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3rd Generation Partnership Project;

Technical Specification Group Services and System Aspects;

Telecommunication management;

Subscriber and equipment trace;

Trace data definition and management

(Release 17)

** 

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# 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:

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where:

x the first digit:

1 presented to TSG for information;

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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.

# Introduction

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

TS 32.421: "Subscriber and equipment trace; Trace concepts and requirements";

TS 32.422: "Subscriber and equipment trace; Trace control and configuration management ";

**TS 32.423: "Subscriber and equipment trace; Trace data definition and management";**

Subscriber and MS Trace provide very detailed information at call level on one or more specific mobile(s). This data is an additional source of information to Performance Measurements and allows going further in monitoring and optimisation operations.

Contrary to Performance Measurements, which are a permanent source of information, Trace is activated on user demand for a limited period of time for specific analysis purpose

Trace plays a major role in activities such as determination of the root cause of a malfunctioning mobile, advanced troubleshooting, optimisation of resource usage and quality, RF coverage control and capacity improvement, dropped call analysis, Core Network and TRAN end to end procedure validation.

The capability to log data on any interface at call level for a specific user (e.g. IMSI or SUPI) or mobile type (e.g. IMEI or IMEISV) allows getting information which cannot be deduced from Performance Measurements such as perception of end-user QoS during his call (e.g. requested QoS vs. provided QoS), correlation between protocol messages and RF measurements, or interoperability with specific mobile vendors.

Moreover, Performance Measurements provide values aggregated on an observation period, Subscriber and Equipment Trace give instantaneous values for a specific event (e.g. call, location update, etc.).

If Performance Measurements are mandatory for daily operations, future network planning and primary trouble shooting, Subscriber and MS Trace is the easy way to go deeper into investigation and network optimisation.

In order to produce this data, Subscriber and MS trace are carried out in the NEs, which comprise the network. The data can then be transferred to an external system (e.g. an Operations System (OS) in TMN terminology, for further evaluation).

# 1 Scope

The present document describes Trace data definition and management. It covers the trace records content, their format and transfer across UMTS networks, EPS networks or 5GS networks. GSM Trace is outside of the scope of this specification..

The present document also describes the data definition for Minimization of Drive Tests (MDT) across 3GPP networks.

The objectives of the present document are:

- To provide the descriptions for a standard set of Trace and MDT data;

- To define the common format of trace and MDT records; and

- To define a method for the reporting of Trace and MDT results across the management interfaces.

Clause 4 details the various Trace records content, Clause 5 defines GPB trace format for NR, Annex A provides Trace and MDT report file format, Annex B provides the trace report file conventions and transfer procedure, Annex C provides the trace reporting functional architecture and Annex D provides some trace and MDT files examples, Annex G provides normative GPB trace record schema and examples.

Trace and MDT concepts and requirements are covered in TS 32.421 [2] while Trace control and configuration management are described in 3GPP TS 32.422 [3].

The definition of Trace and MDT data is intended to result in comparability of Trace and MDT data produced in a multi-vendor wireless 3GPP networks.

The following is beyond the scope of the present document, and therefore the present document does not describe:

- Any notification mechanisms or IRPs for trace. Only file transfer mechanism is specified for trace data transfer;

- Any data compression mechanisms for trace data transfer;

- Any Trace capability limitations (e.g. maximum number of simultaneous traced mobiles for a given NE).

# 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 TS 32.101: "Telecommunication management; Principles and high level requirements".

[2] 3GPP TS 32.421: "Telecommunication management; Subscriber and equipment trace: Trace concepts and requirements."

[3] 3GPP TS 32.422: "Telecommunication management; Subscriber and equipment trace: Trace control and configuration management ".

[4] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[5] W3C Recommendation "Extensible Markup Language (XML) 1.0" (Second Edition, 6 October 2000) http://www.w3.org/TR/2000/REC-xml-20001006

[6] W3C Recommendation "Namespaces in XML" (14 January 1999)  
http://www.w3.org/TR/1999/REC-xml-names-19990114

[7] W3C Recommendation "XML Schema Part 0: Primer" (2 May 2001)  
http://www.w3.org/TR/2001/REC-xmlschema-0-20010502

[8] W3C Recommendation "XML Schema Part 1: Structures" (2 May 2001)  
http://www.w3.org/TR/2001/REC-xmlschema-1-20010502

[9] W3C Recommendation "XML Schema Part 2: Datatypes" (2 May 2001)  
http://www.w3.org/TR/2001/REC-xmlschema-2-20010502

[10] International Standard ISO 8601: 1988 (E) "Representations of dates and times" (1988-06-15)  
http://www.iso.ch/markete/8601.pdf

[11] 3GPP TS 32.300: "Telecommunication management; Configuration Management (CM); Name convention for Managed Objects".

[12] 3GPP TS 32.622: "Telecommunication management; Configuration Management (CM); Generic network resources Integration Reference Point (IRP): Network Resource Model (NRM)".

[13] 3GPP TS 29.274: "3GPP Evolved Packet System (EPS); Evolved General Packet Radio Service (GPRS) Tunnelling Protocol for Control plane (GTPv2-C); Stage 3".

[14] 3GPP TS 29.212: "Policy and Charging Control (PCC); Reference points".

[15] 3GPP TS 29.273: "Evolved Packet System (EPS); 3GPP EPS AAA interfaces".

[16] 3GPP TS 36.413: "Evolved Universal Terrestrial Radio Access Network (E-UTRAN); S1 Application Protocol (S1AP)".

[17] 3GPP TS 36.423 "Evolved Universal Terrestrial Radio Access Network (E-UTRAN); X2 Application Protocol (X2AP)".

[18] 3GPP TS 23.501: "System Architecture for the 5G System; Stage 2".

[19] 3GPP TS 23.502: "Procedures for the 5G System; Stage 2"

[20] 3GPP TS 38.300: "NR and NG-RAN Overall Description; Stage 2".

[21] 3GPP TS 38.331: "NR; Radio Resource Control (RRC); Protocol specification".

[22] 3GPP TS 38.401: "NG-RAN; Architecture Description".

[23] 3GPP TS 38.413: "NG-RAN; NG Application Protocol (NGAP)".

[24] 3GPP TS 38.423: "NG-RAN; Xn Application Protocol (XnAP)".

[25] Void

[26] 3GPP TS 38.473: "NG-RAN; F1 Application Protocol (F1AP)".

[27] 3GPP TS 24.501: "Non-Access-Stratum (NAS) protocol for 5G System (5GS); Stage 3".

[28] 3GPP TS 36.331: "Evolved Universal Terrestrial Radio Access (E-UTRA); Radio Resource Control (RRC); Protocol specification".

[29] 3GPP TS 23.107: "Quality of Service (QoS) concept and architecture".

[30] 3GPP TS 25.331: "Radio Resource Control (RRC); Protocol specification".

[31] 3GPP TS 36.314: "Evolved Universal Terrestrial Radio Access (E-UTRA); Layer 2 - Measurements".

[32] 3GPP TS 37.320: "Universal Terrestrial Radio Access (UTRA) and Evolved Universal Terrestrial Radio Access (E-UTRA); Radio measurement collection for Minimization of Drive Tests (MDT); Overall description; Stage 2".

[33] 3GPP TS 36.213: "Evolved Universal Terrestrial Radio Access (E-UTRA); Physical layer procedures".

[34] 3GPP TS 36.133: "Evolved Universal Terrestrial Radio Access (E-UTRA); Requirements for support of radio resource management".

[35] 3GPP TS 38.314: "NR; layer 2 measurements ".

[36] 3GPP TS 28.552: "Management and orchestration; 5G performance measurements".

[37] 3GPP TS 38.213: "NR; Physical layer procedures for control".

[38] 3GPP TS 36.214: "Evolved Universal Terrestrial Radio Access (E-UTRA); Physical layer; Measurements".

[39] 3GPP TS 32.425: "Telecommunication management; Performance Management (PM); Performance measurements Evolved Universal Terrestrial Radio Access Network (E-UTRAN)".

[40] IETF RFC 6455: "The WebSocket Procotol".

[41] IETF RFC 7692: "Compression Extensions for WebSocket".

[42] 3GPP TS 38.215: "NR; Physical layer measurements".

[43] 3GPP TS 28.532: "Management and orchestration; Generic management services".

[44] 3GPP TS 38.305: "NG Radio Access Network (NG-RAN); Stage 2 functional specification of User Equipment (UE) positioning in NG-RAN".

[45] Language Guide (Proto 3): <https://developers.google.com/protocol-buffers/docs/proto3>.

[46] 3GPP TS 37.483: "NG-RAN; E1 Application Protocol (E1AP)".

# 3 Definitions, symbols and abbreviations

## 3.1 Definitions

For the purposes of the present document, the terms and definitions given in 3GPP TS 32.421 [2], 3GPP TS 32.422 [3] , TS 23.501 [18], TS 38.300 [20], TS 38.401 [22], TS 37.320 [32] and the following apply.

**Minimum Level of detail**: Allows for retrieval of a decoded subset of the IEs contained in the signalling interface messages.

**Medium Level of detail**: Allows for retrieval of the decoded subset of the IEs contained in the signalling interface messages in the Minimum Level plus a selected set of decoded radio measurement IEs.

**Maximum Level of detail**: Allows for retrieval of signalling interface messages within the Trace Scope in encoded format.

## 3.2 Symbols

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

: Choice

: The XML element has a value part

: Sequence

•••

: Optional element

: Required element

**xxx**

**xxx**

1..∞

: Element named xxx  
 The maximum number of occurrence is 1

: Element named xxx  
 The maximum number of occurrence is unbounded

: Global element

## 3.3 Abbreviations

For the purposes of the present document, the abbreviations given in TR 21.905 [4], TS 32.101 [1], TS 23.501 [18], TS 38.300 [20] and TS 38.401 [22] and TS 37.320 [32] apply.

NSA Non Stand Alone

IDC In-Device Coexistence

# 4 Trace record contents

## 4.1 General

The trace reference, trace type and operation system identification are all provided on trace activation.   
Each record may contain an MSC Server, MGW, SGSN, GGSN, S-CSCF, P-CSCF, UTRAN, HSS, MME, Serving GW, E-UTRAN, AUSF, AMF, NEF, NRF, NSSF, PCF, SMF, SMSF, UDM, UPF, AF and , ng-eNB, gNB-CU-CP, gNB-CU-UP and gNB-DU event record. A key is included in the table indicating whether or not the field is mandatory.

The following table shows the template for trace record description for minimum and medium trace depth:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Interface name | Protocol name | IE name | Message name(s) | Trace depth | | Notes |
| **Min** | **Med** |
|  |  |  |  |  |  |  |

**Interface name**: Contains the name of the interface, where the IE is available.

**Protocol name**: Contains the protocol name on the interface, where the IE is available.

**IE name**: The name of the Information Element, which should be decoded.

**Message name(s):** The name of the message(s), where the IE is included.

**Trace depth**: Shows in which trace depth the IE should be recorded. It also classifies whether the IE is mandatory in the trace record or not (M, O or X: meaning described in the previous table)

|  |  |  |
| --- | --- | --- |
| **M** | Mandatory | This field must be in the trace record if it is available, i.e. if the message appears during the trace recording session and the IE is present in the message. |
| **O** | Optional | This field is optional and its support is a matter for agreement between equipment manufacturer and network operator. |
| **X** | Not applicable | This field is not required in this instance. |
| **CM** | Conditional Mandatory | This field must be in the trace record if it is available and the condition is met. |

NOTE: Any kind of comments related to the IE can be made here. Also this is the placeholder for referencing the relevant 3GPP specifications, which define the IE.

## 4.2 MSC Server Trace Record Content

The following table shows the trace record content for MSC Server.   
The trace record is the same for management based activation and for signalling based activation.  
For MSC Server, the Minimum level of detail shall be supported.

| Interface name | Prot.  name | IE name | Message name(s) | Trace depth | | Notes |
| --- | --- | --- | --- | --- | --- | --- |
| **Min** | **Med** |
| Iu, A | CC | Facility | ALERTING  CALL PROCEEDING  CONNECT  DISCONNECT  FACILITY  RELEASE  RELEASE COMPLETE  SETUP | M | M | TS 24.008  TS 24.080 |
| Bearer capability | CALL CONFIRMED  CALL PROCEEDING  EMERGENCY SETUP  MODIFY  MODIFY COMPLETE  MODIFY REJECT  SETUP | M | M | TS 24.008 |
| Cause | CALL CONFIRMED  CONGESTION CONTROL  DISCONNECT  HOLD REJECT  MODIFY REJECT  RELEASE  RELEASE COMPLETE  RETRIEVE REJECT  START DTMF REJECT  STATUS | M | M | TS 24.008 |
| Connected number | CONNECT | M | M | TS 24.008 |
| Calling party BCD number | SETUP | M | M | TS 24.008 |
| Called party BCD number | SETUP | M | M | TS 24.008 |
| Redirecting party BCD number | SETUP | M | M | TS 24.008 |
| Iu, A | MM | Reject cause | AUTHENTICATION FAILURE  CM SERVICE REJECT  ABORT  LOCATION UPDATING REJECT  MM STATUS | M | M | TS 24.008 |
| Location area identification | CM RE-ESTABLISHMENT REQUEST  LOCATION UPDATING ACCEPT  LOCATION UPDATING REQUEST  TMSI REALLOCATION COMMAND | M | M | TS 24.008 |
| Mobile identity | CM RE-ESTABLISHMENT REQUEST  CM SERVICE REQUEST  IDENTITY REQUEST  IDENTITY RESPONSE  IMSI DETACH INDICATION  LOCATION UPDATING ACCEPT  LOCATION UPDATING REQUEST  TMSI REALLOCATION COMMAND | M | M | TS 24.008 |
| CM service type | CM SERVICE REQUEST | M | M | TS 24.008 |
| Location updating type | LOCATION UPDATING REQUEST | M | M | TS 24.008 |
| Iu, A | SS | Facility | FACILITY  REGISTER  RELEASE COMPLETE | M | M | TS 24.008 |
| Cause | RELEASE COMPLETE | M | M | TS 24.008 |
| Iu, A | SMS | TP‑Originating‑Address | SMS‑DELIVER | M | M | TS 23.040 |
| TP‑Service‑Centre‑ Time‑Stamp | SMS‑DELIVER  SMS‑SUBMIT‑REPORT  SMS‑STATUS‑REPORT | M | M | TS 23.040 |
| TP‑Failure‑Cause | SMS‑DELIVER‑REPORT  SMS‑SUBMIT‑REPORT | M | M | TS 23.040 |
| TP‑Destination‑Address | SMS‑SUBMIT  SMS‑COMMAND | M | M | TS 23.040 |
| TP‑Recipient‑Address | SMS‑STATUS‑REPORT | M | M | TS 23.040 |
| A | BSSMAP | Channel Type | ASSIGNMENT REQUEST  HANDOVER REQUEST | M | M | TS 48.008 |
| Circuit | ASSIGNMENT REQUEST | M | M | TS 48.008 |
| Cell Identifier (Serving) | ASSIGNMENT COMPLETE  HANDOVER REQUEST  HANDOVER COMMAND  HANDOVER PERFORMED  PERFORM LOCATION REQUEST | M | M | TS 48.008 |
| Chosen Channel | ASSIGNMENT COMPLETE  HANDOVER REQUEST ACKNOWLEDGE  HANDOVER PERFORMED | M | M | TS 48.008 |
| Speech version (chosen) | ASSIGNMENT COMPLETE  HANDOVER REQUEST  HANDOVER REQUIRED  HANDOVER REQUEST ACKNOWLEDGE  HANDOVER PERFORMED | M | M | TS 48.008 |
| Cause | ASSIGNMENT FAILURE  HANDOVER REQUEST  HANDOVER REQUIRED  HANDOVER FAILURE  CLEAR REQUEST  CLEAR COMMAND  HANDOVER PERFORMED  HANDOVER REQUIRED REJECT | M | M | TS 48.008 |
| RR Cause | ASSIGNMENT FAILURE  HANDOVER COMPLETE  HANDOVER FAILURE | M | M | TS 48.008 |
| Cell Identifier (target) | HANDOVER REQUEST | M | M | TS 48.008 |
| Current Channel type 1 | HANDOVER REQUEST  HANDOVER REQUIRED | M | M | TS 48.008 |
| Cell Identifier List (Preferred) | HANDOVER REQUIRED  PAGING | M | M | TS 48.008 |
| IMSI | PAGING  COMMON ID | M | M | TS 48.008 |
| Location Type | PERFORM LOCATION REQUEST | M | M | TS 48.008 |
| Location Estimate | PERFORM LOCATION RESPONSE | M | M | TS 48.008 |
| LCS Cause | PERFORM LOCATION RESPONSE  PERFORM LOCATION ABORT | M | M | TS 48.008 |
| B | MAP | SS-Code | MAP\_REGISTER\_SS  MAP\_ERASE\_SS  MAP\_ACTIVATE\_SS  MAP\_DEACTIVATE\_SS  MAP\_INTERROGATE\_SS  MAP\_REGISTER\_PASSWORD  MAP\_REGISTER\_CC\_ENTRY  MAP\_ERASE\_CC\_ENTRY | M | M | TS 29.002 |
| Forwarded-to number with subaddress | MAP\_REGISTER\_SS | M | M | TS 29.002 |
| Basic service | MAP\_REGISTER\_SS  MAP\_ERASE\_SS  MAP\_ACTIVATE\_SS  MAP\_DEACTIVATE\_SS  MAP\_INTERROGATE\_SS | M | M | TS 29.002 |
| SM RP DA | MAP-SEND-INFO-FOR-MT-SMS | M | M | TS 29.002 |
| Service Centre Address | MAP-SEND-INFO-FOR-MO-SMS | M | M | TS 29.002 |
| Alert Reason | MAP-READY-FOR-SM | M | M | TS 29.002 |
| Abort reason | Abort | M | M | TS 29.002  TS 23.018 |
| C | MAP | MSISDN | Complete Call  Process Access Request ack  Process Call Waiting  Send Info For Incoming Call ack  MAP-SEND-INFO-FOR-MT-SMS  MAP-SEND-INFO-FOR-MO-SMS | M | M | TS 29.002  TS 23.018 |
| IMEI(SV) | Complete Call  Page MS ack  Process Access Request  Process Access Request ack  Provide IMEI ack  Search For MS ack | M | M | TS 29.002  TS 23.018 |
| PLMN bearer capability | Complete Call  Process Call Waiting | M | M | TS 29.002  TS 23.018 |
| ISDN bearer capability | Complete Call  Process Call Waiting | M | M | TS 29.002  TS 23.018 |
| IMSI | Page MS  Process Access Request  Process Access Request ack  Provide IMSI ack  Search For MS  Send Info For Incoming Call ack  MAP-SEND-INFO-FOR-MT-SMS | M | M | TS 29.002  TS 23.018 |
| Location area ID / Current location area ID | Page MS  Page MS ack  Process Access Request  Search For MS ack | M | M | TS 29.002  TS 23.018 |
| Page type | Page MS  Search For MS | M | M | TS 29.002  TS 23.018 |
| Serving cell ID | Page MS ack  Process Access Request  Search For MS ack | M | M | TS 29.002  TS 23.018 |
| Service area ID | Page MS ack  Process Access Request  Search For MS ack | M | M | TS 29.002  TS 23.018 |
| CM service type | Process Access Request | M | M | TS 29.002  TS 23.018 |
| MSRN | Send Info For Incoming Call | M | M | TS 29.002  TS 23.018 |
| Bearer service | Send Info For Incoming Call  Send Info For Outgoing Call | M | M | TS 29.002  TS 23.018 |
| Teleservice | Send Info For Incoming Call  Send Info For Outgoing Call | M | M | TS 29.002  TS 23.018 |
| Dialled number | Send Info For Incoming Call | M | M | TS 29.002  TS 23.018 |
| Number of forwarding | Send Info For Incoming Call | M | M | TS 29.002  TS 23.018 |
| Forwarded-to number | Send Info For Incoming Call ack | M | M | TS 29.002  TS 23.018 |
| Forwarding reason | Send Info For Incoming Call ack | M | M | TS 29.002  TS 23.018 |
| Called number | Send Info For Outgoing Call | M | M | TS 29.002  TS 23.018 |
| MSISDN | Send Routeing Info | M | M | TS 29.002  TS 23.018 |
| User error | Every message where it appears | M | M | TS 29.002 |
| Provider error | Every message where it appears | M | M | TS 29.002 |
| Service Centre Address | MAP-SEND-ROUTING-INFO-FOR-SM  MAP-REPORT-SM-DELIVERY-STATUS  MAP-ALERT-SERVICE-CENTRE | M | M | TS 29.002 |
| SM Delivery Outcome | MAP-REPORT-SM-DELIVERY-STATUS | M | M | TS 29.002 |
| MSIsdn-Alert | MAP-ALERT-SERVICE-CENTRE  MAP-INFORM-SERVICE-CEN | M | M | TS 29.002 |
| Number of forwarding | Send Routeing Info | M | M | TS 29.002  TS 23.018 |
| ISDN BC | Send Routeing Info | M | M | TS 29.002  TS 23.018 |
| IMSI | Send Routeing Info ack | M | M | TS 29.002  TS 23.018 |
| Roaming number | Send Routeing Info ack | M | M | TS 29.002  TS 23.018 |
| Forwarded-to number | Send Routeing Info ack | M | M | TS 29.002  TS 23.018 |
| Forwarding reason | Send Routeing Info ack | M | M | TS 29.002  TS 23.018 |
| MSISDN | Send Routeing Info ack  MAP\_SEND\_ROUTING\_INFO\_FOR\_SM | M | M | TS 29.002  TS 23.018 |
| User error | Every message where it appears | M | M | TS 29.002 |
| Provider error | Every message where it appears | M | M | TS 29.002 |
| D | MAP | HLR number | MAP\_RESTORE\_DATA | M | M | TS 29.002 |
| MS Not Reachable Flag | MAP\_RESTORE\_DATA | M | M | TS 29.002 |
| SS-Code | MAP\_REGISTER\_SS  MAP\_ERASE\_SS  MAP\_ACTIVATE\_SS  MAP\_DEACTIVATE\_SS  MAP\_INTERROGATE\_SS  MAP\_REGISTER\_PASSWORD  MAP\_REGISTER\_CC\_ENTRY  MAP\_ERASE\_CC\_ENTRY | M | M | TS 29.002 |
| Forwarded-to number with subaddress | MAP\_REGISTER\_SS | M | M | TS 29.002 |
| Basic service | MAP\_REGISTER\_SS  MAP\_ERASE\_SS  MAP\_ACTIVATE\_SS  MAP\_DEACTIVATE\_SS  MAP\_INTERROGATE\_SS | M | M | TS 29.002 |
| Alert Reason | MAP-READY-FOR-SM | M | M | TS 29.002 |
| MSC Address | MAP\_UPDATE\_LOCATION | M | M | TS 29.002 |
| IMSI | Provide Roaming Number  Provide Subscriber Info  MAP\_UPDATE\_LOCATION  MAP\_CANCEL\_LOCATION  MAP\_PURGE\_MS  MAP-INSERT-SUBSCRIBER-DATA  MAP-DELETE-SUBSCRIBER-DATA  MAP\_RESTORE\_DATA | M | M | TS 29.002  TS 23.018 |
| MSISDN | Provide Roaming Number  MAP-INSERT-SUBSCRIBER-DATA | M | M | TS 29.002  TS 23.018 |
| PLMN bearer capability | Provide Roaming Number | M | M | TS 29.002  TS 23.018 |
| ISDN BC | Provide Roaming Number | M | M | TS 29.002  TS 23.018 |
| Roaming number | Provide Roaming Number ack | M | M | TS 29.002  TS 23.018 |
| Service area ID | Provide Subscriber Info ack | M | M | TS 29.002  TS 23.018 |
| Cell ID | Provide Subscriber Info ack | M | M | TS 29.002  TS 23.018 |
| IMEI(SV) | Provide Subscriber Info ack | M | M | TS 29.002  TS 23.018 |
| User error | Every message where it appears | M | M | TS 29.002 |
| Provider error | Every message where it appears | M | M | TS 29.002 |
| F | MAP | IMEI(SV) | MAP\_CHECK\_IMEI | M | M | TS 29.002  TS 23.018 |
| Equipment status | MAP\_CHECK\_IMEI | M | M | TS 29.002  TS 23.018 |
| User error | Every message where it appears | M | M | TS 29.002 |
| Provider error | Every message where it appears | M | M | TS 29.002 |
| E | MAP | Target Cell Id | MAP\_PREPARE\_HANDOVER  MAP\_PREPARE\_SUBSEQUENT\_HANDOVER | M | M | TS 29.002 |
| Target RNC Id | MAP\_PREPARE\_HANDOVER  MAP\_PREPARE\_SUBSEQUENT\_HANDOVER | M | M | TS 29.002 |
| IMSI | MAP\_PREPARE\_HANDOVER | M | M | TS 29.002 |
| RAB ID/ Selected RAB id | MAP\_PREPARE\_HANDOVER  MAP\_PROCESS\_ACCESS\_SIGNALLING  MAP\_PREPARE\_SUBSEQUENT\_HANDOVER | M | M | TS 29.002 |
| Handover Number | MAP\_PREPARE\_HANDOVER  MAP\_SEND\_HANDOVER\_REPORT | M | M | TS 29.002 |
| User error | Every message where it appears | M | M | TS 29.002 |
| Provider error | Every message where it appears | M | M | TS 29.002 |
| Iu-Selected Codec | MAP\_PREPARE\_HANDOVER  MAP\_PROCESS\_ACCESS\_SIGNALLING  MAP\_FORWARD\_ACCESS\_SIGNALLING | M | M | TS 29.002 |
| Iu-Currently Used Codec | MAP\_PREPARE\_HANDOVER  MAP\_FORWARD\_ACCESS\_SIGNALLING | M | M | TS 29.002 |
| Iu-Supported Codecs List | MAP\_PREPARE\_HANDOVER  MAP\_FORWARD\_ACCESS\_SIGNALLING | M | M | TS 29.002 |
| Iu-Available Codecs List | MAP\_PREPARE\_HANDOVER  MAP\_PROCESS\_ACCESS\_SIGNALLING | M | M | TS 29.002 |
| Target MSC Number | MAP\_PREPARE\_SUBSEQUENT\_HANDOVER | M | M | TS 29.002 |
| G | MAP | IMSI | MAP\_SEND\_IDENTIFICATION | M | M | TS 29.002 |
| MSC Number | MAP\_SEND\_IDENTIFICATION | M | M | TS 29.002 |
| User error | Every message where it appears | M | M | TS 29.002 |
| Provider error | Every message where it appears | M | M | TS 29.002 |
| Mc | Megaco | Context | Every procedure where it appears | M | M | TS 23.205 |
| Bearer Termination 1 | Every procedure where it appears | M | M | TS 23.205 |
| Bearer Termination 2 | Every procedure where it appears | M | M | TS 23.205 |
| Bearer Characteristics | Establish Bearer | M | M | TS 23.205 |
| Destination Binding Reference | Establish Bearer | M | M | TS 23.205 |
| Sender Binding Reference | Prepare Bearer | M | M | TS 23.205 |
| Codec | Prepare Bearer  Modify Bearer Characteristics | M | M | TS 23.205 |
| Release Cause | Release Bearer  Bearer Released | M | M | TS 23.205 |
| Iu | RANAP | RAB ID | RAB ASSIGNMENT REQUEST  RAB ASSIGNMENT RESPONSE  RAB RELEASE REQUEST  IU RELEASE COMPLETE  RELOCATION REQUEST  RELOCATION REQUEST ACKNOWLEDGE  RELOCATION COMMAND | M | M | TS 25.413 |
| Cause | RAB ASSIGNMENT REQUEST  RAB ASSIGNMENT RESPONSE  RAB RELEASE REQUEST  IU RELEASE REQUEST  IU RELEASE COMMAND  RELOCATION REQUIRED  RELOCATION REQUEST  RELOCATION REQUEST ACKNOWLEDGE  RELOCATION PREPARATION FAILURE  RELOCATION FAILURE  RELOCATION CANCEL  SECURITY MODE REJECT  LOCATION REPORT  ERROR INDICATION | M | M | TS 25.413 |
| Source ID | RELOCATION REQUIRED | M | M | TS 25.413 |
| Target ID | RELOCATION REQUIRED | M | M | TS 25.413 |
| Paging Cause | PAGING | M | M | TS 25.413 |
| Permanent NAS UE Identity | COMMON ID  PAGING  RELOCATION REQUEST | M | M | TS 25.413 |
| Area Identity | LOCATION REPORT | M | M | TS 25.413 |
| Last Known Service Area | LOCATION REPORT | M | M | TS 25.413 |
| LAI | INITIAL UE MESSAGE  DIRECT TRANSFER | M | M | TS 25.413 |
| SAI | INITIAL UE MESSAGE  DIRECT TRANSFER | M | M | TS 25.413 |
| Global RNC-ID | ERROR INDICATION | M | M | TS 25.413 |

