3: This value was allocated in an earlier version of the protocol and shall not be used. | | | |

### 7.5.2 Session ID

For the S101 interface, the Session ID Information Element is conditional for all S101 messages apart from the path management messages and, if present, shall always be the first IE following the S101 Header.

The IMSI IE shall be used for the parameter Session ID for a UE with an authenticated IMSI. The Session ID IE shall be encoded as per the International Mobile Station Identity information element, as defined in 3GPP TS 29.274 [6].

### 7.5.2A Session ID2

For emergency attached UEs which do not have an IMSI or have an IMSI but not one authenticated by the network, the MEI IE shall be used as the Session ID2, i.e. using the IMEI as the Session ID. The Session ID2 IE is conditional and if present, shall always be the first IE following the S101 Header.

In this case, the Session ID2 IE shall be encoded as per the Mobile Equipment Identity Type IE, as defined in 3GPP TS 29.274 [6].

### 7.5.3 Cause

In a response, the Cause Value shall indicate the acceptance or the rejection of the corresponding request. The Cause value shall be included in the response message.

"Request accepted" shall be returned when an MME or an HRPD Access has accepted a Direct Transfer request.

"Notification accepted" shall be returned when an MME or an HRPD Access has accepted a notification.

"No memory available" shall indicate that the MME or an HRPD Access does not have enough memory to use.

"System failure" shall indicate that a generic permanent error condition has occurred.

"Invalid message format", "Mandatory IE incorrect", "Mandatory IE missing" and "Conditional IE missing" shall indicate protocol errors as described in the section on Error handling.

Refer to 3GPP TS 29.274 [6] for the encoding of this Information Element.

Table 7.5.3-1 Cause Values used on the S101 Interface

|  |  |  |
| --- | --- | --- |
| Message Type | Cause value  (decimal) | Meaning |
|  | 0 | Reserved. Shall not be sent and if received the Cause shall be treated as an invalid IE |
| Request |  |  |
| 1-15 | Spare. This value range is reserved for Cause values in a request message |
| Acceptance Response | 16 | Request accepted |
| 17 | Request accepted partially |
| 18 | Notification accepted |
| 19-63 | Spare. This value range is reserved for Cause values in acceptance response message |
| Rejection Response | 64 | Context Non Existent/Found |
| 65 | Invalid Message Format |
| 66 | Spare |
| 67 | Invalid length |
| 68 | Service not supported |
| 69 | Mandatory IE incorrect |
| 70 | Mandatory IE missing |
| 71 | Reserved (See NOTE 1.) |
| 72 | System failure |
| 73 | No resources available |
| 74 | No memory available |
| 75-102 | Spare |
| 103 | Conditional IE missing |
| 104-255 | Spare. This value range is reserved for Cause values in rejection response message |
| NOTE 1: This value was allocated in an earlier version of the specification. | | |

NOTE: In the first release of the present document the value of the length field of this IE is 1 for cause values without "offending IE", and 4 + the length of the offending IE for those including it. In future releases of the specification additional octets may be specified. The legacy receiving entity simply ignores the unknown octets and values in the spare bits.

### 7.5.4 Recovery

The Recovery information element shall indicate if the peer MME or HRPD Access has restarted. Refer to 3GPP TS 29.274 [6] for the encoding of this Information Element.

### 7.5.5 HRPD Sector ID

The HRPD Sector ID information element shall provide a reference in the target system that can be used to create a unique mapping to an HRPD Access or MME that is appropriate to operate as the peer entity for an S101 interface tunnel.

The HRPD Sector Identifier is defined in 3GPP2 C.S0024-B [7] section 13.9.

The E-UTRAN Access makes the HRPD Sector ID available by provisioning this in the E-UTRAN Access equipment.