## 4.3 MGW Trace Record Content

The following table describes the trace record content for minimum and medium trace depth for Megaco protocol in the Media GateWay (MGW).

| Interface name | Prot.  name | IE name | Procedure name(s) | Trace depth | | Notes |
| --- | --- | --- | --- | --- | --- | --- |
| Min | Med |
| Mc | Megaco | Context | Every procedure where it appears | **M** | **M** | TS 23.205 |
| Bearer Termination 1 | Every procedure where it appears | **M** | **M** | TS 23.205 |
| Bearer Termination 2 | Every procedure where it appears | **M** | **M** | TS 23.205 |
| Bearer Characteristics | Establish Bearer | **M** | **M** | TS 23.205 |
| Destination Binding Reference | Establish Bearer | **M** | **M** | TS 23.205 |
| Destination Bearer Address | Establish Bearer | **M** | **M** | TS 23.205 |
| Sender Binding Reference | Prepare Bearer | **M** | **M** | TS 23.205 |
| Sender Bearer Address | Prepare Bearer | **M** | **M** | TS 23.205 |
| Codec | Prepare Bearer  Modify Bearer Characteristics | **M** | **M** | TS 23.205 |
| Release Cause | Release Bearer  Bearer Released | **M** | **M** | TS 23.205 |
| Iu-UP, Nb-UP |  | Error Cause value | Every NACK message | **M** | **M** | TS 25.415 |
| Iu-UP, Nb-UP |  | RFCI indicators | Rate control procedure | **M** | **M** | TS 25.415 |
| Iu-UP, Nb-UP |  | Local\_Channel\_Type | TFO\_TRANS | **M** | **M** | TS 28.062 |
| Iu-UP, Nb-UP |  | Indication whether <ENQUIRY> character is received by the CTM receiver | CTM availability negotiation | **M** | **M** | TS 26.226 |

## 4.4 SGSN Trace Record Content

The following table shows the trace record content for SGSN.

The trace record is the same for management based activation and for signalling based activation.

For SGSN, the Minimum level of detail shall be supported.

| **Interface name** | **Prot.**  **name** | **IE name** | **Message name(s)** | **Trace depth** | | **Notes** |
| --- | --- | --- | --- | --- | --- | --- |
| **Min** | **Med** |
| Iu | SM | Requested QoS/Requested new QoS | Activate PDP context request  ACTIVATE SECONDARY PDP CONTEXT REQUEST  modify PDP context request | **M** | **M** | TS 24.008 |
| Requested PDP address | Activate PDP context request | **M** | **M** | TS 24.008 |
| Access point name | Activate PDP context request  request PDP context activation | **M** | **M** | TS 24.008  TS 23.003 |
| Negotiated QoS/New QoS | Activate PDP context Accept  Activate secondary PDP context Accept  modify PDP context request  modify PDP context accept | **M** | **M** | TS 24.008 |
| PDP Address | Activate PDP context Accept  modify PDP context request | **M** | **M** | TS 24.008 |
| SM cause | Activate PDP context reject  Activate SECONDARY PDP context reject  request PDP context ACTIVATION reject  MODIFY PDP context reject  deactivate PDP context request  SM STATUS | **M** | **M** | TS 24.008 |
| Offered PDP address | request PDP context activation | **M** | **M** | TS 24.008 |
| Iu | MM | MS network capability | ATTACH REQUEST  ROUTING AREA UPDATE REQUEST | **M** | **M** | TS 24.008 |
| Attach type | ATTACH REQUEST | **M** | **M** | TS 24.008 |
| IMSI | ATTACH REQUEST | **M** | **M** | TS 24.008 |
| MS Radio Access capability | ATTACH REQUEST  ROUTING AREA UPDATE REQUEST | **M** | **M** | TS 24.008 |
| Attach result | ATTACH ACCEPT | **M** | **M** | TS 24.008 |
| Routing area identification | ATTACH ACCEPT  ROUTING AREA UPDATE REQUEST  ROUTING AREA UPDATE ACCEPT | **M** | **M** | TS 24.008 |
| GMM cause | ATTACH ACCEPT  ATTACH REJECT  DETACH REQUEST  AUTHENTICATION AND CIPHERING FAILURE  ROUTING AREA UPDATE ACCEPT  ROUTING AREA UPDATE REJECT  GMM STATUS | **M** | **M** | TS 24.008 |
| Detach type | DETACH REQUEST | **M** | **M** | TS 24.008 |
| Mobile identity | AUTHENTICATION AND CIPHERING RESPONSE  IDENTITY RESPONSE  ROUTING AREA UPDATE ACCEPT | **M** | **M** | TS 24.008 |
| Update type | ROUTING AREA UPDATE REQUEST | **M** | **M** | TS 24.008 |
| Update result | ROUTING AREA UPDATE ACCEPT | **M** | **M** | TS 24.008 |
| Iu | SMS | TP‑Originating‑Address | SMS‑DELIVER | **M** | **M** | TS 23.040 |
| TP‑Service‑Centre‑Time‑Stamp | SMS‑DELIVER  SMS‑SUBMIT‑REPORT  SMS‑STATUS‑REPORT | **M** | **M** | TS 23.040 |
| TP‑Failure‑Cause | SMS‑DELIVER‑REPORT  SMS‑SUBMIT‑REPORT | **M** | **M** | TS 23.040 |
| TP‑Destination‑Address | SMS‑SUBMIT  SMS‑COMMAND | **M** | **M** | TS 23.040 |
| TP‑Recipient‑Address | SMS‑STATUS‑REPORT | **M** | **M** | TS 23.040 |
| Gn | GTP | IMSI | Create PDP Context Request  Update PDP Context Request  PDU Notification Request  Identification Response  SGSN Context Request  Forward Relocation Request  Relocation Cancel Request  MBMS Notification Request  Create MBMS Context Request  Update MBMS Context Request  Delete MBMS Context Request | **M** | **M** | TS 29.060 |
| RAI | Create PDP Context Request  Update PDP Context Request  Identification Request  SGSN Context Request  Create MBMS Context Request  Update MBMS Context Request | **M** | **M** | TS 29.060 |
| End User Address | Create PDP Context Request  Create PDP Context Response  Update PDP Context Request  PDU Notification Request  PDU Notification Reject Request  MBMS Notification Request  MBMS Notification Reject Request  Create MBMS Context Request  Delete MBMS Context Request  MBMS Registration Request  MBMS De-registration Request  MBMS Session Start Request  MBMS Session Stop Request | **M** | **M** | TS 29.060 |
| Access Point Name | Create PDP Context Request  PDU Notification Request  PDU Notification Reject Request  MBMS Notification Request  MBMS Notification Reject Request  Create MBMS Context Request  Delete MBMS Context Request  MBMS Registration Request  MBMS De-registration Request  MBMS Session Start Request  MBMS Session Stop Request | **M** | **M** | TS 29.060 |
| SGSN Address for signalling | Create PDP Context Request  Update PDP Context Request  Identification Request  SGSN Context Request  SGSN Context Response  Forward Relocation Request  Forward Relocation Response  Create MBMS Context Request  Update MBMS Context Request | **M** | **M** | TS 29.060 |
| SGSN Address for user traffic | Create PDP Context Request  Update PDP Context Request  SGSN Context Acknowledge  MBMS Session Start Response | **M** | **M** | TS 29.060 |
| MSISDN | Create PDP Context Request  Create MBMS Context Request | **M** | **M** | TS 29.060 |
| Quality of Service Profile | Create PDP Context Request  Create PDP Context Response  Update PDP Context Request  Update PDP Context Response  MBMS Session Start Request | **M** | **M** | TS 29.060 |
| RAT Type | Create PDP Context Request  Update PDP Context Request | **M** | **M** | TS 29.060 |
| IMEI(SV) | Create PDP Context Request | **M** | **M** | TS 29.060 |
| User Location Information | Create PDP Context Request  Update PDP Context Request | **M** | **M** | TS 29.060 |
| Cause | Create PDP Context Response  Update PDP Context Response  Delete PDP Context Response  PDU Notification Response  PDU Notification Reject Request  PDU Notification Reject Response  Identification Response  SGSN Context Response  SGSN Context Acknowledge  Forward Relocation Response  Relocation Cancel Response  Forward Relocation Complete Acknowledge  Forward SRNS Context Acknowledge  MBMS Notification Response  MBMS Notification Reject Request  MBMS Notification Reject Response  Create MBMS Context Response  Update MBMS Context Response  Delete MBMS Context Response  MBMS Registration Response  MBMS De-Registration Response  MBMS Session Start Response  MBMS Session Stop Response | **M** | **M** | TS 29.060 |
| GGSN Address for Control Plane | Create PDP Context Response  Update PDP Context Response  PDU Notification Request  MBMS Notification Request  Create MBMS Context Response  Update MBMS Context Response | **M** | **M** | TS 29.060 |
| GGSN Address for user traffic | Create PDP Context Response  Update PDP Context Response | **M** | **M** | TS 29.060 |
| GSN Address | Error Indication | **M** | **M** | TS 29.060 |
| SGSN Number | SGSN Context Request  Forward Relocation Response | **M** | **M** | TS 29.060 |
| MBMS UE Context | SGSN Context Response  Forward Relocation Request | **M** | **M** | TS 29.060 |
| RANAP Cause | Forward Relocation Request  Forward Relocation Response | **M** | **M** | TS 29.060 |
| Target Identification | Forward Relocation Request | **M** | **M** | TS 29.060 |
| Gs | BSSAP+ | IMSI | BSSAP+-ALERT-ACK  BSSAP+-ALERT-REJECT  BSSAP+-ALERT-REQUEST  BSSAP+-DOWNLINK-TUNNEL-REQUEST  BSSAP+-GPRS-DETACH-ACK  BSSAP+-GPRS-DETACH-INDICATION  BSSAP+-IMSI-DETACH-ACK  BSSAP+-IMSI-DETACH-INDICATION  BSSAP+-LOCATION-UPDATE-ACCEPT  BSSAP+-LOCATION-UPDATE-REJECT  BSSAP+-LOCATION-UPDATE-REQUEST  BSSAP+-MOBILE-STATUS  BSSAP+-MS-ACTIVITY-INDICATION  BSSAP+-MS-UNREACHABLE  BSSAP+-PAGING-REJECT  BSSAP+-PAGING-REQUEST  BSSAP+-TMSI-REALLOCATION-COMPLETE  BSSAP+-UPLINK-TUNNEL-REQUEST | **M** | **M** | TS 29.018 |
| Gs Cause | BSSAP+-ALERT-REJECT  BSSAP+-MOBILE-STATUS  BSSAP+-MS-UNREACHABLE  BSSAP+-PAGING-REJECT | **M** | **M** | TS 29.018 |
| VLR number | BSSAP+-DOWNLINK-TUNNEL-REQUEST  BSSAP+-PAGING-REQUEST  BSSAP+-RESET-ACK  BSSAP+-RESET-INDICATION | **M** | **M** | TS 29.018 |
| SGSN number | BSSAP+-GPRS-DETACH-INDICATION  BSSAP+-IMSI-DETACH-INDICATION  BSSAP+-LOCATION-UPDATE-REQUEST  BSSAP+-RESET-ACK  BSSAP+-RESET-INDICATION  BSSAP+-UPLINK-TUNNEL-REQUEST | **M** | **M** | TS 29.018 |
| IMSI detach from GPRS service type | BSSAP+-GPRS-DETACH-INDICATION | **M** | **M** | TS 29.018 |
| Cell global identity/ New CGI | BSSAP+-GPRS-DETACH-INDICATION  BSSAP+-IMSI-DETACH-INDICATION  BSSAP+-LOCATION-UPDATE-REQUEST  BSSAP+-MS-ACTIVITY-INDICATION  BSSAP+-TMSI-REALLOCATION-COMPLETE | **M** | **M** | TS 29.018 |
| Service area identification /New SAI | BSSAP+-GPRS-DETACH-INDICATION  BSSAP+-IMSI-DETACH-INDICATION  BSSAP+-LOCATION-UPDATE-REQUEST  BSSAP+-MS-ACTIVITY-INDICATION  BSSAP+-TMSI-REALLOCATION-COMPLETE | **M** | **M** | TS 29.018 |
| Detach type | BSSAP+-IMSI-DETACH-INDICATION | **M** | **M** | TS 29.018 |
| Reject cause | BSSAP+-LOCATION-UPDATE-REJECT | **M** | **M** | TS 29.018 |
| Update type | BSSAP+-LOCATION-UPDATE-REQUEST | **M** | **M** | TS 29.018 |
| LAI/Old LAI | BSSAP+-LOCATION-UPDATE-ACCEPT  BSSAP+-LOCATION-UPDATE-REQUEST  BSSAP+-PAGING-REQUEST | **M** | **M** | TS 29.018 |
| IMEISV | BSSAP+-LOCATION-UPDATE-REQUEST | **M** | **M** | TS 29.018 |
| Erroneous message | BSSAP+-MOBILE-STATUS | **M** | **M** | TS 29.018 |
| Gr | MAP | IMSI | MAP\_CANCEL\_LOCATION  MAP\_PURGE\_MS  MAP\_UPDATE\_GPRS\_LOCATION  MAP\_NOTE\_MM\_EVENT  MAP-INSERT-SUBSCRIBER-DATA  MAP-DELETE-SUBSCRIBER-DATA  MAP-READY-FOR-SM | **M** | **M** | TS 29.002 |
| Cancellation Type | MAP\_CANCEL\_LOCATION | **M** | **M** | TS 29.002 |
| User error | Every message where it appears | **M** | **M** | TS 29.002 |
| Provider error | Every message where it appears | **M** | **M** | TS 29.002 |
| Location Information for GPRS | MAP\_NOTE\_MM\_EVENT | **M** | **M** | TS 29.002 |
| MSISDN | MAP-INSERT-SUBSCRIBER-DATA | **M** | **M** | TS 29.002 |
| Alert Reason | MAP-READY-FOR-SM | **M** | **M** | TS 29.002 |
| Gd | SM RP OA | MAP-MO-FORWARD-SHORT-MESSAGE  MAP-MT-FORWARD-SHORT-MESSAGE | **M** | **M** | TS 29.002 |
| SM RP DA | MAP-MO-FORWARD-SHORT-MESSAGE  MAP-MT-FORWARD-SHORT-MESSAGE | **M** | **M** | TS 29.002 |
| IMSI | MAP-MO-FORWARD-SHORT-MESSAGE | **M** | **M** | TS 29.002 |
| More Messages To Send | MAP-MT-FORWARD-SHORT-MESSAGE | **M** | **M** | TS 29.002 |
| Gf | IMEI(SV) | MAP\_CHECK\_IMEI | **M** | **M** | TS 29.002 |
| Equipment status | MAP\_CHECK\_IMEI | **M** | **M** | TS 29.002 |
| User error | Every message where it appears | **M** | **M** | TS 29.002 |
| Provider error | Every message where it appears | **M** | **M** | TS 29.002 |
| Iu | RANAP | RAB ID | RAB ASSIGNMENT REQUEST  RAB ASSIGNMENT RESPONSE  RAB RELEASE REQUEST  IU RELEASE COMPLETE  RELOCATION REQUEST  RELOCATION REQUEST ACKNOWLEDGE  RELOCATION COMMAND | **M** | **M** | TS 25.413 |
| Cause | RAB ASSIGNMENT REQUEST  RAB ASSIGNMENT RESPONSE  RAB RELEASE REQUEST  IU RELEASE REQUEST  IU RELEASE COMMAND  RELOCATION REQUIRED  RELOCATION REQUEST  RELOCATION REQUEST ACKNOWLEDGE  RELOCATION PREPARATION FAILURE  RELOCATION FAILURE  RELOCATION CANCEL  SECURITY MODE REJECT  LOCATION REPORT  ERROR INDICATION | **M** | **M** | TS 25.413 |
| Source ID | RELOCATION REQUIRED | **M** | **M** | TS 25.413 |
| Target ID | RELOCATION REQUIRED | **M** | **M** | TS 25.413 |
| Paging Cause | PAGING | **M** | **M** | TS 25.413 |
| Permanent NAS UE Identity | COMMON ID  PAGING  RELOCATION REQUEST | **M** | **M** | TS 25.413 |
| Area Identity | LOCATION REPORT | **M** | **M** | TS 25.413 |
| Last Known Service Area | LOCATION REPORT | **M** | **M** | TS 25.413 |
| RAC | INITIAL UE MESSAGE  DIRECT TRANSFER | **M** | **M** | TS 25.413 |
| SAI | INITIAL UE MESSAGE  DIRECT TRANSFER | **M** | **M** | TS 25.413 |
| Global RNC-ID | ERROR INDICATION | **M** | **M** | TS 25.413 |
| S3 | GTPv2C | IMSI | DETACH NOTIFICATION  CS PAGING INDICATON  RELOCATION CANCEL Request  IDENTIFICATION RESPONSE  CONTEXT RESPONSE  CONTEXT REQUEST  FORWARD RELOCATION REQUEST | M | M | TS 29.274 |
| TMSI | CS PAGING INDICATON | M | M | TS 29.274 |
| GUTI | CONTEXT REQUEST  IDENTIFICATION Request | M | M | TS 29.274 |
| RAI | IDENTIFICATION Request  CONTEXT REQUEST | M | M | TS 29.274 |
| P-TMSI | IDENTIFICATION Request  CONTEXT REQUEST | M | M | TS 29.274 |
| Indication | FORWARD RELOCATION COMPLETE NOTIFICATION  FORWARD RELOCATION REQUEST | M | M | TS 29.274 |
| BSSGP Cause | FORWARD RELOCATION RESPONSE  FORWARD RELOCATION REQUEST | M | M | TS 29.274 |
| RANAP Cause | FORWARD RELOCATION RESPONSE  FORWARD RELOCATION REQUEST | M | M | TS 29.274 |
| eNodeB Cause | FORWARD RELOCATION RESPONSE | M | M | TS 29.274 |
| RAT Type | CONTEXT REQUEST | M | M | TS 29.274 |
| Target Identification | FORWARD RELOCATION REQUEST | M | M | TS 29.274 |
| Cause | RELOCATION CANCEL RESPONSE  FORWARD SRNS CONTEXt ACKNOWLEDGE  IDENTIFICATION RESPONSE  CONTEXt ACKNOWLEDGE  CONTEXT RESPONSE  FORWARD RELOCATION COMPLETE ACKNOWLEDGE  FORWARD RELOCATION RESPONSE  DETACH NOTIFICATION  DETACH aCKNOWLEDGE | M | M | TS 29.274 |
| RAN Cause | FORWARD RELOCATION REQUES | M | M | TS 29.274 |
| Selected PLMN ID | FORWARD RELOCATION REQUEST | M | M | TS 29.274 |
| S4 | GTPV2C | Traffic Aggregate Description (TAD) | Bearer Resource Command | M | M | TS 25.413 |
| Linked Bearer Identity (LBI) | Bearer Resource Command  Create Bearer Request  Delete Bearer Response | M | M | TS 25.413 |
| Linked EPS Bearer ID | Bearer Resource Failure Indication  Delete Session Request  Delete Bearer Request | M | M | TS 25.413 |
| Cause | Bearer Resource Failure Indication  Create Session Response  Create Bearer Response  Modify Bearer Response  Delete Session Response  Delete Bearer Response  Downlink Data Notification Acknowledgement  Downlink Data Notification Failure Indication  Update Bearer Response  Create Indirect Data Forwarding Tunnel Response  Update Bearer Complete | M | M | TS 25.413 |
| Bearer Contexts to be modified | Modify Bearer Request | M | M | TS 25.413 |
| Bearer Contexts to be removed | Modify Bearer Request | M | M | TS 25.413 |
| IMSI | Create Session Request  Update Bearer Request | M | M | TS 25.413 |
| MSISDN | Create Session Request  Modify Bearer Response | M | M | TS 25.413 |
| Serving Network | Create Session Request | M | M | TS 25.413 |
| Access Point Name (APN) | Create Session Request | M | M | TS 25.413 |
| PDN Type | Create Session Request | M | M | TS 25.413 |
| Bearer Contexts | Create Session Request  Create Bearer Request  Create Bearer Response  Delete Bearer Request  Delete Bearer Response  Update Bearer Request  Update Bearer Response  Create Indirect Data Forwarding Tunnel Request  Create Indirect Data Forwarding Tunnel Response  Update Bearer Complete | M | M | TS 25.413 |
| RAT Type | Create Session Request  Modify Bearer Request | M | M | TS 25.413 |
| Bearer Contexts created | Create Session Response | M | M | TS 25.413 |
| Bearer Contexts marked for removal | Create Session Response | M | M | TS 25.413 |
| Bearer Contexts modified | Modify Bearer Response | M | M | TS 25.413 |
| Bearer Contexts marked for removal | Modify Bearer Response | M | M | TS 25.413 |
| S6d | Diameter | User Name | NOTIFY REQUEST  AUTHENTICATION INFORMATION REQUEST  DELETE SUBSCRIBER DATA REQUEST  INSERT SUBSCRIBER DATA REQUEST  PURGE UE REQUEST  CANCEL LOCATION REQUEST  UPDATE LOCATION REQUEST | M | M | TS 29.272 |
| Terminal Infomration | NOTIFY REQUEST  UPDATE LOCATION REQUEST | M | M | TS 29.272 |
| Result | NOTIFY ANSWER  AUTHENTICATION INFORMATION ANSWER  DELETE SUBSCRIBER DATA ANSWER  INSERT SUBSCRIBER DATA ANSWER  PURGE UE ANSWER  CANCEL LOCATION ANSWER  UPDATE LOCATION ANSWER | M | M | TS 29.272 |
| RAT Type | UPDATE LOCATION REQUEST | M | M | TS 29.272 |
| APN | NOTIFY REQUEST | M | M | TS 29.272 |
| Visited PLMN Id | AUTHENTICATION INFORMATION REQUEST  UPDATE LOCATION REQUEST | M | M | TS 29.272 |
| S13' | Diameter | Terminal Information | ME Identity Check Request | M | M | TS 29.272 |
| Result | ME Identity Check Answer | M | M | TS 29.272 |

## 4.5 GGSN Trace Record Content

The following table describes the trace record content for minimum and medium trace depth for GGSN.   
The record content is same for management based activation and for signalling based activation.   
For GGSN, the Minimum level of detail shall be supported.

| Interface name | Prot. Name | IE name | Message name(s) | Trace depth | | Notes |
| --- | --- | --- | --- | --- | --- | --- |
| Min | Med |
| Gn | GTP | IMSI | Create PDP Context Request  Update PDP Context Request  PDU Notification Request  Send Routeing Information for GPRS Request  Send Routeing Information for GPRS Response  Failure Report Request  Note MS Present Request  MBMS Notification Request  Create MBMS Context Request  Update MBMS Context Request  Delete MBMS Context Request | **M** | **M** | TS 29.060 |
| RAI | Create PDP Context Request  Update PDP Context Request  Create MBMS Context Request  Update MBMS Context Request | **M** | **M** | TS 29.060 |
| End User Address | Create PDP Context Request  Create PDP Context Response  Update PDP Context Request  PDU Notification Request  PDU Notification Reject Request  MBMS Notification Request  MBMS Notification Reject Request  Create MBMS Context Request  Delete MBMS Context Request  MBMS Registration Request  MBMS De-registration Request  MBMS Session Start Request  MBMS Session Stop Request | **M** | **M** | TS 29.060 |
| Access Point Name | Create PDP Context Request  PDU Notification Request  PDU Notification Reject Request  MBMS Notification Request  MBMS Notification Reject Request  Create MBMS Context Request  Delete MBMS Context Request  MBMS Registration Request  MBMS De-registration Request  MBMS Session Start Request  MBMS Session Stop Request | **M** | **M** | TS 29.060 |
| SGSN Address for signalling | Create PDP Context Request  Update PDP Context Request  Create MBMS Context Request  Update MBMS Context Request | **M** | **M** | TS 29.060 |
| SGSN Address for user traffic | Create PDP Context Request  Update PDP Context Request  MBMS Session Start Response | **M** | **M** | TS 29.060 |
| MSISDN | Create PDP Context Request  Create MBMS Context Request | **M** | **M** | TS 29.060 |
| Quality of Service Profile | Create PDP Context Request  Create PDP Context Response  Update PDP Context Request  Update PDP Context Response  MBMS Session Start Request | **M** | **M** | TS 29.060 |
| RAT Type | Create PDP Context Request  Update PDP Context Request | **M** | **M** | TS 29.060 |
| IMEI(SV) | Create PDP Context Request | **M** | **M** | TS 29.060 |
| User Location Information | Create PDP Context Request  Update PDP Context Request | **M** | **M** | TS 29.060 |
| Cause | Create PDP Context Response  Update PDP Context Response  Delete PDP Context Response  PDU Notification Response  PDU Notification Reject Request  PDU Notification Reject Response  Send Routeing Information for GPRS Response  Failure Report Response  Note MS GPRS Present Response  MBMS Notification Response  MBMS Notification Reject Request  MBMS Notification Reject Response  Create MBMS Context Response  Update MBMS Context Response  Delete MBMS Context Response  MBMS Registration Response  MBMS De-Registration Response  MBMS Session Start Response  MBMS Session Stop Response | **M** | **M** | TS 29.060 |
| GGSN Address for Control Plane | Create PDP Context Response  Update PDP Context Response  PDU Notification Request  MBMS Notification Request  Create MBMS Context Response  Update MBMS Context Response | **M** | **M** | TS 29.060 |
| GGSN Address for user traffic | Create PDP Context Response  Update PDP Context Response | **M** | **M** | TS 29.060 |
| MAP Cause | Send Routeing Information for GPRS Response  Failure Report Response | **M** | **M** | TS 29.060 |
| GSN Address | Send Routeing Information for GPRS Response  Note MS Present Request | **M** | **M** | TS 29.060 |
| Gmb | Diameter Gmb | IMSI | MBMS Authorization Request (AAR)  MBMS Authorization Response (AAA) | **M** | **M** | TS 29.061 |
| RAI | MBMS Authorization Request (AAR) | **M** | **M** | TS 29.061 |
| Access Point Name | MBMS Authorization Request (AAR) | **M** | **M** | TS 29.061 |
| MSISDN | MBMS Authorization Request (AAR) | **M** | **M** | TS 29.061 |
| IMEI(SV) | MBMS Authorization Request (AAR) | **M** | **M** | TS 29.061 |
| IP Multicast Address | MBMS Authorization Request (AAR) | **M** | **M** | TS 29.061 |
| TMGI | MBMS Authorization Response (AAA) | **M** | **M** | TS 29.061 |
| Result-Code | MBMS Authorization Response (AAA)  MBMS User Deactivation Response (STA)  MBMS Session start-stop indication Response (raa)  MBMS service termination answer (ASR) | **M** | **M** | TS 29.061 |
| Experimental-Result | MBMS Authorization Response (AAA)  MBMS Session start-stop indication Response (raa) | **M** | **M** | TS 29.061 |
| Error-Reporting-Host | MBMS Authorization Response (AAA)  MBMS User Deactivation Response (STA)  MBMS Session start-stop indication Response (raa)  MBMS service termination answer (ASR) | **M** | **M** | TS 29.061 |

## 4.6 UTRAN Trace Record Content

For RNC, the Maximum level of detail shall be supported.

Table 4.6.1 : UTRAN Trace Record Content

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Interface (specific messages)** | **Format** | **Level of details** | | | **Description** |
| **Min** | **Med** | **Max** |
| RRC (without rrc dedicated measurements) | Decoded | **M** | **M** | **O** | Message name |
| **O** | **O** | **O** | Record extensions |
| **M** | **M** | **X** | rncID of traced RNC |
| **M** | **M** | **X** | Dedicated IE extracted from RRC messages between the traced RNC and the UE. A subset of IEs as given in the table 4.6.2. is provided. |
| ASN.1 | **X** | **X** | **M** | Raw Uu Messages: RRC messages between the traced RNC and the UE. The encoded content of the message is provided |
| Iub (without nbap dedicated measurements) | Decoded | **M** | **M** | **O** | Message name |
| **O** | **O** | **O** | Record extensions |
| **M** | **M** | **X** | rncID of traced RNC cId |
| **M** | **M** | **X** | rbId + Dedicated IE extracted from NBAP messages send/received inside traced UEs communication context. A subset of IEs as given in the table 4.6.2.is provided |
| ASN.1 | **X** | **X** | **M** | Raw Iub Messages: NBAP messages between the traced RNC and the NodeB or cell. The encoded content of the message is provided |
| Iu | Decoded | **M** | **M** | **O** | Message name |
| **O** | **O** | **O** | Record extensions |
| **M** | **M** | **X** | rncID of traced RNC CoreNetworkID CN Domain Indicator |
| **M** | **M** | **X** | rabId + Dedicated IE extracted from RANAP messages between the traced RNC and Core Network. A subset of IEs as given in the table 4.6.2. is provided. |
| ASN.1 | **X** | **X** | **M** | Raw Iu Messages RANAP: messages between the traced RNC and Core Network The encoded content of the message is provided |
| Iur | Decoded | **M** | **M** | **O** | Message name |
| **O** | **O** | **O** | Record extensions |
| **M** | **M** | **X** | rncID of traced RNC rncID of neighbouring RNC |
| **M** | **M** | **X** | rlId + Dedicated IE extracted from RNSAP messages between the traced RNC and the neighbouring RNC. A subset of IEs as given in the table 4.6.2.is provided |
| ASN.1 | **X** | **X** | **M** | Raw Iur Messages: RNSAP messages between the traced RNC and the neighbouring RNC. The encoded content of the message is provided |
| nbap (only dedicated measurements) | Decoded | **X** | **M** | **X** | Iub IEs from NBAP measurement reports messages |
| ASN.1 | **X** | **X** | **M** | NBAP measurement reports messages |
| rrc (only dedicated measurements) | Decoded | **X** | **M** | **X** | Uu IEs from RRC measurement reports messages |
| ASN.1 | **X** | **X** | **M** | RRC measurement reports messages |

**Definitions:**

- rncID of traced RNC: The id of the RNC traced, e.g. the RNC which handles the connection of the traced MS, during the Trace Recording Session.

- rncID of neighbouring RNC: The ids of all Neighbouring RNC involved in the Iur procedures during the Trace Recording Session.

- cId: The cIds of all cells involved in the Iub and Iur procedures during the Trace Recording Session. The cId is provided with each NBAP and RNSAP messages  
 for which the cId is relevant.

- rabId: Specific recorded IE that contains the RAB identifier.