Table 7.5.5-1: HRPD Sector ID IE

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | Bits | | | | | | | |  |
|  | Octets | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |  |
|  | 1 | Type = 4 | | | | | | | |  |
|  | 2 to 3 | Length = 16 | | | | | | | |  |
|  | 4 | Spare | | | | Instance | | | |  |
|  | 5 to 20 | HRPD Sector Identifier | | | | | | | |  |

### 7.5.6 S101 Transparent Container

The S101 Transparent Container information element shall contain an encapsulated HRPD message or an encapsulated E-UTRAN message that is either generated by the UE and is being transferred to the MME or HRPD access, or is generated by the MME or HRPD access and is being transferred to the UE. It is variable in length and shall always be an integral number of octets. The highest numbered octet shall be filled, if necessary, with extra bits set to '0' in the low order bit positions to create an integral number of octets.

Table 7.5.6-1: S101 Transparent Container IE

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | Bits | | | | | | | |  |
|  | Octets | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |  |
|  | 1 | Type = 5 | | | | | | | |  |
|  | 2 to 3 | Length = n | | | | | | | |  |
|  | 4 | Spare | | | | Instance | | | |  |
|  | 5 to (n+4) | S101 Transparent Container | | | | | | | |  |

The format of an encapsulated E-UTRAN message is defined in 3GPP TS 24.301 [10].

The format of the encapsulated HRPD messages is defined in 3GPP2 C.S0087-0 [9].

### 7.5.7 Handover Indicator

The Handover Indicator information element shall indicate the status of the Handover to the receiving system as a result of the encapsulated message carried in an S101 Transparent Container message.

Table 7.5.7-1: Handover Indicator IE

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | Bits | | | | | | | |  |
|  | Octets | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |  |
|  | 1 | Type = 6 | | | | | | | |  |
|  | 2 to 3 | Length = 1 | | | | | | | |  |
|  | 4 | Spare | | | | Instance | | | |  |
|  | 5 | Handover Indicator | | | | | | | |  |

Table 7.5.7-2: Handover Indicator

|  |  |
| --- | --- |
| Handover Indicator (Decimal) | Meaning |
| 0 | Not Used |
| 1 | HO Ready |
| 2 | HO Failure |
| 3 | HO Complete |
| 4 | Redirection |
| 5 | HO Required |
| All Others | Spare |

### 7.5.8 Private Extension

The Private Extension information element shall contain vendor specific information. Refer to 3GPP TS 29.274 [6] for the encoding of this Information Element.

### 7.5.9 PDN GW PMIP GRE Tunnel Info

The PDN GW PMIP GRE Tunnel Info shall contain: the PDN Identity, i.e. APN, the PDN GW Address and the PDN GW GRE Key, which identifies a PMIP GRE tunnel towards a PDN GW.

Table 7.5.9-1: PDN GW PMIP GRE Tunnel Info IE

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | Bits | | | | | | | |  |
|  | Octets | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |  |
|  | 1 | Type = 7 | | | | | | | |  |
|  | 2 to 3 | Length = n | | | | | | | |  |
|  | 4 | Spare | | | | Instance | | | |  |
|  | 5 | PDN Identity Length = m | | | | | | | |  |
|  | 6 to (m+5) | PDN Identity (=APN) | | | | | | | |  |
|  | m+6 | PDN GW IP Address Length = k | | | | | | | |  |
|  | (m+7) to (k+m+6) | PDN GW IP Address | | | | | | | |  |
|  | (k+m+7) to (k+m+10) | PDN GW GRE Key | | | | | | | |  |

### 7.5.10 S103 GRE Tunnel Info

The S103 GRE Tunnel Info IE shall contain the PDN Identity and HSGW GRE Key, which identifies a GRE tunnel towards a HSGW.

Table 7.5.10-1: S103 GRE Tunnel Info IE

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | Bits | | | | | | | |  |
|  | Octets | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |  |
|  | 1 | Type = 8 | | | | | | | |  |
|  | 2 to 3 | Length = n | | | | | | | |  |
|  | 4 | Spare | | | | Instance | | | |  |
|  | 5 | PDN Identity Length = m | | | | | | | |  |
|  | 6 to (m+5) | PDN Identity (=APN) | | | | | | | |  |
|  | (m+6) to (m+9) | HSGW GRE Key | | | | | | | |  |

### 7.5.11 S103 HSGW IP Address

The S103 HSGW IP Address IE shall contain S103 HSGW IP Address.

Table 7.5.11-1: S103 HSGW IP Address

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | Bits | | | | | | | |  |
|  | Octets | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |  |
|  | 1 | Type = 9 | | | | | | | |  |
|  | 2 to 3 | Length = n | | | | | | | |  |
|  | 4 | Spare | | | | Instance | | | |  |
|  | 5 to (n+4) | S103 HSGW IP Address | | | | | | | |  |

### 7.5.12 Void

### 7.5.13 Unauthenticated IMSI

The unauthenticated IMSI IE includes the IMSI of UE when UE is emergency attached and contains an IMSI which is not authenticated.

Table 7.5.13-1: Unauthenticated IMSI IE

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | Bits | | | | | | | |  |
|  | Octets | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |  |
|  | 1 | Type = 12 (decimal) | | | | | | | |  |
|  | 2 to 3 | Length = n | | | | | | | |  |
|  | 4 | Spare | | | | Instance | | | |  |
|  | 5 | Number digit 2 | | | | Number digit 1 | | | |  |
|  | 6 | Number digit 4 | | | | Number digit 3 | | | |  |
|  | … | … | | | | … | | | |  |
|  | n+4 | Number digit m | | | | Number digit m-1 | | | |  |

Octets 5 to (n+4) represent the IMSI value in international number format as described in ITU-T Rec E.164 [25], encoded as TBCD digits, i.e. digits from 0 through 9 are encoded "0000" to "1001". When there is an odd number of digits, bits 8 to 5 of the last octet are encoded with the filler "1111". The maximum number of digits is 15.

### 7.5.14 EUTRAN Round Trip Delay

The EUTRAN Round Trip Delay information element provides an estimate of the radio round trip delay from the UE to the serving eNB.

Table 7.5.14-1: EUTRAN Round Trip Delay IE

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | Bits | | | | | | | |  |
|  | Octets | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |  |
|  | 1 | Type = 13 | | | | | | | |  |
|  | 2 to 3 | Length = n | | | | | | | |  |
|  | 4 | Spare | | | | Instance | | | |  |
|  | 5 to 6 | EUTRAN Round Trip Delay Estimation Info -  Integer (0..2047) as specified in 3GPP TS 36.413 [12] | | | | | | | |  |

# 7A S121 Messages and Message Formats

## 7A.1 Introduction

This section is divided into path management which defines the general messages for the pre-configured tunnel and a section for the specific messages used for information transfer over the control plane.

Table 7A.1 specifies GTPv2-C message types that are used across the S121 interface.

Table 7A.1: Message types for S121

| Message Type value (Decimal) | Message | Reference |
| --- | --- | --- |
| 0 | Reserved | 3GPP TS 29.274 [6] |
| 1 | Echo Request | 3GPP TS 29.274 [6] |
| 2 | Echo Response | 3GPP TS 29.274 [6] |
| 3 | Version Not Supported Indication | 3GPP TS 29.274 [6] |
| 4-16 | Reserved for S101 interface | 7 |
| 17 | RIM Information Transfer | 7A.3.1 |
| 18-24 | For future S121 interface use |  |
| 25 to 31 | Reserved for Sv interface | 3GPP TS 29.280 [14] |
| 32-239 | Reserved for GTPv2-C spec | 3GPP TS 29.274 [6] |
| 240-247 | Reserved for Sv interface | 3GPP TS 29.280 [14] |
| 248-255 | Reserved for GTPv2-C spec | 3GPP TS 29.274 [6] |

## 7A.2 Path Management Messages

### 7A.2.1 Introduction

The path from the MME to the non-3GPP Access Network operationally requires management capabilities. The following GTPv2-C messages support path management for the S121 interface:

- Echo Request

- Echo Response

- Version Not Supported Indication

These messages are defined for GTPv2-C and the handling and definition shall also be as defined in GTPv2-C, see 3GPP TS 29.274 [6].