- rlId: Specific recorded IE that contains the Radio Link identifier

- rbId: Specific recorded IE that contains the Radio Bearer identifier

- Message name: Name of the protocol message

- Record extensions: A set of manufacturer specific extensions to the record

- Decoded: Some IEs shall be decoded (cf. detailed list in table 4.6.2. depending on trace depth)

- ASN.1: Messages in encoded format

Table 4.6.2 : trace record description for minimum and medium trace depth

| **Interface name** | **Prot.**  **name** | **IE name** | **Message name(s)** | **Trace depth** | | **Notes** |
| --- | --- | --- | --- | --- | --- | --- |
| **Min** | **Med** |
| Uu | RRC | RAB info type | RADIO BEARER SETUP  HO TO UTRAN COMMAND  RADIO BEARER RELEASE  RADIO BEARER RECONFIGURATION | **M** | **M** | TS 25.331 |
| RB info type | RADIO BEARER RECONFIGURATION  RADIO BEARER RELEASE  RADIO BEARER SETUP  HO TO UTRAN COMMAND | **M** | **M** | TS 25.331 |
| URA identity | RADIO BEARER SETUP  RADIO BEARER RELEASE  URA UPDATE CONFIRM  RADIO BEARER RECONFIGURATION | **M** | **M** | TS 25.331 |
| CN domain | SIGNALLING CONNECTION RELEASE  INITIAL DIRECT TRANSFER  DL DIRECT TRANSFER  UL DIRECT TRANSFER | **M** | **M** | TS 25.331 |
| Logical channel priority | RADIO BEARER SETUP | **M** | **M** | TS 25.331 |
| RRC state indicator | RADIO BEARER SETUP  PHYSICAL CHANNEL RECONFIGURATION  TRANSPORT CHANNEL RECONFIGURATION  RADIO BEARER RECONFIGURATION  CELL UPDATE CONFIRM  URA UPDATE CONFIRM | **M** | **M** | TS 25.331 |
| Primary CPICH scrambling code of added cell | ACTIVE SET UPDATE | **O** | **O** | TS 25.331 |
| Primary CPICH scrambling code of removed cell | ACTIVE SET UPDATE | **O** | **O** | TS 25.331 |
| Target cell identity | CELL CHANGE ORDER | **M** | **M** | TS 25.331 |
| Cell synchronisation information | RRC/MEASUREMENT REPORT  for measurement = intra frequency | **X** | **M** | TS 25.331 |
| Cell parameters Id | RRC/MEASUREMENT REPORT  for measurement = intra frequency | **O** | **O** | TS 25.331 |
| Timeslot list | RRC/MEASUREMENT REPORT  for measurement = intra frequency | **X** | **O** | TS 25.331 |
| CPICH Ec/No | RRC/MEASUREMENT REPORT  for measurement = intra frequency | **X** | **O** | TS 25.331 |
| CPICH RSCP | RRC/MEASUREMENT REPORT  for measurement = intra frequency | **X** | **O** | TS 25.331 |
| PCCPCH RSCP | RRC/MEASUREMENT REPORT  for measurement = intra frequency | **X** | **O** | TS 25.331 |
| Pathloss | RRC/MEASUREMENT REPORT  for measurement = intra frequency | **X** | **M** | TS 25.331 |
| UARFCN uplink (Nu) | RRC/MEASUREMENT REPORT  for measurement = inter frequency | **X** | **O** | TS 25.331 |
| UARFCN downlink (Nd) | RRC/MEASUREMENT REPORT  for measurement = inter frequency | **X** | **O** | TS 25.331 |
| UARFCN (Nt) | RRC/MEASUREMENT REPORT  for measurement = inter frequency | **X** | **O** | TS 25.331 |
| Cell synchronisation information | RRC/MEASUREMENT REPORT  for measurement = inter frequency | **X** | **M** | TS 25.331 |
| CPICH Ec/No | RRC/MEASUREMENT REPORT  for measurement = inter frequency | **X** | **O** | TS 25.331 |
| CPICH RSCP | RRC/MEASUREMENT REPORT  for measurement = inter frequency | **X** | **O** | TS 25.331 |
| PCCPCH RSCP | RRC/MEASUREMENT REPORT  for measurement = inter frequency | **X** | **O** | TS 25.331 |
| Pathloss | RRC/MEASUREMENT REPORT  for measurement = inter frequency | **X** | **M** | TS 25.331 |
| Cell parameters Id | RRC/MEASUREMENT REPORT  for measurement = inter frequency | **O** | **O** | TS 25.331 |
| Timeslot list | RRC/MEASUREMENT REPORT  for measurement = inter frequency | **X** | **O** | TS 25.331 |
| BCCH ARFCN | RRC/MEASUREMENT REPORT  for measurement = inter RAT | **X** | **M** | TS 25.331 |
| GSM Carrier RSSI | RRC/MEASUREMENT REPORT  for measurement = inter RAT | **X** | **M** | TS 25.331 |
| RLC buffer Payload | RRC/MEASUREMENT REPORT  for measurement = traffic volume | **X** | **M** | TS 25.331 |
| Average RLC buffer payload | RRC/MEASUREMENT REPORT  for measurement = traffic volume | **X** | **M** | TS 25.331 |
| Variance of RLC buffer payload | RRC/MEASUREMENT REPORT  for measurement = traffic volume | **X** | **M** | TS 25.331 |
| Logged Connection Establishment Failure Report | UE INFORMATION RESPONSE | **X** | **M** | TS 25.331 |
| Iub | NBAP | RL identity | RADIO LINK SETUP REQUEST  RADIO LINK RECONFIGURATION PREPARE  RADIO LINK RECONFIGURATION REQUEST  RADIO LINK RECONFIGURATION READY  RADIO LINK RECONFIGURATION FAILURE  RADIO LINK RECONFIGURATION RESPONSE  RADIO LINK ADDITION REQUEST  RADIO LINK RECONFIGURATION REQUEST  RADIO LINK SETUP RESPONSE  RADIO LINK SETUP FAILURE  RADIO LINK ADDITION RESPONSE  RADIO LINK ADDITION FAILURE  RADIO LINK DELETION REQUEST | **M** | **M** | TS 25.433 |
| RL info type | RADIO LINK SETUP FAILURE  RADIO LINK ADDITION FAILURE  RADIO LINK RECONFIGURATION FAILURE | **M** | **M** | TS 25.433 |
| C-ID | RADIO LINK SETUP REQUEST  RADIO LINK ADDITION REQUEST | **M** | **M** | TS 25.433 |
| UL Scrambling Code | RADIO LINK SETUP REQUEST  RADIO LINK RECONFIGURATION PREPARE | **O** | **O** | TS 25.433 |
| UL Timeslot information | RADIO LINK SETUP REQUEST  RADIO LINK RECONFIGURATION PREPARE | **O** | **O** | TS 25.433 |
| UL SIR target | RADIO LINK SETUP REQUEST  RADIO LINK RECONFIGURATION PREPARE | **M** | **M** | TS 25.433 |
| Minimum UL channelization length | RADIO LINK SETUP REQUEST  RADIO LINK RECONFIGURATION PREPARE | **O** | **O** | TS 25.433 |
| Initial DL transmission Power | RADIO LINK SETUP REQUEST  RADIO LINK ADDITION REQUEST | **M** | **M** | TS 25.433 |
| Maximum DL transmission Power | RADIO LINK SETUP REQUEST  RADIO LINK RECONFIGURATION PREPARE  RADIO LINK ADDITION REQUEST  RADIO LINK RECONFIGURATION REQUEST | **M** | **M** | TS 25.433 |
| Minimum DL transmission Power | RADIO LINK SETUP REQUEST  RADIO LINK ADDITION REQUEST  RADIO LINK RECONFIGURATION PREPARE  RADIO LINK RECONFIGURATION REQUEST | **M** | **M** | TS 25.433 |
| DL scrambling code | RADIO LINK SETUP REQUEST  RADIO LINK ADDITION REQUEST  RADIO LINK RECONFIGURATION PREPARE  RADIO LINK RECONFIGURATION REQUEST | **O** | **O** | TS 25.433 |
| DL Code information | RADIO LINK SETUP REQUEST  RADIO LINK ADDITION REQUEST  RADIO LINK RECONFIGURATION PREPARE  RADIO LINK RECONFIGURATION REQUEST | **O** | **O** | TS 25.433 |
| DL Timeslot information | RADIO LINK SETUP REQUEST  RADIO LINK RECONFIGURATION PREPARE  RADIO LINK RECONFIGURATION REQUEST | **O** | **O** | TS25.433 |
| Puncture limit | RADIO LINK SETUP REQUEST  RADIO LINK RECONFIGURATION PREPARE | **M** | **M** | TS 25.433 |
| UL Time Slot ISCP Info | RADIO LINK SETUP RESPONSE  RADIO LINK ADDITION RESPONSE | **O** | **O** | TS 25.433 |
| Received total wide band power | RADIO LINK SETUP RESPONSE  RADIO LINK SETUP FAILURE  RADIO LINK ADDITION RESPONSE  RADIO LINK ADDITION FAILURE | **O** | **O** | TS 25.433 |
| Iu | RANAP | RAB identity | All messages where it is present | **M** | **M** | TS 25.413 |
| RAB info type | RAB ASSIGNMENT REQUEST  RELOCATION REQUEST  RAB MODIFY REQUEST  RAB ASSIGNMENT RESPONSE | **M** | **M** | TS 25.413 |
| RAB parameters | RAB ASSIGNMENT REQUEST  RELOCATION REQUEST | **M** | **M** | TS 25.413 |
| Assigned RAB parameters values | RAB ASSIGNMENT RESPONSE | **M** | **M** | TS 25.413 |
| Requested RAB parameters values | RAB MODIFY REQUEST | **M** | **M** | TS 25.413 |
| Source ID | RELOCATION REQUIRED | **M** | **M** | TS 25.413 |
| Target ID | RELOCATION REQUIRED | **M** | **M** | TS 25.413 |
| LAI | DIRECT TRANSFER | **M** | **M** | TS 25.413 |
| RAC | DIRECT TRANSFER | **M** | **M** | TS 25.413 |
| SAI | DIRECT TRANSFER | **M** | **M** | TS 25.413 |
| Iur | RNSAP | RL id identity | RADIO LINK SETUP REQUEST  RADIO LINK RECONFIGURATION PREPARE  RADIO LINK RECONFIGURATION REQUEST  RADIO LINK RECONFIGURATION READY  RADIO LINK RECONFIGURATION FAILURE  RADIO LINK RECONFIGURATION RESPONSE  RADIO LINK ADDITION REQUEST  RADIO LINK RECONFIGURATION REQUEST  RADIO LINK SETUP RESPONSE  RADIO LINK SETUP FAILURE  RADIO LINK ADDITION RESPONSE  RADIO LINK ADDITION FAILURE  RADIO LINK DELETION REQUEST | **M** | **M** | TS 25.423 |
| C-ID | RADIO LINK SETUP REQUEST  RADIO LINK ADDITION REQUEST | **M** | **M** | TS 25.423 |
| RL info type | RADIO LINK SETUP FAILURE  RADIO LINK ADDITION FAILURE  RADIO LINK SETUP FAILURE  RADIO LINK RECONFIGURATION FAILURE | **M** | **M** | TS 25.423 |
| UL Scrambling Code | RADIO LINK SETUP REQUEST  RADIO LINK RECONFIGURATION PREPARE | **O** | **O** | TS 25.423 |
| UL Timeslot information | RADIO LINK SETUP REQUEST  RADIO LINK RECONFIGURATION PREPARE | **O** | **O** | TS25.423 |
| UL SIR target | RADIO LINK SETUP REQUEST  RADIO LINK RECONFIGURATION PREPARE | **M** | **M** | TS 25.423 |
| Minimum UL channelization length | RADIO LINK SETUP REQUEST  RADIO LINK RECONFIGURATION PREPARE | **O** | **O** | TS 25.423 |
| Initial DL transmission Power | RADIO LINK SETUP REQUEST  RADIO LINK ADDITION REQUEST | **M** | **M** | TS 25.423 |
| Maximum DL transmission Power | RADIO LINK SETUP REQUEST  RADIO LINK RECONFIGURATION PREPARE  RADIO LINK ADDITION REQUEST  RADIO LINK RECONFIGURATION REQUEST | **M** | **M** | TS 25.423 |
| Minimum DL transmission Power | RADIO LINK SETUP REQUEST  RADIO LINK ADDITION REQUEST  RADIO LINK RECONFIGURATION PREPARE  RADIO LINK RECONFIGURATION REQUEST | **M** | **M** | TS 25.423 |
| DL scrambling code | RADIO LINK SETUP REQUEST  RADIO LINK ADDITION REQUEST  RADIO LINK RECONFIGURATION PREPARE  RADIO LINK RECONFIGURATION REQUEST | **O** | **O** | TS 25.423 |
| DL channelization code | RADIO LINK SETUP REQUEST  RADIO LINK ADDITION REQUEST  RADIO LINK RECONFIGURATION PREPARE  RADIO LINK RECONFIGURATION REQUEST | **O** | **O** | TS 25.423 |
| DL Timeslot information | RADIO LINK SETUP REQUEST  RADIO LINK RECONFIGURATION PREPARE  RADIO LINK RECONFIGURATION REQUEST | **O** | **O** | TS 25.423 |
| Puncture limit | RADIO LINK SETUP REQUEST  RADIO LINK RECONFIGURATION PREPARE | **M** | **M** | TS 25.423 |
| UL Time Slot ISCP Info | RADIO LINK SETUP RESPONSE  RADIO LINK ADDITION RESPONSE | **O** | **O** | TS 25.423 |
| Received total wide band power | RADIO LINK SETUP RESPONSE  RADIO LINK SETUP FAILURE  RADIO LINK ADDITION RESPONSE  RADIO LINK ADDITION FAILURE | **O** | **O** | TS 25.423 |

**Constraints:**

The following optional IE names shall be supported for corresponding modes as described below:

For FDD mode:

- Primary CPICH scrambling code of added cell

- Primary CPICH scrambling code of removed cell

- CPICH Ec/No

- CPICH RSCP

- UL Scrambling Code

- Minimum UL channelization length

- UARFCN downlink (Nd)

- UARFCN uplink (Nu)

- DL Scrambling Code

- DL Code information

- DL channelization code

- Received total wide band power

For TDD mode :

- PCCPCH RSCP

- Cell parameters Id

- UARFCN (Nt)

- Timeslot list

- UL Timeslot information

- DL Timeslot information

- UL Time Slot ISCP Info.

## 4.7 Void

## 4.8 Void

## 4.9 HSS Trace Record Content

The following table contains the Trace record description for the minimum and medium trace depth for MAP and Diameter protocol for the C, D, Gr, Gc,Cx, Sh, S6a, N70, N71 and NU1 interfaces in the HSS.   
The trace record is the same for management based activation and for signalling based activation.

| Interface name | Prot.  name | IE name | Message name(s) | Trace depth | | Notes |
| --- | --- | --- | --- | --- | --- | --- |
| Min | Med |
| D | MAP | IMSI | MAP\_UPDATE\_LOCATION  MAP\_CANCEL\_LOCATION  MAP\_PURGE\_MS  MAP-INSERT-SUBSCRIBER-DATA  MAP\_RESTORE\_DATA  MAP-SEND-IMSI  MAP-READY-FOR-SM | **M** | **M** | TS 29.002 |
| MSC Address | MAP\_UPDATE\_LOCATION | **M** | **M** | TS 29.002 |
| VLR number | MAP\_UPDATE\_LOCATION  MAP\_PURGE\_MS | **M** | **M** | TS 29.002 |
| User error | Every message where it appears | **M** | **M** | TS 29.002 |
| Provider error | Every message where it appears | **M** | **M** | TS 29.002 |
| SGSN number | MAP\_PURGE\_MS | **M** | **M** | TS 29.002 |
| MSISDN | MAP-INSERT-SUBSCRIBER-DATA  MAP-SEND-IMSI | **M** | **M** | TS 29.002 |
| MS Not Reachable Flag | MAP\_RESTORE\_DATA | **M** | **M** | TS 29.002 |
| SS-Code | MAP\_REGISTER\_SS  MAP\_ERASE\_SS  MAP\_ACTIVATE\_SS  MAP\_DEACTIVATE\_SS  MAP\_INTERROGATE\_SS  MAP\_REGISTER\_PASSWORD  MAP\_REGISTER\_CC\_ENTRY  MAP\_ERASE\_CC\_ENTRY | **M** | **M** | TS 29.002 |
| Forwarded-to number with subaddress | MAP\_REGISTER\_SS | **M** | **M** | TS 29.002 |
| Alert Reason | MAP-READY-FOR-SM | **M** | **M** | TS 29.002 |
| Basic service | MAP\_REGISTER\_SS  MAP\_ERASE\_SS  MAP\_ACTIVATE\_SS  MAP\_DEACTIVATE\_SS  MAP\_INTERROGATE\_SS | **M** | **M** | TS 29.002 |
| C | MAP | Service Centre Address | MAP-SEND-ROUTING-INFO-FOR-SM | **M** | **M** | TS 29.002 |
| Network Node Number | MAP-SEND-ROUTING-INFO-FOR-SM | **M** | **M** | TS 29.002 |
| GPRS Node Indicator | MAP-SEND-ROUTING-INFO-FOR-SM | **M** | **M** | TS 29.002 |
| User error | Every message where it appears | **M** | **M** | TS 29.002 |
| Provider error | Every message where it appears | **M** | **M** | TS 29.002 |
| MSISDN | MAP-SEND-ROUTING-INFO-FOR-SM  Send Routeing Info ack | **M** | **M** | TS 29.002 |
| Number of forwarding | Send Routeing Info | **M** | **M** | TS 29.002  TS 23.018 |
| IMSI | Send Routeing Info ack | **M** | **M** | TS 29.002  TS 23.018 |
| Roaming number | Send Routeing Info ack | **M** | **M** | TS 29.002  TS 23.018 |
| Forwarded-to number | Send Routeing Info ack | **M** | **M** | TS 29.002  TS 23.018 |
| Forwarding reason | Send Routeing Info ack | **M** | **M** | TS 29.002  TS 23.018 |
| Additional Number | MAP-SEND-ROUTING-INFO-FOR-SM | **M** | **M** | TS 29.002 |
| Gr | MAP | SGSN address | MAP\_UPDATE\_GPRS\_LOCATION | **M** | **M** | TS 29.002 |
| IMSI | MAP\_CANCEL\_LOCATION  MAP\_PURGE\_MS  MAP\_UPDATE\_GPRS\_LOCATION  MAP-INSERT-SUBSCRIBER-DATA  MAP-READY-FOR-SM | **M** | **M** | TS 29.002 |
| SGSN number | MAP\_UPDATE\_GPRS\_LOCATION  MAP\_PURGE\_MS | **M** | **M** | TS 29.002 |
| Alert Reason | MAP-READY-FOR-SM | **M** | **M** | TS 29.002 |
| User error | Every message where it appears | **M** | **M** | TS 29.002 |
| Provider error | Every message where it appears | **M** | **M** | TS 29.002 |
| Gc | MAP | IMSI | MAP\_SEND\_ROUTING\_INFO\_FOR\_GPRS  MAP\_FAILURE\_REPORT  MAP\_NOTE\_MS\_PRESENT\_FOR\_GPRS | **M** | **M** | TS 29.002 |
| SGSN address | MAP\_SEND\_ROUTING\_INFO\_FOR\_GPRS  MAP\_NOTE\_MS\_PRESENT\_FOR\_GPRS | **M** | **M** | TS 29.002 |
| GGSN address | MAP\_SEND\_ROUTING\_INFO\_FOR\_GPRS  MAP\_FAILURE\_REPORT  MAP\_NOTE\_MS\_PRESENT\_FOR\_GPRS | **M** | **M** | TS 29.002 |
| Mobile Not Reachable Reason | MAP\_SEND\_ROUTING\_INFO\_FOR\_GPRS | **M** | **M** | TS 29.002 |
| User error | Every message where it appears | **M** | **M** | TS 29.002 |
| Provider error | Every message where it appears | **M** | **M** | TS 29.002 |
| Cx | Diameter | Public User Identity | User-Authorization-Request  Multimedia-Auth-Request  Location Info Request | **M** | **M** | TS 29.228 |
| Private User Identity | User-Authorization-Request  Multimedia-Auth-Request  Registration-Termination-Request  Push-Profile-Request | **M** | **M** | TS 29.228 |
| Visited Network Identifier | User-Authorization-Request | **M** | **M** | TS 29.228 |
| S-CSCF Name | Server-Assignment-Request  Multimedia-Auth-Request | **M** | **M** | TS 29.228 |
| Server Assignment Type | Server-Assignment-Request | **M** | **M** | TS 29.228 |
| User Data Already Available | Server-Assignment-Request | **M** | **M** | TS 29.228 |
| Reason for de-registration | Registration-Termination-Request | **M** | **M** | TS 29.228 |
| Routing Information | Registration-Termination-Request  Push-Profile-Request | **M** | **M** | TS 29.228 |
| Number Authentication Items | Multimedia-Auth-Request | **M** | **M** | TS 29.228 |
| Authentication Data | Multimedia-Auth-Request | **M** | **M** | TS 29.228 |
| Authentication Scheme | Multimedia-Auth-Request | **M** | **M** | TS 29.228 |
| Registration result | Server-Assignment-Answer | **M** | **M** | TS 29.228 |
| Result | User-Authorization-Answer  Registration-Termination-Answer  Location Info Answer  Push-Profile-Answer  Multimedia-Auth-Answer | **M** | **M** | TS 29.228 |
| Sh | Diameter | User Identity | User-Data-Request  Profile-Update-Request  Subscribe-Notifications-Request  Push-Notification-Request | **M** | **M** | TS 29.328 |
| Requested data | User-Data-Request  Profile-Update-Request  Subscribe-Notifications-Request | **M** | **M** | TS 29.328 |
| Application Server Identity | User-Data-Request  Profile-Update-Request  Subscribe-Notifications-Request | **M** | **M** | TS 29.328 |
| Data | Profile-Update-Request  Push-Notification-Request | **M** | **M** | TS 29.328 |
| Subscription request type | Subscribe-Notifications-Request | **M** | **M** | TS 29.328 |
| Result | User-Data-Answer  Profile-Update-Answer  Subscribe-Notifications-Answer  Push-Notification-Answer | **M** | **M** | TS 29.328 |
| S6a | Diameter | User Name | NOTIFY REQUEST  AUTHENTICATION INFORMATION REQUEST  DELETE SUBSCRIBER DATA REQUEST  INSERT SUBSCRIBER DATA REQUEST  PURGE UE REQUEST  CANCEL LOCATION REQUEST  UPDATE LOCATION REQUEST | **M** | **M** | TS 29.272 |
| Terminal Infomration | NOTIFY REQUEST  UPDATE LOCATION REQUEST | **M** | **M** | TS 29.272 |
| Result | NOTIFY ANSWER  AUTHENTICATION INFORMATION ANSWER  DELETE SUBSCRIBER DATA ANSWER  INSERT SUBSCRIBER DATA ANSWER  PURGE UE ANSWER  CANCEL LOCATION ANSWER  UPDATE LOCATION ANSWER | **M** | **M** | TS 29.272 |
| RAT Type | UPDATE LOCATION REQUEST | **M** | **M** | TS 29.272 |
| APN | NOTIFY REQUEST |  |  |  |
| Visited PLMN Id | AUTHENTICATION INFORMATION REQUEST  UPDATE LOCATION REQUEST | **M** | **M** | TS 29.272 |
| N70 | Nhss | Message Name | Nhss\_imsUEContextManagement  Nhss\_imsSubscriberDataManagement Nhss\_imsUEAuthentication | **M** | **M** | TS 29.562 |
| URI of the request | Nhss\_imsUEContextManagement  Nhss\_imsSubscriberDataManagement Nhss\_imsUEAuthentication | **M** | **M** | TS 29.562 |
| Status code of the response | Nhss\_imsUEContextManagement  Nhss\_imsSubscriberDataManagement Nhss\_imsUEAuthentication | **M** | **M** | TS 29.562 |
| ID of the connected NF | Nhss\_imsUEContextManagement  Nhss\_imsSubscriberDataManagement Nhss\_imsUEAuthentication | **M** | **M** | TS 29.562 |
| ID of the traced NF | Nhss\_imsUEContextManagement  Nhss\_imsSubscriberDataManagement Nhss\_imsUEAuthentication | **M** | **M** | TS 29.562 |
| Record extensions | Nhss\_imsUEContextManagement  Nhss\_imsSubscriberDataManagement Nhss\_imsUEAuthentication | **O** | **O** | TS 29.562 |
| IE extracted from the NU1 messages | Nhss\_imsUEContextManagement  Nhss\_imsSubscriberDataManagement Nhss\_imsUEAuthentication | **O** | **O** | TS 29.562 |
| N71 | Nhss | Message Name | Nhss\_imsSubscriberDataManagement | **M** | **M** | TS 29.562 |
| URI of the request | Nhss\_imsSubscriberDataManagement | **M** | **M** | TS 29.562 |
| Status code of the response | Nhss\_imsSubscriberDataManagement | **M** | **M** | TS 29.562 |
| ID of the connected NF | Nhss\_imsSubscriberDataManagement | **M** | **M** | TS 29.562 |
| ID of the traced NF | Nhss\_imsSubscriberDataManagement | **M** | **M** | TS 29.562 |
| Record extensions | Nhss\_imsSubscriberDataManagement | **O** | **O** | TS 29.562 |
| IE extracted from the NU1 messages | Nhss\_imsSubscriberDataManagement | **O** | **O** | TS 29.562 |
| NU1 | Nhss | Message Name | Nhss\_UEAuthentication  Nhss\_SubscriberDataManagement  Nhss\_UEContextManagement  Nhss\_EventExposure | **M** | **M** | TS 29.563 |
| URI of the request | Nhss\_UEAuthentication  Nhss\_SubscriberDataManagement  Nhss\_UEContextManagement  Nhss\_EventExposure | **M** | **M** | TS 29.563 |
| Status code of the response | Nhss\_UEAuthentication  Nhss\_SubscriberDataManagement  Nhss\_UEContextManagement  Nhss\_EventExposure | **M** | **M** | TS 29.563 |
| ID of the connected NF | Nhss\_UEAuthentication  Nhss\_SubscriberDataManagement  Nhss\_UEContextManagement  Nhss\_EventExposure | **M** | **M** | TS 29.563 |
| ID of the traced NF | Nhss\_UEAuthentication  Nhss\_SubscriberDataManagement  Nhss\_UEContextManagement  Nhss\_EventExposure | **M** | **M** | TS 29.563 |
| Record extensions | Nhss\_UEAuthentication  Nhss\_SubscriberDataManagement  Nhss\_UEContextManagement  Nhss\_EventExposure | **O** | **O** | TS 29.563 |
| IE extracted from the NU1 messages | Nhss\_UEAuthentication  Nhss\_SubscriberDataManagement  Nhss\_UEContextManagement  Nhss\_EventExposure | **O** | **O** | TS 29.563 |