### 7A.2.2 Echo Request message

An MME or an HRPD access node may send an Echo Request to find out if the peer HRPD access node or MME is alive (see subclause 9.2). When and how often an Echo Request message may be sent is implementation specific but an Echo Request shall not be sent more often than every 60 s on each path.

An MME or an HRPD access node shall be prepared to receive an Echo Request at any time and it shall reply with an Echo Response. The optional Private Extension contains vendor or operator specific information.

3GPP TS 29.274 [6] specifies the information elements included in the Echo Request message.

### 7A.2.3 Echo Response message

The message shall be sent as a response to a received Echo Request.

3GPP TS 29.274 [6] specifies the information elements included in the Echo Response message.

The Recovery information element contains the local Restart Counter (see subclause 9.3) value for the node that sends the Echo Response message.

In this release of the specification, the MME and HRPD access node do not need to determine whether the peer node has restarted or not, i.e. they may ignore the Recovery information element.

The optional Private Extension contains vendor or operator specific information.

### 7A.2.4 Version Not Supported Indication message

This message contains only the S121 header and indicates the latest S121 version that the MME or HRPD access node entity on the identified UDP/IP address can support (see 3GPP TS 29.274 [6] subclause 7.1.3).

3GPP TS 29.274 [6] specifies the detailed handling and information elements included in the Version Not Supported Indication message.

## 7A.3 S121 Messages

### 7A.3.1 Introduction

The following message is used to support RIM information exchange between the MME and the HRPD Access Network:

- RIM Information Transfer

### 7A.3.2 RIM Information Transfer

The RIM Information Transfer message shall be sent on the S121 interface between MME and the HRPD Access Network to transfer RIM information between an eNodeB and the HRPD Access Network (see 3GPP TS 23.402 [2]).

For handling of protocol errors the RIM Information Transfer message is treated as a Response message.

Table 7A.3.2-1 specifies the information elements included in the RIM Information Transfer message.

Table 7A.3.2-1: Information Elements in a RIM Information Transfer

|  |  |  |  |
| --- | --- | --- | --- |
| Information elements | Presence Requirement | Reference | Instance |
| S121 Transparent Container | Mandatory | 7A.5.2 | 0 |
| RIM Routing Address | Mandatory | 7A.5.3 | 0 |
| Private Extension | Optional | 7A.5.4 | VS |

The S121 Transparent Container information element shall contain encapsulated RIM Information exchanged between the MME and the HRPD Access Network, i.e. all information elements from the BSSGP RIM PDU, starting from and including the BSSGP "PDU type" (see 3GPP TS 48.018 [15]).

The RIM Routing Address IE shall identify the destination RAN node where the RIM information needs to be sent to. It shall contain:

- an eNodeB ID when the message is sent from the HRPD Access Network to the MME;

- an HRPD Sector ID when the message is sent from the MME to the HRPD Access Network.

## 7A.4 Reliable Delivery of Signalling Messages

For the S121 interface protocol, the reliable delivery of signalling messages shall have the same handling as GTPv2-C. See 3GPP TS 29.274 [6] but with S121 node replacing GTPv2-C node as appropriate.

NOTE: In this release of the specification, the MME and HRPD access node do not need to and can not determine whether the peer node has received the RIM Information Transfer message.

## 7A.5 Information Elements

### 7A.5.1 Information Element Assignments

An S121 message may contain several information elements. The TLIV (Type, Length, Instance, Value) encoding format shall be used for all S121 information elements. See TS 29.274 [6] subclause 8.2 for the general encoding of the IEs.