## 4.10 BM-SC Trace Record Content

The following table describes the trace record content for minimum and medium trace depth for BM-SC.

The record content is same for management based activation and for signalling based activation.

For BM-SC, the Minimum level of detail shall be supported.

| Interface  name | Prot.  name | IE name | Message name(s) | Trace depth | | Notes |
| --- | --- | --- | --- | --- | --- | --- |
| Min | Med |
| Gmb | Diameter Gmb | IMSI | MBMS Authorization Request (AAR)  MBMS Authorization Response (AAA) | M | M | TS 29.061 |
| RAI | MBMS Authorization Request (AAR) | M | M | TS 29.061 |
| Access Point Name | MBMS Authorization Request (AAR) | M | M | TS 29.061 |
| MSISDN | MBMS Authorization Request (AAR) | M | M | TS 29.061 |
| IMEI(SV) | MBMS Authorization Request (AAR) | M | M | TS 29.061 |
| IP Multicast Address | MBMS Authorization Request (AAR) | M | M | TS 29.061 |
| TMGI | MBMS Authorization Response (AAA) | M | M | TS 29.061 |
| Result-Code | MBMS Authorization Response (AAA)  MBMS User Deactivation Response (STA)  MBMS Session start-stop indication Response (raa)  MBMS service termination answer (ASR) | M | M | TS 29.061 |
| Experimental-Result | MBMS Authorization Response (AAA)  MBMS Session start-stop indication Response (raa) | M | M | TS 29.061 |
| Error-Reporting-Host | MBMS Authorization Response (AAA)  MBMS User Deactivation Response (STA)  MBMS Session start-stop indication Response (raa)  MBMS service termination answer (ASR) | M | M | TS 29.061 |

## 4.11 PGW Trace Record Content

The following table shows the trace record content for PGW.

The trace record is the same for management based activation and for signalling based activation.

PGW shall support at least one of the following trace depth levels – Maximum, Medium or Minimum.

Table 4.11.1 : PGW Trace Record Content

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Interface (specific messages)** | **Format** | **Level of details** | | | **Description** |
| **Min** | **Med** | **Max** |
| S2a/S2b | Decoded | **M** | **M** | **O** | Message name |
| **O** | **O** | **O** | Record extensions |
| **M** | **M** | **X** | SGSNID of connected SGSN PGW ID of the traced PGW |
| **M** | **M** | **X** | Dedicated IE extracted from S2a/S2b messages between the traced PGW and the SGSN. A subset of IEs as given in the table 4.11.2. is provided. |
| Encoded\* | **X** | **X** | **M** | Raw Messages: S2a/S2b messages between the traced PGW and the SGSN. The encoded content of the message is provided. |
| S5/S8 | Decoded | **M** | **M** | **O** | Message name |
| **O** | **O** | **O** | Record extensions |
| **M** | **M** | **X** | SGW ID of the connected SGW PGW of the traced PGW |
| **M** | **M** | **X** | IE extracted from S5/S8 messages between the traced PGW and SGW. A subset of IEs as given in the table 4.11.2. is provided. |
| Encoded\* | **X** | **X** | **M** | Raw S5/S8 Messages: messages between the traced PGW and SGW. The encoded content of the message is provided |
| S6b | Decoded | **M** | **M** | **O** | Message name |
| **O** | **O** | **O** | Record extensions |
| **M** | **M** | **X** | PGWID of the traced PGW |
| **M** | **M** | **X** | Dedicated IE extracted from S6b messages between the traced PGW and the AAA. A subset of IEs as given in the table 4.11.2.is provided |
| Encoded\* | **X** | **X** | **M** | Raw S6b messages between the traced PGW and the AAA. The encoded content of the message is provided |
| Gx | Decoded | **M** | **M** | **O** | Message name |
| **O** | **O** | **O** | Record extensions |
| **M** | **M** | **X** | PCRF ID of the connected PCRF PGW ID of the traced PGW |
| **M** | **M** | **X** | Dedicated IE extracted from Gx messages between the traced PGW and another PCRF. A subset of IEs as given in the table 4.11.2.is provided |
| Encoded\* | **X** | **X** | **M** | Raw Gx messages between the traced PGW and another PCRF. The encoded content of the message is provided |

Encoded\* - the messages are left encoded in the format it was received.

Table 4.11.2 : PGW trace record description for minimum and medium trace depth

| **Interface name** | **Prot.**  **name** | **IE name** | **Message name(s)** | **Trace depth** | | **Notes** |
| --- | --- | --- | --- | --- | --- | --- |
| **Min** | **Med** |
| S2a/S2b | PMIP |  |  |  |  |  |
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| S5/S8 | GTPv2C | IMSI | Create Session Request  Update Bearer Request | **M** | **M** | TS 29.274 |
| MSISDN | Create Session Request  Modify Bearer Response | **M** | **M** | TS 29.274 |
| Serving Network | Create Session Request  Modify Bearer Request | **M** | **M** | TS 29.274 |
| Access Point Name (APN) | Create Session Request | **M** | **M** | TS 29.274 |
| PDN Type | Create Session Request | **M** | **M** | TS 29.274 |
| Bearer Contexts | Create Session Request  Create Bearer Request  Create Bearer Response  Delete Bearer Request  Delete Bearer Response  Modify Bearer Command  Modify Bearer Failure Indication  Update Bearer Request  Update Bearer Response  Delete Bearer Command  Delete Bearer Failure Indication | **M** | **M** | TS 29.274 |
| Cause | Create Session Response  Create Bearer Response  Bearer Resource Failure Indication  Modify Bearer Response  Delete Session Response  Delete Bearer Response  Modify Bearer Failure Indication  Update Bearer Response  Delete Bearer Failure Indication | **M** | **M** | TS 29.274 |
| Bearer Contexts created | Create Session Response | **M** | **M** | TS 29.274 |
| Bearer Contexts marked for removal | Create Session Response | **M** | **M** | TS 29.274 |
| APN Restriction | Create Session Response | **M** | **M** | TS 29.274 |
| Linked Bearer Identity (LBI) | Create Bearer Request  Bearer Resource Command  Delete Bearer Response | **M** | **M** | TS 29.274 |
| Traffic Aggregate Description (TAD) | Bearer Resource Command | **M** | **M** | TS 29.274 |
| Linked EPS Bearer ID | Bearer Resource Failure Indication  Delete Session Request  Delete Bearer Request | **M** | **M** | TS 29.274 |
| RAT Type | Create Session Request  Modify Bearer Request | **M** | **M** | TS 29.274 |
| Bearer Contexts to be modified | Modify Bearer Request | **M** | **M** | TS 29.274 |
| Bearer Contexts to be removed | Modify Bearer Request | **M** | **M** | TS 29.274 |
| Bearer Contexts modified |  | **M** | **M** | TS 29.274 |
| Bearer Contexts marked for removal |  | **M** | **M** | TS 29.274 |
| S6b | Diameter | MIP Subscriber Profile | AAR  AAA | **M** | **M** | TS 29.273 |
| APN | AAR | **M** | **M** | TS 29.273 |
| QoS capabilities | AAR | **M** | **M** | TS 29.273 |
| Result Code | AAA | **M** | **M** | TS 29.273 |
| QoS resources | AAA | **M** | **M** | TS 29.273 |
| 3GPP AAA Server Name | AAA | **M** | **M** | TS 29.273 |
| S2c | DSMIP |  |  |  |  |  |
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| Gx | Diameter | Bearer-Identifier | CCR | **M** | **M** | TS 29.212 |
| Bearer-Operation | CCR | **M** | **M** | TS 29.212 |
| IP-CAN-Type | CCR | **M** | **M** | TS 29.212 |
| RAT-Type | CCR | **M** | **M** | TS 29.212 |
| QoS-Information | CCR  CCA  RAR | **M** | **M** | TS 29.212 |
| QoS-Negotiation | CCR | **M** | **M** | TS 29.212 |
| QoS-Upgrade | CCR | **M** | **M** | TS 29.212 |
| Default-EPS-Bearer-QoS | CCR  CCA  RAR | **M** | **M** | TS 29.212 |
| Supported-Features | CCR  CCA  RAR  RAA | **M** | **M** | TS 29.212 |
| Event-Trigger | CCR  CCA  RAR | **M** | **M** | TS 29.212 |
| Result Code | RAA | **M** | **M** | TS 29.212 |
| Origin-Realm | CCR  CCA  RAR  RAA | **M** | **M** | TS 29.212 |
| Destination-Realm | CCR  RAR | **M** | **M** | TS 29.212 |
|  |  |  |  |  |  |  |
| SGi |  |  |  |  |  |  |

## 4.12 MME Trace Record Content

The following table shows the trace record content for MME.

The trace record is the same for management based activation and for signalling based activation.

MME shall support at least one of the following trace depth levels – Maximum, Medium or Minimum.

Table 4.12.1 : MME Trace Record Content

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Interface (specific messages)** | **Format** | **Level of details** | | | **Description** |
| **Min** | **Med** | **Max** |
| S1 | Decoded | **M** | **M** | **O** | Message name |
| **O** | **O** | **O** | Record extensions |
| **M** | **M** | **X** | eNBID of connected eNB MME ID of the traced MME |
| **M** | **M** | **X** | Dedicated IE extracted from S1 messages between the traced eNB and the MME. A subset of IEs as given in the table 4.12.2. is provided. |
| ASN.1 | **X** | **X** | **M** | Raw Messages: S1 messages between the traced eNB and the MME. The encoded content of the message is provided. |
| S1 NAS PDU IE | 3GPP TS 24.301, sections 8 and 9 | **X** | **X** | **M** | Hexdata dump of the decrypted NAS message formatted according to 3GPP TS 24.301, sections 8 and 9, recorded as a separate message entry in the call trace file |
| S3 | Decoded | **M** | **M** | **O** | Message name |
| **O** | **O** | **O** | Record extensions |
| **M** | **M** | **X** | SGSN ID of the connected SGSN MME ID of the traced MME |
| **M** | **M** | **X** | IE extracted from S3 messages between the traced MME and SGSN. A subset of IEs as given in the table 4.12.2. is provided. |
| Encoded \* | **X** | **X** | **M** | Raw S3 Messages: messages between the traced MME and SGSN. The encoded content of the message is provided |
| S11 | Decoded | **M** | **M** | **O** | Message name |
| **O** | **O** | **O** | Record extensions |
| **M** | **M** | **X** | SGW ID of the connected SGW MME ID of the traced MME |
| **M** | **M** | **X** | Dedicated IE extracted from S11 messages between the traced SGW and the MME. A subset of IEs as given in the table 4.12.2.is provided |
| Encoded \* | **X** | **X** | **M** | Raw S11 messages between the traced SGW and the MME. The encoded content of the message is provided |
| S6a | Decoded | **M** | **M** | **O** | Message name |
| **O** | **O** | **O** | Record extensions |
| **M** | **M** | **X** | HSS ID of the connected HSS MME ID of the traced MME |
| **M** | **M** | **X** | Dedicated IE extracted from S6a messages between the traced HSS and the MME. A subset of IEs as given in the table 4.12.2.is provided |
| Encoded \* | **X** | **X** | **M** | Raw S6a messages between the traced HSS and the MME. The encoded content of the message is provided |
| S10 | Decoded | **M** | **M** | **O** | Message name |
| **O** | **O** | **O** | Record extensions |
| **M** | **M** | **X** | MME ID of the connected MME MME ID of the traced MME |
| **M** | **M** | **X** | Dedicated IE extracted from S10 messages between the traced MME and another MME. A subset of IEs as given in the table 4.12.2.is provided |
| Encoded \* | **X** | **X** | **M** | Raw S10 messages between the traced MME and another MME. The encoded content of the message is provided |
| N26 | Decoded | **M** | **M** | **O** | Message name |
| **O** | **O** | **O** | Record extensions |
| **M** | **M** | **X** | AMF ID of the connected AMF MME ID of the traced MME |
| **M** | **M** | **X** | Dedicated IE extracted from N26 messages between the traced MME and AMF. A subset of IEs as given in the table 4.12.2.is provided |
| Encoded \* | **X** | **X** | **M** | Raw N26 messages between the traced MME and another MME. The encoded content of the message is provided |

Encoded\* - the messages are left encoded in the format it was received.