Within information elements, certain fields may be described as spare. These bits shall be transmitted with the value defined for them. To allow for future features, the receiver shall not evaluate these bits.

Table 7A.5-1: Information Elements

| IE Type Value | Information Element | Comment / Reference | Number of Fixed Octets |
| --- | --- | --- | --- |
| 0 | Reserved | 3GPP TS 29.274 [3] | 3GPP TS 29.274 [3] |
| 1-3 | Reserved for GTPv2-C. | 3GPP TS 29.274 [3] | 3GPP TS 29.274 [3] |
| 4-34 | Reserved for S101 interface |  |  |
| 35 | S121 Transparent Container | Variable Length / 7A.5.2 | Not Applicaple |
| 36 | RIM Routing Address | Variable Length / 7A.5.3 | Not Applicaple |
| 37-50 | For future use for the S121 interface. |  |  |
| 51-70 | Reserved for Sv interface. | 3GPP TS 29.280 [14] | 3GPP TS 29.280 [14] |
| 71-254 | Reserved for GTPv2-C. | 3GPP TS 29.274 [6] | 3GPP TS 29.274 [6] |
| 255 | Private Extension | 7A.5.4 | 3GPP TS 29.274 [6] |

### 7A.5.2 S121 Transparent Container

The S121 Transparent Container information element shall contain encapsulated RIM information, i.e. a transparent copy of the BSSGP RIM PDU as specified in 3GPP TS 48.018 [15].

It is variable in length and shall always be an integral number of octets. The highest numbered octet shall be filled, if necessary, with extra bits set to '0' in the low order bit positions to create an integral number of octets.

Table 7A.5.2-1: S121 Transparent Container IE

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | Bits | | | | | | | |  |
|  | Octets | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |  |
|  | 1 | Type = 35 | | | | | | | |  |
|  | 2 to 3 | Length = n | | | | | | | |  |
|  | 4 | Spare | | | | Instance | | | |  |
|  | 5 to (n+4) | S121 Transparent Container | | | | | | | |  |

### 7A.5.3 RIM Routing Address

The RIM Routing Address IE shall identify the destination RAN node to which the RIM Information needs to be sent to.

The RIM Routing Address information element is coded as depicted in Table 7A.5.3-1

Table 7A.5.3-1: RIM Routing Address IE

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | Bits | | | | | | | |  |
|  | Octets | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |  |
|  | 1 | Type = 36 | | | | | | | |  |
|  | 2 to 3 | Length = n | | | | | | | |  |
|  | 4 | Spare | | | | Instance | | | |  |
|  | 5 | Routing Address Type | | | | | | | |  |
|  | 6 to (n+4) | Routing Address | | | | | | | |  |

Routing Address Type values are specified in Table 7A.5.3-2.

Table 7A.5.3-2: Routing Address Type values

|  |  |
| --- | --- |
| Target Types | Values (Decimal) |
| Macro eNodeB ID | 0 |
| Home eNodeB ID | 1 |
| HRPD Sector Identifier | 2 |
| <spare> | 3 to 255 |

The Routing Address Type is either a Macro eNodeB ID or a Home eNodeB ID for RIM Information Transfer towards E-UTRAN. In this case the Routing Address field includes Macro or Home eNodeB ID as defined in Figure 8.51-2 and 8.51-3 of 3GPP TS 29.274 [6].

The Routing Address Type is HRPD Sector Identifier for RIM Information Transfer towards HRPD Access Network. In this case the Routing Address field includes HRPD Sector Identifier which is defined in 3GPP2 C.S0024-B [7] section 13.9.

### 7A.5.4 Private Extension

The Private Extension information element shall contain vendor specific information. Refer to 3GPP TS 29.274 [6] for the encoding of this Information Element.

# 8 Path Protocols

Path handling is specified in 3GPP TS 29.274 [6].

# 9 Error Handling

## 9.1 Protocol Errors

See 3GPP TS 29.274 [6] section 7.7 for the complete specification of protocol error handling.

## 9.2 Path Failure

See 3GPP TS 29.274 [6] for the complete specification of the path failure procedures.

## 9.3 Restoration and Recovery

See 3GPP TS 23.007 [8] for the complete specification of the restoration and recovery procedures.

# 10 Security provided to Communication over the S101/S121 Interface

Protection of communication over the S101 interfaces shall be provided according to security mechanisms defined in 3GPP TS 33.402 [11].

Protection of communication over the S121 interface shall be secured as described in clause 11 of 3GPP TS 33.402 [11].

# 11 IP - The Networking Technology used by S101/S121

## 11.1 IP Version

See 3GPP TS 29.274 [6] for the complete specification of the IP versions supported over the GTPv2-C like S101 and S121 reference points.

## 11.2 IP Fragmentation

See 3GPP TS 29.274 [6] for the complete specification of the fragmentation procedures used in S101 and S121.

# 12 S101 Parameters

## 12.1 General

The S101 interface system parameters defined and their recommended values shall not be fixed but it shall be possible to configure them as described in 3GPP TS 29.274 [6].

## 12.2 Timers

See 3GPP TS 29.274 [6] for the complete specification of the timers and their recommended values used over S101, e.g. response time to wait for a request message.

## 12.3 Others

See 3GPP TS 29.274 [6] for the complete specification of the maximum number of retry attempts to resend a request message used over S101.

# 13 S103 Interface Specification

## 13.1 Introduction

The S103 interface is defined between the Serving GW and HSGW and supports the forwarding of DL data during mobility from E-UTRAN to HRPD access networks. Signalling procedures on the S101 interface, documented in 3GPP TS 23.402 [2], are used to set up tunnels on the S103 user plane interface.

## 13.2 S103 Interface

The S103 interface protocol stack and signalling requirements are specified in 3GPP TS 23.402 [2]. The S103 interface shall use Generic Routing Encapsulation as specified in IETF RFC 2784 [4] including the Key and Sequence Number Extensions to GRE in IETF RFC 2890 [5]. The Key Field value of each GRE packet header shall uniquely identify the UE-PDN connection.