Table 4.12.2 : MME trace record description for minimum and medium trace depth

| **Interface name** | **Prot.**  **name** | **IE name** | **Message name(s)** | **Trace depth** | | **Notes** |
| --- | --- | --- | --- | --- | --- | --- |
| **Min** | **Med** |
| S1 | MM | EPS attach type | ATTACH REQUEST | M | M | TS 24.301 |
| GUTI | ATTACH REQUEST  ATTACH ACCEPT  TRACKING AREA UPDATE REQUEST  TRACKING AREA UPDATE ACCEPT  DETACH REQUEST  GUTI REALLOCATION COMMAND | M | M | TS 24.301 |
| IMSI | ATTACH REQUEST  DETACH REQUEST | M | M | TS 24.301 |
| Old P-TMSI | ATTACH REQUEST  TRACKING AREA UPDATE REQUEST | M | M | TS 24.301 |
| M-TMSI |  | M | M | TS 24.301 |
| Last visisted registered TAI | ATTACH REQUEST  TRACKING AREA UPDATE REQUEST | M | M | TS 24.301 |
| UE network capability | ATTACH REQUEST  TRACKING AREA UPDATE REQUEST | M | M | TS 24.301 |
| MS network capability | ATTACH REQUEST | M | M | TS 24.301 |
| LAI | ATTACH REQUEST ATTACH ACCEPT  TRACKING AREA UPDATE REQUEST  TRACKING AREA UPDATE ACCEPT | M | M | TS 24.301 |
| EPS attach result | ATTACH ACCEPT | M | M | TS 24.301 |
| EMM cause | ATTACH ACCEPT  ATTACH REJECT  TRACKING AREA UPDATE ACCEPT  TRACKING AREA UPDATE REJECT  DETACH REQUEST  AUTHENTICATION FAILURE  SERVICE REJECT  SECURITY MODE REJECT  EMM STATUS | M | M | TS 24.301 |
| EPS bearer context status | TRACKING AREA UPDATE REQUEST  TRACKING AREA UPDATE ACCEPT | M | M | TS 24.301 |
| Detach type | DETACH REQUEST | M | M | TS 24.301 |
| EPS update type | TRACKING AREA UPDATE REQUEST | M | M | TS 24.301 |
| EPS update result | TRACKING AREA UPDATE ACCEPT | M | M | TS 24.301 |
| Identity type | IDENTITY REQUEST | M | M | TS 24.301 |
| Mobile identity | IDENTITY RESPONSE | M | M | TS 24.301 |
| IMEISV request | SECURITY MODE COMMAND | M | M | TS 24.301 |
| IMEISV | SECURITY MODE COMPLETE | M | M | TS 24.301 |
| Selected NAS security algorithms | SECURITY MODE COMMAND | M | M | TS 24.301 |
| UE security capability | SECURITY MODE COMMAND | M | M | TS 24.301 |
| Equivalent PLMNs list | ATTACH ACCEPT  TRACKING AREA UPDATE ACCEPT | M | M | TS 24.301 |
| TAI list | ATTACH ACCEPT  TRACKING AREA UPDATE ACCEPT  GUTI REALLOCATION COMMAND | M | M | TS 24.301 |
| S1 | SM | EPS bearer identity | PDN CONNECTIVITY REQUEST  PDN CONNECTIVITY REJECT  PDN DISCONNECT REQUEST  PDN DISCONNECT REJECT  ACTIVATE DEFAULT EPS BEARER CONTEXT REQUEST  ACTIVATE DEFAULT EPS BEARER CONTEXT ACCEPT  ACTIVATE DEFAULT EPS BEARER CONTEXT REJECT  ACTIVATE DEDICATED EPS BEARER CONTEXT REQUEST  ACTIVATE DEDICATED EPS BEARER CONTEXT ACCEPT  ACTIVATE DEDICATED EPS BEARER CONTEXT REJECT  ESM STATUS  DEACTIVATE EPS BEARER CONTEXT REQUEST  DEACTIVATE EPS BEARER CONTEXT ACCEPT  MODIFY EPS BEARER CONTEXT REQUEST  MODIFY EPS BEARER CONTEXT ACCEPT  MODIFY EPS BEARER CONTEXT REJECT  BEARER RESOURCE ALLOCATION REQUEST  BEARER RESOURCE ALLOCATION REJECT  BEARER RESOURCE MODIFICATION REQUEST  BEARER RESOURCE MODIFICATION REJECT | M | M | TS 24.301 |
| Linked EPS bearer identity | PDN DISCONNECT REQUEST  ACTIVATE DEDICATED EPS BEARER CONTEXT REQUEST  BEARER RESOURCE ALLOCATION REQUEST  BEARER RESOURCE MODIFICATION REQUEST | M | M | TS 24.301 |
| Procedure Transaction Identity | PDN CONNECTIVITY REQUEST  PDN CONNECTIVITY REJECT  PDN DISCONNECT REQUEST  PDN DISCONNECT REJECT  ACTIVATE DEFAULT EPS BEARER CONTEXT REQUEST  ACTIVATE DEFAULT EPS BEARER CONTEXT ACCEPT  ACTIVATE DEFAULT EPS BEARER CONTEXT REJECT  ACTIVATE DEDICATED EPS BEARER CONTEXT REQUEST  ACTIVATE DEDICATED EPS BEARER CONTEXT ACCEPT  ACTIVATE DEDICATED EPS BEARER CONTEXT REJECT  ESM STATUS  DEACTIVATE EPS BEARER CONTEXT REQUEST  DEACTIVATE EPS BEARER CONTEXT ACCEPT  MODIFY EPS BEARER CONTEXT REQUEST  MODIFY EPS BEARER CONTEXT ACCEPT  MODIFY EPS BEARER CONTEXT REJECT  BEARER RESOURCE ALLOCATION REQUEST  BEARER RESOURCE ALLOCATION REJECT  BEARER RESOURCE MODIFICATION REQUEST  BEARER RESOURCE MODIFICATION REJECT | M | M | TS 24.301 |
| Request type | PDN CONNECTIVITY REQUEST | M | M | TS 24.301 |
| APN | PDN CONNECTIVITY REQUEST  ACTIVATE DEFAULT EPS BEARER CONTEXT REQUEST | M | M | TS 24.301 |
| EPS QoS | ACTIVATE DEFAULT EPS BEARER CONTEXT REQUEST  ACTIVATE DEDICATED EPS BEARER CONTEXT REQUEST  MODIFY EPS BEARER CONTEXT REQUEST | M | M | TS 24.301 |
| Negotiated QoS/New QoS | ACTIVATE DEFAULT EPS BEARER CONTEXT REQUEST  ACTIVATE DEDICATED EPS BEARER CONTEXT REQUEST  MODIFY EPS BEARER CONTEXT REQUEST | M | M | TS 24.301 |
| PDN address | ACTIVATE DEFAULT EPS BEARER CONTEXT REQUEST | M | M | TS 24.301 |
| APN-AMBR | ACTIVATE DEFAULT EPS BEARER CONTEXT REQUEST  MODIFY EPS BEARER CONTEXT REQUEST | M | M | TS 24.301 |
| ESM cause | PDN CONNECTIVITY REJECT  PDN DISCONNECT REJECT  ACTIVATE DEFAULT EPS BEARER CONTEXT REQUEST  ACTIVATE DEFAULT EPS BEARER CONTEXT REJECT  ACTIVATE DEDICATED EPS BEARER CONTEXT REJECT  ESM STATUS  DEACTIVATE EPS BEARER CONTEXT REQUEST  MODIFY EPS BEARER CONTEXT REJECT  BEARER RESOURCE ALLOCATION REJECT  BEARER RESOURCE MODIFICATION REQUEST  BEARER RESOURCE MODIFICATION REJECT | M | M | TS 24.301 |
| Traffic flow template | ACTIVATE DEDICATED EPS BEARER CONTEXT REQUEST  MODIFY EPS BEARER CONTEXT REQUEST | M | M | TS 24.301 |
| Traffic flow aggregate | BEARER RESOURCE ALLOCATION REQUEST  BEARER RESOURCE MODIFICATION REQUEST | M | M | TS 24.301 |
| Required traffic flow QoS | BEARER RESOURCE ALLOCATION REQUEST  BEARER RESOURCE MODIFICATION REQUEST | M | M | TS 24.301 |
| PDN type | PDN CONNECTIVITY REQUEST | M | M | TS 24.301 |
| S3 | GTPv2-C | IMSI | DETACH NOTIFICATION  CS PAGING INDICATON | **M** | **M** | TS 29.274 |
| TMSI | CS PAGING INDICATON | **M** | **M** | TS 29.274 |
| Cause | DETACH NOTIFICATION  DETACH aCKNOWLEDGE | **M** | **M** | TS 29.274 |
| S3/S10 | GTPv2-C | IMSI | RELOCATION CANCEL Request  IDENTIFICATION RESPONSE  CONTEXT RESPONSE  CONTEXT REQUEST  FORWARD RELOCATION REQUEST | **M** | **M** | TS 29.274 |
| GUTI | CONTEXT REQUEST  IDENTIFICATION Request | **M** | **M** | TS 29.274 |
| RAI | IDENTIFICATION Request  CONTEXT REQUEST | **M** | **M** | TS 29.274 |
| P-TMSI | IDENTIFICATION Request  CONTEXT REQUEST | **M** | **M** | TS 29.274 |
| Indication | FORWARD RELOCATION COMPLETE NOTIFICATION  FORWARD RELOCATION REQUEST | **M** | **M** | TS 29.274 |
| BSSGP Cause | FORWARD RELOCATION RESPONSE  FORWARD RELOCATION REQUEST | **M** | **M** | TS 29.274 |
| RANAP Cause | FORWARD RELOCATION RESPONSE  FORWARD RELOCATION REQUEST | **M** | **M** | TS 29.274 |
| eNodeB Cause | FORWARD RELOCATION RESPONSE | **M** | **M** | TS 29.274 |
| RAT Type | CONTEXT REQUEST | **M** | **M** | TS 29.274 |
| Target Identification | FORWARD RELOCATION REQUEST | **M** | **M** | TS 29.274 |
| Cause | RELOCATION CANCEL RESPONSE  FORWARD SRNS CONTEXt ACKNOWLEDGE  IDENTIFICATION RESPONSE  CONTEXt ACKNOWLEDGE  CONTEXT RESPONSE  FORWARD RELOCATION COMPLETE ACKNOWLEDGE  FORWARD RELOCATION RESPONSE | **M** | **M** | TS 29.274 |
| RAN Cause | FORWARD RELOCATION REQUEST | **M** | **M** | TS 29.274 |
| Selected PLMN ID | FORWARD RELOCATION REQUEST | **M** | **M** | TS 29.274 |
| S6a | Diameter | User Name | NOTIFY REQUEST  AUTHENTICATION INFORMATION REQUEST  DELETE SUBSCRIBER DATA REQUEST  INSERT SUBSCRIBER DATA REQUEST  PURGE UE REQUEST  CANCEL LOCATION REQUEST  UPDATE LOCATION REQUEST | **M** | **M** | TS 29.272 |
| Terminal Infomration | NOTIFY REQUEST  UPDATE LOCATION REQUEST | **M** | **M** | TS 29.272 |
| Result | NOTIFY ANSWER  AUTHENTICATION INFORMATION ANSWER  DELETE SUBSCRIBER DATA ANSWER  INSERT SUBSCRIBER DATA ANSWER  PURGE UE ANSWER  CANCEL LOCATION ANSWER  UPDATE LOCATION ANSWER | **M** | **M** | TS 29.272 |
| RAT Type | UPDATE LOCATION REQUEST | **M** | **M** | TS 29.272 |
| APN | NOTIFY REQUEST |  |  |  |
| Visited PLMN Id | AUTHENTICATION INFORMATION REQUEST  UPDATE LOCATION REQUEST | **M** | **M** | TS 29.272 |
| S11 | GTPv2-C | IMSI | Create SESSION Request  CHANGE NOTIFICATION REQUEST  CHANGE NOTIFICATION RESPONSE  SUSPEND NOTIFICATION  SUSPEND ACKNOWLEDGE  RESUME NOTIFICATION  RESUME ACKNOWLEDGE | **M** | **M** | TS 29.274 |
| APN | Create SESSION Request | **M** | **M** | TS 29.274 |
| Indication Flags | MODIFY bEARER Request  DELETE SESSION REQUEST | **M** | **M** | TS 29.274 |
| EPS Bearer ID | Create SESSION ReSPONSE  Create Bearer RESPONSE  MODIFY bEARER Request  MODIFY bEARER ReSPONSE  DELETE bEARER Request  DELETE Bearer RESPONSE  UPDATE USER PLANE RESPONSE  MODIFY BEARER COMMAND  MODIFY BEARER FAILURE INDICATION  UPDATE BEARER RESPONSE  DELETE BEARER FAILURE INDICATION  CREATE INDIRECT DATA FOPRWARDING TUNNEL RESPONSE  UPDATE BEARER COMPLETE | **M** | **M** | TS 29.274 |
| MME-CSID | Create SESSION Request  Create Bearer RESPONSE  DELETE Bearer RESPONSE | **M** | **M** | TS 29.274 |
| SGW-CSID | Create SESSION Request  Create SESSION ReSPONSE  Create Bearer Request  Create Bearer RESPONSE  DELETE bEARER Request  DELETE Bearer RESPONSE | **M** | **M** | TS 29.274 |
| MSISDN | Create SESSION Request  MODIFY bEARER ReSPONSE | **M** | **M** | TS 29.274 |
| Bearer Level QoS | Create SESSION Request  Create Bearer Request  MODIFY bEARER Request  MODIFY bEARER ReSPONSE  MODIFY BEARER COMMAND  UPDATE BEARER REQUEST | **M** | **M** | TS 29.274 |
| RAT Type | Create SESSION Request  MODIFY Bearer Request  CHANGE NOTIFICATION REQUEST | **M** | **M** | TS 29.274 |
| MEI | Create SESSION Request  MODIFY Bearer Request | **M** | **M** | TS 29.274 |
| Cause | Create SESSION ReSPONSE  Create Bearer RESPONSE  Bearer RESOURCE FAILURE INDICATION  MODIFY bEARER ReSPONSE  DELETE SESSION RESPONSE  DELETE Bearer RESPONSE  DOWNLINK DATA NOTIFICATION ACKNOWLEDGEMENT  DOWNLINK DATA NOTIFICATION INDICATION  UPDATE USER PLANE RESPONSE  MODIFY BEARER FAILURE INDICATION  UPDATE BEARER RESPONSE  DELETE BEARER FAILURE INDICATION  CREATE INDIRECT DATA FOPRWARDING TUNNEL RESPONSE  UPDATE BEARER COMPLETE  CHANGE NOTIFICATION RESPONSE  CREATE FORWARDING TUNNEL RESPONSE | **M** | **M** | TS 29.274 |
| PGW-CSID | Create Bearer Request  DELETE bEARER Request | **M** | **M** | TS 29.274 |
| S1 | S1AP | E-RAB ID | All messages where it is present | **M** | **M** | TS 36.413 |
| E-RAB Level QoS Parameters | E-RAB SETUP REQUEST  E-RAB MODIFY REQUEST  INITIAL CONTEXT SETUP REQUEST | **M** | **M** | TS 36.413 |
| Cause | INITIAL CONTEXT SETUP FAILURE  UE CONTEXT RELEASE REQUEST  UE CONTEXT RELEASE COMMAND  UE CONTEXT MODIFICATION FAILURE  HANDOVER REQUIRED  HANDOVER PREPARATION FAILURE  HANDOVER REQUEST  HANDOVER FAILURE  HANDOVER CANCEL  PATH SWITCH REQUEST FAILURE  NAS NON DELIVERY INDICATION | **M** | **M** | TS 36.413 |
| Handover Type | HANDOVER REQUIRED  HANDOVER COMMAND  HANDOVER REQUEST | **M** | **M** | TS 36.413 |
| E-UTRAN CGI | HANDOVER NOTIFY  PATH SWITCH REQUEST  INITIAL UE MESSAGE  UPLINK NAS TRANSPORT | **M** | **M** | TS 36.413 |
| TAI | HANDOVER NOTIFY  PATH SWITCH REQUEST  UPLINK NAS TRANSPORT  PAGING | **M** | **M** | TS 36.413 |
| Target ID | HANDOVER REQUIRED | **M** | **M** | TS 36.413 |
| CDMA2000 HO Status | DOWNLINK S1 CDMA2000 TUNNELING | **M** | **M** | TS 36.413 |
| CDMA2000 RAT Type | DOWNLINK S1 CDMA2000 TUNNELING  UPLINK S1 CDMA2000 TUNNELING | **M** | **M** | TS 36.413 |
| CDMA2000 Sector ID | UPLINK S1 CDMA2000 TUNNELING | **M** | **M** | TS 36.413 |
| CDMA2000 HO Required Indication | UPLINK S1 CDMA2000 TUNNELING | **M** | **M** | TS 36.413 |
| S13 | Diameter | Terminal Information | ME Identity Check Request | **M** | **M** | TS 29.272 |
| Result | ME Identity Check Answer | **M** | **M** | TS 29.272 |

## 4.13 E-UTRAN Trace Record Content

For eNB, the Maximum level of detail shall be supported. The trace record is the same for management based activation and for signalling based activation.

Table 4.13.1 : E-UTRAN Trace Record Content

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Interface (specific messages)** | **Format** | **Level of details** | | | **Description** |
| **Min** | **Med** | **Max** |
| RRC (without rrc dedicated measurements) | Decoded | **M** | **M** | **O** | Message name |
| **O** | **O** | **O** | Record extensions |
| **M** | **M** | **X** | Global eNBID of traced eNB |
| **M** | **M** | **X** | Dedicated IE extracted from RRC messages between the traced eNB and the UE. A subset of IEs as given in the table 4.13.2. is provided. |
| ASN.1 | **X** | **X** | **M** | Raw Uu Messages: RRC messages between the traced eNB and the UE. The encoded content of the message is provided |
| S1 | Decoded | **M** | **M** | **O** | Message name |
| **O** | **O** | **O** | Record extensions |
| **M** | **M** | **X** | Global eNBID of traced eNB MME ID of the connected MME |
| **M** | **M** | **X** | E-RabId + Dedicated IE extracted from S1AP messages between the traced eNB and Core Network. A subset of IEs as given in the table 4.13.2. is provided. |
| ASN.1 | **X** | **X** | **M** | Raw S1 Messages S1AP: messages between the traced eNB and Core Network The encoded content of the message is provided |
| X2 | Decoded | **M** | **M** | **O** | Message name |
| **O** | **O** | **O** | Record extensions |
| **M** | **M** | **X** | Global eNBID of traced eNB Global eNBID of neighbouring eNB  Global gNBID of connected gNB-CU-CP node over X2 (for NSA) |
| **M** | **M** | **X** | Dedicated IE extracted from X2AP messages between the traced eNB and the neighbouring eNB/connected gNB-CU-CP. A subset of IEs as given in the table 4.13.2.is provided |
| ASN.1 | **X** | **X** | **M** | Raw X2 Messages:X2AP messages between the traced eNB and the neighbouring eNB/connected gNB-CU-CP. The encoded content of the message is provided |
| RRC (only dedicated measurements) | Decoded | **X** | **M** | **X** | Uu IEs from RRC measurement reports messages |
| ASN.1 | **X** | **X** | **M** | RRC measurement reports messages |

NOTE: For the security keys in IEs or part of IEs that are containing security keys used by the eNB (e.g. **KeNB**), the value 0 shall be written in the trace file.

**Definitions:**

Global eNBID of traced eNB: The id of the eNB traced, e.g. the eNB which handles the connection of the traced MS, during the Trace Recording Session. The id corresponds to the “Global eNB ID”, as defined in [16] and [17].

Global eNBID of neighbouring eNB: The ids of all Neighbouring eNB involved in the X2 procedures during the Trace Recording Session. The id corresponds to the “Global eNB ID”, as defined in [16] and [17].

Global gNBID of connected gNB-CU-CP node over X2 (for NSA): The ids of all connected NSA nodes involved during the Trace Recording Session. The id corresponds to the “Global gNB ID”, as defined in [16] and [17].

cell Id: The cell Ids of the cells involved in the X2 procedures during the Trace Recording Session. The cell Ids is provided with each X2AP messages for which the cId is relevant.

E-RABId: Specific recorded IE that contains the E-RAB identifier.

Message name: Name of the protocol message

Record extensions: A set of manufacturer specific extensions to the record

Decoded: Some IEs shall be decoded (cf. detailed list in table 4.6.2. depending on trace depth)

ASN.1: Messages in encoded format

Table 4.13.2 : trace record description for minimum and medium trace depth

| **Interface name** | **Prot.**  **name** | **IE name** | **Message name(s)** | **Trace depth** | | **Notes** |
| --- | --- | --- | --- | --- | --- | --- |
| **Min** | **Med** |
| Uu | RRC | Cs fallback indicator | MOBILITY FROM EUTRA COMMAND | **M** | **M** | TS 36.331 |
| CN domain | PAGING | **O** | **O** | TS 36.331 |
| S-TMSI | PAGING | **O** | **O** | TS 36.331 |
| ReestablishmentCause | RRC CONNECTION REESTABLISHMENT REQUEST | **M** | **M** | TS 36.331 |
| Wait time | RRC CONNECTION REJECT | **CM** | **M** | TS 36.331 |
| Release Cause | RRC CONNECTION RELEASE | **M** | **M** | TS 36.331 |
| Redirection Information | RRC CONNECTION RELEASE | **M** | **M** | TS 36.331 |
| Establishment Cause | RRC CONNECTION REQUEST | **CM** | **CM** | TS 36.331 |
| Selected PLMN-Identity | RRC CONNECTION SETUP COMPLETE | **CM** | **CM** | TS 36.331 |
| RegisteredMME | RRC CONNECTION SETUP COMPLETE | **CM** | **CM** | TS 36.331 |
| Rat-Type | UE CAPABILITY INFORMATION | **M** | **M** | TS 36.331 |
| Measured Results | MEASUREMENT REPORT | **X** | **M** | TS 36.331 |
| CDMA2000-Type | HANDOVER FROM EUTRA PREPARATION REQUEST  UL HANDOVER PREPARATION TRANSFER  UL INFORMATION TRANSFER | **M** | **M** | TS 36.331 |
| Target RAT Type | MOBILITY FROM EUTRA COMMAND | **M** | **M** | TS 36.331 |
| ConnEstFailReport-r11 | UE INFORMATION RESPONSE | **X** | **M** | TS 36.331 |
| RLF-Report-r9 | UE INFORMATION RESPONSE | **X** | **M** | TS 36.331 |
| S1 | S1AP | E-RAB ID | All messages where it is present | **M** | **M** | TS 36.413 |
| E-RAB Level QoS Parameters | E-RAB SETUP REQUEST  E-RAB MODIFY REQUEST  INITIAL CONTEXT SETUP REQUEST | **M** | **M** | TS 36.413 |
| Cause | INITIAL CONTEXT SETUP FAILURE  UE CONTEXT RELEASE REQUEST  UE CONTEXT RELEASE COMMAND  UE CONTEXT MODIFICATION FAILURE  HANDOVER REQUIRED  HANDOVER PREPARATION FAILURE  HANDOVER REQUEST  HANDOVER FAILURE  HANDOVER CANCEL  PATH SWITCH REQUEST FAILURE  NAS NON DELIVERY INDICATION | **M** | **M** | TS 36.413 |
| Handover Type | HANDOVER REQUIRED  HANDOVER COMMAND  HANDOVER REQUEST | **M** | **M** | TS 36.413 |
| E-UTRAN CGI | HANDOVER NOTIFY  PATH SWITCH REQUEST  INITIAL UE MESSAGE  UPLINK NAS TRANSPORT | **CM** | **CM** | TS 36.413 |
| TAI | HANDOVER NOTIFY  PATH SWITCH REQUEST  UPLINK NAS TRANSPORT | **M** | **M** | TS 36.413 |
| Target ID | HANDOVER REQUIRED | **M** | **M** | TS 36.413 |
| CDMA2000 HO Status | DOWNLINK S1 CDMA2000 TUNNELING | **M** | **M** | TS 36.413 |
| CDMA2000 RAT Type | DOWNLINK S1 CDMA2000 TUNNELING  UPLINK S1 CDMA2000 TUNNELING | **M** | **M** | TS 36.413 |
| CDMA2000 Sector ID | UPLINK S1 CDMA2000 TUNNELING | **M** | **M** | TS 36.413 |
| CDMA2000 HO Required Indication | UPLINK S1 CDMA2000 TUNNELING | **M** | **M** | TS 36.413 |
| X2 | X2AP | E-RAB id | All messages where it is present | **M** | **M** | TS 36.423 |
| E-RAB Level QoS | HANDOVER REQUEST  SGNB ADDITION REQUEST  SGNB ADDITION REQUEST ACKNOWLEDGE  SGNB MODIFICATION REQUEST  SGNB MODIFICATION REQUEST ACKNOWLEDGE  SGNB MODIFICATION REQUIRED | **M** | **M** | TS 36.423 |
| Cause | HANDOVER REQUEST  HANDOVER PREPARATION FAILURE  HANDOVER CANCEL  SGNB ADDITION REQUEST REJECT  SGNB RECONFIGURATION COMPLETE  SGNB MODIFICATION REQUEST  SGNB MODIFICATION REQUEST REJECT  SGNB MODIFICATION REQUIRED  SGNB MODIFICATION REFUSE  SGNB RELEASE REQUEST  SGNB RELEASE REQUEST REJECT  SGNB RELEASE REQUIRED  SGNB CHANGE REQUIRED  SGNB CHANGE REFUSE | **M** | **M** | TS 36.423 |
| Target Cell ID | HANDOVER REQUEST | **M** | **M** | TS 36.423 |
| GUMMEI | HANDOVER REQUEST | **M** | **M** | TS 36.423 |
| UE History Information | HANDOVER REQUEST | **M** | **M** | TS 36.423 |
| UE RLF Report Container | RLF INDICATION | **X** | **M** | TS 36.423 |

**Constraints:**

The condition for capturing the following Information Element is that Cell Traffic Trace is used:

- Wait time from RRC protocol.