Annex A (informative):  
Change history

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Date** | **TSG #** | **TSG Doc.** | **CR** | **Rev** | **Subject/Comment** | **New** |
| 2008-09 | CT#41 | CP-080477 |  |  | V2.0.0 approved in CT#41 | 8.0.0 |
| 2008-12 | CT#42 | CP-080693 | 0001 | 1 | Adding references to the GTP-C specification for S101Revised from agreed version in C4-082683 | 8.1.0 |
|  |  |  | 0003 |  | Private Extension IE in the Direct Transfer Request |  |
|  |  |  | 0005 |  | Path Management Messages and Version Not Supported Cause |  |
|  |  |  | 0006 | 2 | Reliable Delivery of Signalling MessagesWas agreed version of C4-082756 |  |
|  |  |  | 0008 | 3 | GRE Tunnel KeysRevised from agreed version C4-083145 |  |
|  |  |  | 0009 | 2 | S101 Sector ID |  |
|  |  |  | 0011 |  | S101 Session ID |  |
|  |  |  | 0012 | 2 | S101 interface messages and UEs |  |
|  |  |  | 0013 |  | Removal of APN Editor's Notes |  |
|  |  |  | 0014 |  | Sorting of Type Fields |  |
|  |  |  | 0015 |  | DTR and NR IE restriction |  |
|  |  |  | 0018 |  | S Bit Removal |  |
|  |  |  | 0019 |  | Handover Required Indication from the MME |  |
|  |  |  | 0021 |  | HRPD air interface reference specification correction |  |
|  |  |  | 0022 | 1 | Recovery IE over S101 |  |
| 2009-03 | CT#43 | CP-090053 | 0023 |  | Editorial clean-up of S101 | 8.2.0 |
|  |  |  | 0024 | 1 | Making Session ID Generic and Adding Instance Value to the Messages |  |
| 2009-09 | CT#45 | CP-090530 | 0031 | 1 | Sequence Number to be 3 Octets and Removal of Header Extension | 8.3.0 |
| 2009-09 | CT#45 | CP-090562 | 0028 | 6 | Emergency Session Id | 9.0.0 |
|  |  | CP-090562 | 0030 | 2 | Unauthenticated IMSI for emergency in S101 |  |
| 2009-12 | CT#46 | CP-090764 | 0036 |  | GRE Keys CR Misimplementation | 9.1.0 |
|  |  |  | 0033 |  | Adding the RTD information in UPLINK CDMA2000 TUNNELING |  |
| 2010-03 | CT#47 | CP-100019 | 0038 | 1 | Reference for HRPD Sector ID | 9.2.0 |
|  |  | CP-100019 | 0041 | 1 | Correcting Cause values for S101 |  |
|  |  | CP-100039 | 0039 | 1 | EUTRAN Round Trip Delay Estimation Info |  |
| 2010-06 | CT#48 | CP-100263 | 0043 |  | Correction to 3GPP2 references | 9.3.0 |
| 2010-07 |  |  |  |  | Editorial correction to previous entry in history table | 9.3.1 |
| 2010-09 | CT#49 | CP-100451 | 0044 | 1 | Reference to GTPv2 | 9.4.0 |
| 2011-03 | CT#51 | CP-110071 | 0045 |  | Correct the endpoint node of S103 tunnel | 10.0.0 |
| 2011-06 | CT#52 | CP-110355 | 0051 | 1 | IE Type Extandable Corrections | 10.1.0 |
| 2011-09 | CT#53 | CP-110567 | 0052 | 1 | Conditional IE missing cause value | 10.2.0 |
| 2011-12 | CT#54 | CP-110790 | 0056 | 2 | Handling of Extendable IEs | 10.3.0 |
| 2012-09 | - | - | - | - | Automatic update from previous version 10.3.0 (MCC) | 11.0.0 |
| 2013-09 | CT#61 | CP-130470 | 0057 | 1 | Path management messages over the S121 reference point | 12.0.0 |
|  |  |  | 0062 | 1 | Definition of S121 Messages and Message Formats |  |
|  |  |  | 0058 | 1 | Security requirements for the S121 reference point |  |
|  |  |  | 0059 | 1 | Networking Technology for the S121 reference point |  |
|  |  |  | 0060 | 1 | Update scope to cover the S121 reference point |  |
|  |  |  | 0061 | 1 | Definition of S121 Message Header |  |
|  |  |  | 0063 | 1 | GTP-C message types for rSRVCC |  |
| 2013-12 | CT#62 | CP-130635 | 0064 | 1 | HRPD Sector ID definition | 12.1.0 |
| 2014-06 | CT#64 | CP-140250 | 0065 | - | HRPD Sector ID definition | 12.2.0 |
|  |  | CP-140261 | 0066 | 1 | Version Not Supported Indication |  |
|  |  | CP-140261 | 0067 | 1 | Correct the handling of Restart Counter |  |
| 2014-12 | CT#66 | CP-140972 | 0068 | 1 | Removal of Optimized HO procedure from HRPD to EUTRAN | 12.3.0 |
| 2015-12 | CT#70 | - | - | - | Update to Rel-13 version (MCC) | 13.0.0 |
| 2017-03 | CT#75 | - | - | - | Update to Rel-14 version (MCC) | 14.0.0 |
| 2018-06 | CT#80 | - | - | - | Update to Rel-15 version (MCC) | 15.0.0 |
| 2020-07 | CT#88e | - | - | - | Update to Rel-16 version (MCC) | 16.0.0 |