- Establishment Cause from RRC protocol.

- Selected PLMN-Identity from RRC protocol.

- RegisteredMME from RRC protocol.

- E-UTRAN CGI from S1 interface from the following messages: Initial UE message, Handover Notify.

## 4.14 SGW Trace Record Content

The following table shows the trace record content for SGW.

The trace record is the same for management based activation and for signalling based activation.

SGW shall support at least one of the following trace depth levels – Maximum, Medium or Minimum.

Table 4.14.1 : SGW Trace Record Content

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Interface (specific messages)** | **Format** | **Level of details** | | | **Description** |
| **Min** | **Med** | **Max** |
| S11 | Decoded | **M** | **M** | **O** | Message name |
| **O** | **O** | **O** | Record extensions |
| **M** | **M** | **X** | MME ID of the connected MME SGW ID of the traced SGW |
| **M** | **M** | **X** | Dedicated IE extracted from S11 messages between the traced MME and the SGW. A subset of IEs as given in the table 4.14.2.is provided |
| Encoded\* | **X** | **X** | **M** | Raw S11 messages between the traced MME and the SGW. The encoded content of the message is provided |
| S5/S8 | Decoded | **M** | **M** | **O** | Message name |
| **O** | **O** | **O** | Record extensions |
| **M** | **M** | **X** | PGW ID of the connected PGW SGW of the traced SGW |
| **M** | **M** | **X** | IE extracted from S5/S8 messages between the traced SGW and PGW. A subset of IEs as given in the table 4.14.2. is provided. |
| Encoded\* | **X** | **X** | **M** | Raw S5/S8 Messages: messages between the traced SGW and PGW. The encoded content of the message is provided |
| S4 | Decoded | **M** | **M** | **O** | Message name |
| **O** | **O** | **O** | Record extensions |
| **M** | **M** | **X** | SGSNID of the connected SGSN  SGWID of the traced SGW |
| **M** | **M** | **X** | Dedicated IE extracted from S4 messages between the traced SGW and the SGSN. A subset of IEs as given in the table 4.14.2.is provided |
| Encoded\* | **X** | **X** | **M** | Raw S4 messages between the traced PGW and the AAA. The encoded content of the message is provided |
| Gxc | Decoded | **M** | **M** | **O** | Message name |
| **O** | **O** | **O** | Record extensions |
| **M** | **M** | **X** | PCRF ID of the connected PCRF SGW ID of the traced SGW |
| **M** | **M** | **X** | Dedicated IE extracted from Gx messages between the traced SGW and another PCRF. A subset of IEs as given in the table 4.14.2.is provided |
| Encoded\* | **X** | **X** | **M** | Raw Gx messages between the traced SGW and another PCRF. The encoded content of the message is provided |

Encoded\* - the messages are left encoded in the format it was received.

Table 4.14.2 : SGW trace record description for minimum and medium trace depth

| **Interface name** | **Prot.**  **name** | **IE name** | **Message name(s)** | **Trace depth** | | **Notes** |
| --- | --- | --- | --- | --- | --- | --- |
| **Min** | **Med** |
| S11 | GTPv2C | IMSI | Create Session Request  Suspend Notification  Suspend Acknowledge  Resume Notification  Resume Acknowledge | **M** | **M** | TS 29.274 |
| MSISDN | Create Session Request  Modify Bearer Response | **M** | **M** | TS 29.274 |
| RAT type | Create Session Request  Modify Bearer Request | **M** | **M** | TS 29.274 |
| Serving Network | Create Session Request  Modify Bearer Request | **M** | **M** | TS 29.274 |
| Access Point Name (APN) | Create Session Request | **M** | **M** | TS 29.274 |
| PDN Type | Create Session Request | **M** | **M** | TS 29.274 |
| Bearer Contexts | Create Session Request  Create Bearer Request  Create Bearer Response  Delete Bearer Request  Delete Bearer Response  Modify Bearer Command  Modify Bearer Failure Indication  Update Bearer Request  Update Bearer Response  Delete Bearer Command  Delete Bearer Failure Indication  Create Indirect Data Forwarding Tunnel Request  Create Indirect Data Forwarding Tunnel Response  Update Bearer Complete | **M** | **M** | TS 29.274 |
| Cause | Create Session Response  Create Bearer Response  Bearer Resource Failure Indication  Modify Bearer Response  Delete Session Response  Downlink Data Notification Acknowledgement  Downlink Data Notification Failure Indication  Modify Bearer Failure Indication  Update Bearer Response  Delete Bearer Failure Indication  Create Indirect Data Forwarding Tunnel Response  Update Bearer Complete | **M** | **M** | TS 29.274 |
| Bearer Contexts created | Create Session Response | **M** | **M** | TS 29.274 |
| APN Restriction | Create Session Response | **M** | **M** | TS 29.274 |
| Linked Bearer Identity (LBI) | Create Bearer Request  Bearer Resource Command  Delete Session Request  Delete Bearer Request  Delete Bearer Response | **M** | **M** | TS 29.274 |
| Traffic Aggregate Description (TAD) | Bearer Resource Command | **M** | **M** | TS 29.274 |
| Linked EPS Bearer ID | Bearer Resource Command | **M** | **M** | TS 29.274 |
| Bearer Contexts to be removed | Modify Bearer Request | **M** | **M** | TS 29.274 |
| Bearer Contexts modified | Modify Bearer Response | **M** | **M** | TS 29.274 |
| Bearer Contexts marked for removal | Modify Bearer Response  Update User Plane Response | **M** | **M** | TS 29.274 |
| Bearer Contexts to be updated | Update User Plane Request | **M** | **M** | TS 29.274 |
| Bearer Contexts to be removed | Update User Plane Request | **M** | **M** | TS 29.274 |
| Bearer Contexts updated | Update User Plane Response | **M** | **M** | TS 29.274 |
| Bearer Contexts to be modified | Modify Bearer Request | **M** | **M** | TS 29.274 |
| S4 | GTPv2C | Traffic Aggregate Description (TAD) | Bearer Resource Command | **M** | **M** | TS 29.274 |
| Linked Bearer Identity (LBI) | Bearer Resource Command  Create Bearer Request  Delete Bearer Response | **M** | **M** | TS 29.274 |
| Linked EPS Bearer ID | Bearer Resource Failure Indication  Delete Session Request  Delete Bearer Request | **M** | **M** | TS 29.274 |
| Cause | Bearer Resource Failure Indication  Create Session Response  Create Bearer Response  Modify Bearer Response  Delete Session Response  Delete Bearer Response  Downlink Data Notification Acknowledgement  Downlink Data Notification Failure Indication  Update Bearer Response  Create Indirect Data Forwarding Tunnel Response  Update Bearer Complete | **M** | **M** | TS 29.274 |
| Bearer Contexts to be modified | Modify Bearer Request | **M** | **M** | TS 29.274 |
| Bearer Contexts to be removed | Modify Bearer Request | **M** | **M** | TS 29.274 |
| IMSI | Create Session Request  Update Bearer Request | **M** | **M** | TS 29.274 |
| MSISDN | Create Session Request  Modify Bearer Response | **M** | **M** | TS 29.274 |
| Serving Network | Create Session Request | **M** | **M** | TS 29.274 |
| Access Point Name (APN) | Create Session Request | **M** | **M** | TS 29.274 |
| PDN Type | Create Session Request | **M** | **M** | TS 29.274 |
| Bearer Contexts | Create Session Request  Create Bearer Request  Create Bearer Response  Delete Bearer Request  Delete Bearer Response  Update Bearer Request  Update Bearer Response  Create Indirect Data Forwarding Tunnel Request  Create Indirect Data Forwarding Tunnel Response  Update Bearer Complete | **M** | **M** | TS 29.274 |
| RAT Type | Create Session Request  Modify Bearer Request | **M** | **M** | TS 29.274 |
| Bearer Contexts created | Create Session Response | **M** | **M** | TS 29.274 |
| Bearer Contexts marked for removal | Create Session Response | **M** | **M** | TS 29.274 |
| Bearer Contexts modified | Modify Bearer Response | **M** | **M** | TS 29.274 |
| Bearer Contexts marked for removal | Modify Bearer Response | **M** | **M** | TS 29.274 |
| S5/S8 | GTPv2C | IMSI | Create Session Request  Update Bearer Request | **M** | **M** | TS 29.274 |
| MSISDN | Create Session Request  Modify Bearer Response | **M** | **M** | TS 29.274 |
| Serving Network | Create Session Request  Modify Bearer Request | **M** | **M** | TS 29.274 |
| Access Point Name (APN) | Create Session Request | **M** | **M** | TS 29.274 |
| PDN Type | Create Session Request | **M** | **M** | TS 29.274 |
| Bearer Contexts | Create Session Request  Create Bearer Request  Create Bearer Response  Delete Bearer Request  Delete Bearer Response  Modify Bearer Command  Modify Bearer Failure Indication  Update Bearer Request  Update Bearer Response  Delete Bearer Command  Delete Bearer Failure Indication | **M** | **M** | TS 29.274 |
| Cause | Create Session Response  Create Bearer Response  Bearer Resource Failure Indication  Modify Bearer Response  Delete Session Response  Delete Bearer Response  Modify Bearer Failure Indication  Update Bearer Response  Delete Bearer Failure Indication | **M** | **M** | TS 29.274 |
| Bearer Contexts created | Create Session Response | **M** | **M** | TS 29.274 |
| Bearer Contexts marked for removal | Create Session Response | **M** | **M** | TS 29.274 |
| APN Restriction | Create Session Response | **M** | **M** | TS 29.274 |
| Linked Bearer Identity (LBI) | Create Bearer Request  Bearer Resource Command  Delete Bearer Response | **M** | **M** | TS 29.274 |
| Traffic Aggregate Description (TAD) | Bearer Resource Command | **M** | **M** | TS 29.274 |
| Linked EPS Bearer ID | Bearer Resource Failure Indication  Delete Session Request  Delete Bearer Request | **M** | **M** | TS 29.274 |
| RAT Type | Create Session Request  Modify Bearer Request | **M** | **M** | TS 29.274 |
| Bearer Contexts to be modified | Modify Bearer Request | **M** | **M** | TS 29.274 |
| Bearer Contexts to be removed | Modify Bearer Request | **M** | **M** | TS 29.274 |
| Bearer Contexts modified |  | **M** | **M** | TS 29.274 |
| Bearer Contexts marked for removal |  | **M** | **M** | TS 29.274 |
| Gxc | Diameter | IP-CAN-Type | CCR | **M** | **M** | TS 29.212 |
| RAT-Type | CCR | **M** | **M** | TS 29.212 |
| QoS-Information | CCR  CCA  RAR | **M** | **M** | TS 29.212 |
| QoS-Negotiation | CCR | **M** | **M** | TS 29.212 |
| QoS-Rule-Report | CCR  RAA | **M** | **M** | TS 29.212 |
| Default-EPS-Bearer-QoS | CCR  CCA  RAR | **M** | **M** | TS 29.212 |
| Supported-Features | CCR  CCA  RAR  RAA | **M** | **M** | TS 29.212 |
| Event-Trigger | CCR  CCA  RAR | **M** | **M** | TS 29.212 |
| Result Code | RAA | **M** | **M** | TS 29.212 |
| Origin-Realm | CCR  CCA  RAR  RAA | **M** | **M** | TS 29.212 |
| QoS-Rule-Remove | RAR  CAA | **M** | **M** | TS 29.212 |
| QoS-Rule-Install | RAR  CAA | **M** | **M** | TS 29.212 |
| Destination-Realm | CCR  RAR | **M** | **M** | TS 29.212 |

## 4.15 EIR Trace Record Content

The following table contains the Trace record description for the minimum and medium trace depth for MAP(F), S13, S13’, MAP(Gf) interfaces in the EIR.   
The trace record is the same for management based activation and for signalling based activation.

| Interface name | Prot.  name | IE name | Message name(s) | Trace depth | | Notes |
| --- | --- | --- | --- | --- | --- | --- |
| Min | Med |
| F | MAP | IMEI(SV) | MAP\_CHECK\_IMEI | M | M | TS 29.002  TS 23.018 |
| Equipment status | MAP\_CHECK\_IMEI | M | M | TS 29.002  TS 23.018 |
| User error | Every message where it appears | M | M | TS 29.002 |
| Provider error | Every message where it appears | M | M | TS 29.002 |
| S13/S13' | Diameter | Terminal Information | ME Identity Check Request | M | M | TS 29.272 |
| Result | ME Identity Check Answer | M | M | TS 29.272 |
| Gf | MAP | IMEI(SV) | MAP\_CHECK\_IMEI | M | M | TS 29.002 |
| Equipment status | MAP\_CHECK\_IMEI | M | M | TS 29.002 |
| User error | Every message where it appears | M | M | TS 29.002 |
| Provider error | Every message where it appears | M | M | TS 29.002 |

## 4.16 LTE MDT Trace Record Content

### 4.16.1 Trace Record for Immediate MDT measurements

The following table contains the Trace record description for LTE immediate MDT measurements.   
The trace record is the same for management based activation and for signalling based activation.

| MDT measurement  name | Measurement  attribute name(s) | Measurement attribute definition | Notes |
| --- | --- | --- | --- |
| M1 | RSRPs | List of RSRP values received in RRC measurement report. One value per measured cell. | TS 32.422 [3]  TS 37.320 [32] |
| RSRQs | List of RSRQ values received in RRC measurement report. One value per measured cell. | TS 32.422 [3]  TS 37.320 [32] |
| SINRs | List of SINR values received in RRC measurement report. One value per measured cell. | TS 32.422 [3]  TS 36.214 [38] |
| PCIs | List of Physical Cell Identity of measured cells. The order of PCI values in the list should be the same as the corresponding measured values in the RSRPs and RSRQs attributes. | TS 36.331 [28] |
| Triggering event | Event that triggered the M1 measurement report, used only in case of RRM configured measurements (events A1, A2, A3, A4, A5, A6, B1 or B2) | TS 32.422 [3]  TS 37.320 [32] |
| M2 | PH distr | Distribution of the power headroom samples reported by the UE during the collectionperiod. The distribution is the interval of [40; -23] dB. | TS 36.213 [33]  TS 32.422 [3]  TS 37.320 [32] |
| M3 | RIP distr | Distribution of the measured Received Interference Power samples obtained during the collection period. The distribution is in the interval of [-126, -75] dBm. | TS 36.133 [34]  TS 32.422 [3]  TS 37.320 [32] |
| M4 | UL volumes | List of measured UL volumes in bytes per E-RAB. One value per E-RAB. | TS 32.422 [3]  TS 37.320 [32] |
| DL volumes | List of measured DL volumes in bytes per E-RAB. One value per E-RAB. | TS 32.422 [3]  TS 37.320 [32] |
| QCIs | List of QCIs of the E-RABs for which the volume and throughput measurements apply. The order of QCI values in the list should be the same as the corresponding measured values in the UL volumes and DL volumes attributes. | TS 32.422 [3]  TS 37.320 [32] |
| M5 | UL Thp Time | Throughput time used for calculation of the uplink throughput (per UE). | TS 36.314 [31]  TS 32.422 [3]  TS 37.320 [32] |
| UL Thp Volume | Throughput volume used for calculation of the uplink throughput (per UE). | TS 36.314 [31]  TS 32.422 [3]  TS 37.320 [32] |
| UL LastTTI Volume | Volume transmitted in the last TTI and excluded from throughput calculation in the uplink. | TS 36.314 [31]  TS 32.422 [3]  TS 37.320 [32] |
| DL Thp Times | List of throughput times used for calculation of the downlink throughput (per E-RAB). One value per E-RAB. | TS 36.314 [31]  TS 32.422 [3]  TS 37.320 [32] |
| DL Thp Volumes | List of Throughput volumes used for calculation of the downlink throughput (per E-RAB). One value per E-RAB. | TS 36.314 [31]  TS 32.422 [3]  TS 37.320 [32] |
| QCIs | List of QCIs of the E-RABs for which the volume and throughput measurements apply. The order of QCI values in the list should be the same as the corresponding measured values in the DL Thp Volumes and DL Thp Times attributes. | TS 32.422 [3]  TS 37.320 [32] |
| DL Thp Time UE | Throughput time used for calculation of the downlink throughput (per UE). | TS 36.314 [31]  TS 32.422 [3]  TS 37.320 [32] |
| DL Thp Volume UE | Throughput volume used for calculation of the downlink throughput (per UE). | TS 36.314 [31]  TS 32.422 [3]  TS 37.320 [32] |
| DL LastTTI Volume | Volume transmitted in the last TTI and excluded from the throughput calculation in the downlink (per UE). | TS 36.314 [31]  TS 32.422 [3]  TS 37.320 [32] |
| M6 | DL packet delay per QCI | L2 Packet Delay for OAM performance observability or for QoS verification of MDT (per QCI). | TS 36.314 [31] TS 37.320 [32] |
| UL packet delay per QCI | Excess Packet Delay Ratio in Layer PDCP for QoS verification of MDT (per QCI). | TS 36.314 [31]  TS 37.320 [32] |
| M7 | DL packet loss rate per QCI | packets that are lost at Uu transmission, for OAM performance observability. | TS 36.314 [31] TS 37.320 [32] |
| UL packet loss rate per QCI | packets that are lost in the UL, for OAM performance observability or QoS verification of MDT. | TS 36.314 [31]  TS 37.320 [32] |
| M8 | RSSI (WLAN, Bluetooth®) | RSSI measurement by UE. | TS 36.331 [28]  TS 37.320 [32] |
| M9 | RTT (WLAN) | RTT measurement by UE. | TS 36.331 [28]  TS 37.320 [32] |

### 4.16.2 Trace Record for UE location information

The following table contains the Trace record description for LTE UE location information. The trace record is the same for management based activation and for signalling based activation.

| MDT measurement  name | Measurement  attribute name(s) | Measurement attribute definition | Notes |
| --- | --- | --- | --- |
| UE location | GNSS pos | GNSS based coordinates, including (latitude, longitude), as reported by the UE. The IE can be any of *ellipsoidPoint, ellipsoidPointWithUncertaintyCircle, ellipsoidPointWithUncertaintyEllipse, ellipsoidPointWithAltitude, ellipsoidPointWithAltitudeAndUncertaintyEllipsoid, ellipsoidArc, polygon* depending on the IE present in the RRC message. | TS 36.331 |
| UE rx-tx | The UE reported UE rx-tx time difference measurement. The attribute is used to record E-CID positioning measurements, if available. | TS 32.422  TS 37.320  TS 36.331 |
| eNB rx-tx | The eNB measured eNB rx-tx time difference. The attribute is used to record E-CID positioning measurements, if available. | TS 32.422  TS 37.320  TS 36.214 |
| AoA | The eNB measured angle of arrival measurement. The attribute is used to record E-CID positioning measurements, if available. | TS 32.422  TS 37.320  TS 36.214 |

## 4.17 UMTS MDT Trace Record Content

### 4.17.1 Trace Record for Immediate MDT measurements

The following table contains the Trace record description for UMTS immediate MDT measurements.   
The trace record is the same for management based activation and for signalling based activation.

| MDT measurement  name | Measurement  attribute name(s) | Measurement attribute definition | Notes |
| --- | --- | --- | --- |
| M1 | RSCPs | List of RSCP values received in RRC measurement report. One value per measured cell. | TS 32.422 [3]  TS 37.320 [32] |
| Ec/Nos | List of Ec/No values received in RRC measurement report. One value per measured cell. | TS 32.422 [3]  TS 37.320 [32] |
| SCs | List of Scrambling Codes of measured cells. The order of SC values in the list should be the same as the corresponding measured values in the RSCPs and Ec/Nos attributes. | TS 25.331 [30] |
| M2 | RSCPs | List of RSCP values received in RRC measurement report. One value per measured cell. | TS 32.422 [3]  TS 37.320 [32] |
| ISCPs | List of ISCP values received in RRC measurement report. One value per measured cell. | TS 32.422 [3]  TS 37.320 [32] |
| SCs | List of Scrambling Codes of measured cells. The order of SC values in the list should be the same as the corresponding measured values in the RSCPs and ISCPs attributes. | TS 25.331 [30] |
| M3 | SIR | Distribution of the SIR samples measured by the network during the collection period. | TS 32.422 [3]  TS 37.320 [32] |
| SIR error | Distribution of the SIRerror samples measured by the network during the collection period. | TS 32.422 [3]  TS 37.320 [32] |
| M4 | EDCH PH distr | Distribution of the power headroom samples reported by the UE according to RRM configuration during the collection period. | TS 32.422 [3]  TS 37.320 [32] |
| M5 | RTWP distr | Distribution of the measured Total Wideband Power samples obtained during the collection period. The distribution is in the interval of [-112, -50] dBm. | TS 32.422 [3]  TS 37.320 [32] |
| M6 | UL volumes | List of measured UL volumes in bytes per RAB. One value per RAB. | TS 32.422 [3]  TS 37.320 [32] |
| DL volumes | List of measured DL volumes in bytes per RAB. One value per RAB. | TS 32.422 [3]  TS 37.320 [32] |
| Traffic classes | List of Traffic class parameters (conversational, streaming, interactive, background) of the RABs for which the volume and throughput measurements apply. The order of Traffic class values in the list should be the same as the corresponding measured values in the UL volumes and DL volumes attributes. | TS 25.331 [30] |
| M7 | UL Thps | List of measured UL throughputs in bytes/sec per RAB. One value per RAB. | TS 32.422 [3]  TS 37.320 [32] |
| DL Thps | List of measured DL throughputs in bytes/sec per RAB. One value per RAB. | TS 32.422 [3]  TS 37.320 [32] |
| Traffic classes | List of Traffic class parameters (conversational, streaming, interactive, background) of the RABs for which the volume and throughput measurements apply. The order of Traffic class values in the list should be the same as the corresponding measured values in the UL Thps and DL Thps attributes. | TS 23.107 [29] |
| UL Thp UE | Measured UL throughput in bytes/sec per UE. | TS 32.422 [3]  TS 37.320 [32] |
| DL Thp UE | Measured DL throughput in bytes/sec per UE. | TS 32.422 [3]  TS 37.320 [32] |

### 4.17.2 Trace Record for UE location information

The following table contains the Trace record description for UMTS UE location information. The trace record is the same for management based activation and for signalling based activation.

| **MDT measurement  name** | **Measurement  attribute name(s)** | **Measurement attribute definition** | **Notes** |
| --- | --- | --- | --- |
| UE location | GNSS pos | GNSS based coordinates, including (latitude, longitude) as reported by the UE. | TS 32.422  TS 37.320 |

## 4.18 AMF Trace Record Content

The following table shows the trace record content for AMF.

The trace record is the same for management based activation and for signalling based activation.

AMF shall support at least one of the following trace depth levels – Maximum, Medium or Minimum.

Table 4.18.1 : AMF Trace Record Content

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Interface (specific messages)** | **Format** | **Level of details** | | | **Description** |
| **Min** | **Med** | **Max** |
| N1 | Decoded | **M** | **M** | **O** | Message name |
| **O** | **O** | **O** | Record extensions |
| **M** | **M** | **X** | ID of the connected gNB-CU-CP node/ng-eNB ID of the traced AMF |
| **O** | **O** | **X** | IE extracted from N1 messages between the traced AMF and the gNB-CU-CP/ng-eNB node. |
| ASN.1 | **X** | **X** | **M** | Raw Messages: N1 messages between the traced AMF and the gNB-CU-CP/ng-eNB node. The encoded content of the message is provided. |
| N1 NAS PDU IE | Encoded\* | **X** | **X** | **M** | Hexdata dump of the decrypted NAS message formatted according to 3GPP TS 24.501 [x10], sections 8 and 9, recorded as a separate message entry in the call trace file |
| N8 | Decoded | **M** | **M** | **O** | Message name |
| **O** | **O** | **O** | Record extensions |
| **M** | **M** | **X** | UDM ID of the connected UDM AMF ID of the traced AMF |
| **O** | **O** | **X** | IE extracted from N8 messages between the traced AMF and the UDM. |
| Encoded\* | **X** | **X** | **M** | Raw N8 messages between the traced AMF and the UDM. The encoded content of the message is provided |
| N11 | Decoded | **M** | **M** | **O** | Message name |
| **O** | **O** | **O** | Record extensions |
| **M** | **M** | **X** | SMF ID of the connected SMF AMF ID of the traced AMF |
| **O** | **O** | **X** | IE extracted from N11 messages between the traced AMF and the SMF. |
| Encoded\* | **X** | **X** | **M** | Raw N11 messages between the traced AMF and the SMF. The encoded content of the message is provided |
| N12 | Decoded | **M** | **M** | **O** | Message name |
| **O** | **O** | **O** | Record extensions |
| **M** | **M** | **X** | AUSF ID of the connected AUSF AMF ID of the traced AMF |
| **O** | **O** | **X** | IE extracted from N12 messages between the traced AMF and AUSF. |
| Encoded\* | **X** | **X** | **M** | Raw N12 messages between the traced AMF and AUSF. The encoded content of the message is provided |
| N14 | Decoded | **M** | **M** | **O** | Message name |
| **O** | **O** | **O** | Record extensions |
| **M** | **M** | **X** | AMF ID of the connected AMF AMF ID of the traced AMF |
| **O** | **O** | **X** | IE extracted from N14 messages between the traced AMF and another AMF. |
| Encoded\* | **X** | **X** | **M** | Raw N14 messages between the traced AMF and another AMF. The encoded content of the message is provided |
| N15 | Decoded | **M** | **M** | **O** | Message name |
| **O** | **O** | **O** | Record extensions |
| **M** | **M** | **X** | PCF ID of the connected PCF AMF ID of the traced AMF |
| **O** | **O** | **X** | IE extracted from N15 messages between the traced AMF and PCF. |
| Encoded\* | **X** | **X** | **M** | Raw N15 messages between the traced AMF and PCF. The encoded content of the message is provided |
| N20 | Decoded | **M** | **M** | **O** | Message name |
| **O** | **O** | **O** | Record extensions |
| **M** | **M** | **X** | SMSF ID of the connected SMSF AMF ID of the traced AMF |
| **O** | **O** | **X** | IE extracted from N20 messages between the traced AMF and SMSF. |
| Encoded\* | **X** | **X** | **M** | Raw N20 messages between the traced AMF and SMSF. The encoded content of the message is provided |
| N22 | Decoded | **M** | **M** | **O** | Message name |
| **O** | **O** | **O** | Record extensions |
| **M** | **M** | **X** | NSSF ID of the connected NSSF AMF ID of the traced AMF |
| **O** | **O** | **X** | IE extracted from N22 messages between the traced AMF and NSSF. |
| Encoded\* | **X** | **X** | **M** | Raw N22 messages between the traced AMF and NSSF. The encoded content of the message is provided |
| N26 | Decoded | **M** | **M** | **O** | Message name |
| **O** | **O** | **O** | Record extensions |
| **M** | **M** | **X** | MME ID of the connected MME AMF ID of the traced AMF |
| **O** | **O** | **X** | IE extracted from N26 messages between the traced AMF and MME. |
| Encoded\* | **X** | **X** | **M** | Raw N26 messages between the traced AMF and MME. The encoded content of the message is provided |

Encoded\* - the messages are left encoded in the format it was received.

## 4.19 SMF Trace Record Content

The following table shows the trace record content for SMF.

The trace record is the same for management based activation and for signalling based activation.

SMF shall support at least one of the following trace depth levels – Maximum, Medium or Minimum.

Table 4.19.1 : SMF Trace Record Content

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Interface (specific messages)** | **Format** | **Level of details** | | | **Description** |
| **Min** | **Med** | **Max** |
| N4 | Decoded | **M** | **M** | **O** | Message name |
| **O** | **O** | **O** | Record extensions |
| **M** | **M** | **X** | UPF ID of the connected UPF node SMF ID of the traced SMF |
| **O** | **O** | **X** | IE extracted from N4 messages between the traced SMF and the UPF. |
| Encoded\* | **X** | **X** | **M** | Raw Messages: N4 messages between the traced SMF node and the UPF. The encoded content of the message is provided. |
| N7 | Decoded | **M** | **M** | **O** | Message name |
| **O** | **O** | **O** | Record extensions |
| **M** | **M** | **X** | PCF ID of the connected PCF SMF ID of the traced SMF |
| **O** | **O** | **X** | IE extracted from N7 messages between the traced SMF and PCF. |
| Encoded\* | **X** | **X** | **M** | Raw N7 messages between the traced SMF and PCF. The encoded content of the message is provided |
| N10 | Decoded | **M** | **M** | **O** | Message name |
| **O** | **O** | **O** | Record extensions |
| **M** | **M** | **X** | UDM ID of the connected UDM SMF ID of the traced SMF |
| **O** | **O** | **X** | IE extracted from N10 messages between the traced SMF and the UDM. |
| Encoded\* | **X** | **X** | **M** | Raw N10 messages between the traced SMF and the UDM. The encoded content of the message is provided |
| N11 | Decoded | **M** | **M** | **O** | Message name |
| **O** | **O** | **O** | Record extensions |
| **M** | **M** | **X** | AMF ID of the connected AMF SMF ID of the traced SMF |
| **O** | **O** | **X** | IE extracted from N11 messages between the traced SMF and the AMF. |
| Encoded\* | **X** | **X** | **M** | Raw N11 messages between the traced SMF and the AMF. The encoded content of the message is provided |
| S5-C | Decoded | **M** | **M** | **O** | Message name |
| **O** | **O** | **O** | Record extensions |
| **M** | **M** | **X** | PGW ID of the connected PGW SMF ID of the traced SMF |
| **O** | **O** | **X** | IE extracted from S5-C messages between the traced SMF and PGW. |
| Encoded\* | **X** | **X** | **M** | Raw S5-C messages between the traced SMF and PGW. The encoded content of the message is provided |
| N16 | Decoded | **M** | **M** | **O** | Message name |
| **O** | **O** | **O** | Record extensions |
| **M** | **M** | **X** | V-SMF ID of the connected V-SMF SMF ID of the traced SMF |
| **O** | **O** | **X** | IE extracted from N16 messages between the traced SMF and V-SMF. |
| Encoded\* | **X** | **X** | **M** | Raw N16 messages between the traced SMF and V-SMF. The encoded content of the message is provided |
| N16a | Decoded | **M** | **M** | **O** | Message name |
| **O** | **O** | **O** | Record extensions |
| **M** | **M** | **X** | I-SMF ID of the connected I-SMF SMF ID of the traced SMF |
| **O** | **O** | **X** | IE extracted from N16a messages between the traced SMF and I-SMF. |
| Encoded\* | **X** | **X** | **M** | Raw N16a messages between the traced SMF and I-SMF. The encoded content of the message is provided |
| N38 | Decoded | M | M | O | Message name |
| O | O | O | Record extensions |
| M | M | X | I-SMF ID of the connected I-SMF or V-SMF ID of the connected V-SMF |
| O | O | X | IE extracted from N38 messages between the traced I-SMFs or V-SMFs. |
| Encoded\* | X | X | M | Raw N38 messages between the traced I-SMFs or V-SMFs. The encoded content of the message is provided |

Encoded\* - the messages are left encoded in the format it was received.

## 4.20 PCF Trace Record Content

The following table shows the trace record content for PCF.

The trace record is the same for management based activation and for signalling based activation.

PCF shall support at least one of the following trace depth levels – Maximum, Medium or Minimum.

Table 4.20.1 : PCF Trace Record Content

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Interface (specific messages)** | **Format** | **Level of details** | | | **Description** |
| **Min** | **Med** | **Max** |
| N5 | Decoded | **M** | **M** | **O** | Message name |
| **O** | **O** | **O** | Record extensions |
| **M** | **M** | **X** | AF ID of the connected AF PCF ID of the traced PCF |
| **O** | **O** | **X** | IE extracted from N5 messages between the traced PCF and the AF. |
| ASN.1 | **X** | **X** | **M** | Raw Messages: N5 messages between the traced PCF and the AF. The encoded content of the message is provided. |
| N7 | Decoded | **M** | **M** | **O** | Message name |
| **O** | **O** | **O** | Record extensions |
| **M** | **M** | **X** | SMF ID of the connected SMF PCF ID of the traced PCF |
| **O** | **O** | **X** | IE extracted from N7 messages between the traced PCF and SMF. |
| Encoded\* | **X** | **X** | **M** | Raw N7 Messages: messages between the traced PCF and SMF. |
| N15 | Decoded | **M** | **M** | **O** | Message name |
| **O** | **O** | **O** | Record extensions |
| **M** | **M** | **X** | AMF ID of the connected AMF PCF ID of the traced PCF |
| **O** | **O** | **X** | IE extracted from N15 messages between the traced PCF and the AMF. |
| Encoded\* | **X** | **X** | **M** | Raw N15 messages between the traced PCF and the AMF. The encoded content of the message is provided |

Encoded\* - the messages are left encoded in the format it was received.

## 4.21 AUSF Trace Record Content

The following table shows the trace record content for AUSF.

The trace record is the same for management based activation and for signalling based activation.

AUSF shall support at least one of the following trace depth levels – Maximum, Medium or Minimum.

Table 4.21.1 : AUSF Trace Record Content

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Interface (specific messages)** | **Format** | **Level of details** | | | **Description** |
| **Min** | **Med** | **Max** |
| N12 | Decoded | **M** | **M** | **O** | Message name |
| **O** | **O** | **O** | Record extensions |
| **M** | **M** | **X** | AMF ID of the connected AMF AUSF ID of the traced AUSF |
| **O** | **O** | **X** | IE extracted from N12 messages between the traced AUSF and the AMF. |
| Encoded\* | **X** | **X** | **M** | Raw Messages: N12 messages between the traced AUSF and the AMF. The encoded content of the message is provided. |
| N13 | Decoded | **M** | **M** | **O** | Message name |
| **O** | **O** | **O** | Record extensions |
| **M** | **M** | **X** | UDM of the connected UDM AUSF ID of the traced AUSF |
| **O** | **O** | **X** | IE extracted from N13 messages between the traced AUSF and UDM. |
| Encoded\* | **X** | **X** | **M** | Raw N13 Messages: messages between the traced AUSF and UDM. The encoded content of the message is provided |

Encoded\* - the messages are left encoded in the format it was received.

## 4.22 NEF Trace Record Content

The following table shows the trace record content for NEF.

The trace record is the same for management based activation and for signalling based activation.

NEF shall support at least one of the following trace depth levels – Maximum, Medium or Minimum.

Table 4.22.1 : NEF Trace Record Content

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Interface (specific messages)** | **Format** | **Level of details** | | | **Description** |
| **Min** | **Med** | **Max** |
| N29 | Decoded | **M** | **M** | **O** | Message name |
| **O** | **O** | **O** | Record extensions |
| **M** | **M** | **X** | SMF ID of the connected SMF NEF ID of the traced NEF |
| **O** | **O** | **X** | IE extracted from N29 messages between the traced NEF and the SMF. |
| Encoded\* | **X** | **X** | **M** | Raw Messages: N29 messages between the traced NEF and the SMF. The encoded content of the message is provided. |
| N30 | Decoded | **M** | **M** | **O** | Message name |
| **O** | **O** | **O** | Record extensions |
| **M** | **M** | **X** | PCF ID of the connected PCF NEF ID of the traced NEF |
| **O** | **O** | **X** | IE extracted from N30 messages between the traced NEF and PCF. |
| Encoded\* | **X** | **X** | **M** | Raw N30 Messages: messages between the traced NEF and PCF. The encoded content of the message is provided |
| N33 | Decoded | **M** | **M** | **O** | Message name |
| **O** | **O** | **O** | Record extensions |
| **M** | **M** | **X** | AF ID of the connected AF NEF ID of the traced NEF |
| **O** | **O** | **X** | IE extracted from N33 messages between the traced NEF and AF. |
| Encoded\* | **X** | **X** | **M** | Raw N33 Messages: messages between the traced NEF and AF. The encoded content of the message is provided |

Encoded\* - the messages are left encoded in the format it was received.

## 4.23 NRF Trace Record Content

The following table shows the trace record content for NRF.

The trace record is the same for management based activation and for signalling based activation.

NRF shall support at least one of the following trace depth levels – Maximum, Medium or Minimum.

Table 4.23.1 : NRF Trace Record Content

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Interface (specific messages)** | **Format** | **Level of details** | | | **Description** |
| **Min** | **Med** | **Max** |
| N27 | Decoded | **M** | **M** | **O** | Message name |
| **O** | **O** | **O** | Record extensions |
| **M** | **M** | **X** | NRF ID of the connected NRF NRF ID of the traced NRF |
| **O** | **O** | **X** | IE extracted from N27 messages between the traced NRF and the NRF. |
| Encoded\* | **X** | **X** | **M** | Raw Messages: N27 messages between the traced NRF and the NRF. The encoded content of the message is provided. |

Encoded\* - the messages are left encoded in the format it was received.

## 4.24 NSSF Trace Record Content

The following table shows the trace record content for NSSF.

The trace record is the same for management based activation and for signalling based activation.

NSSF shall support at least one of the following trace depth levels – Maximum, Medium or Minimum.

Table 4.24.1 : NSSF Trace Record Content

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Interface (specific messages)** | **Format** | **Level of details** | | | **Description** |
| **Min** | **Med** | **Max** |
| N22 | Decoded | **M** | **M** | **O** | Message name |
| **O** | **O** | **O** | Record extensions |
| **M** | **M** | **X** | AMF ID of the connected AMF NSSF of the traced NSSF |
| **O** | **O** | **X** | IE extracted from N22 messages between the traced NSSF and the AMF. |
| Encoded\* | **X** | **X** | **M** | Raw Messages: N22 messages between the traced NSSF and the AMF. The encoded content of the message is provided. |
| N31 | Decoded | **M** | **M** | **O** | Message name |
| **O** | **O** | **O** | Record extensions |
| **M** | **M** | **X** | NSSF ID of the connected NSSF NSSF ID of the traced NSSF |
| **O** | **O** | **X** | IE extracted from N31 messages between the traced NSSF and NSSF. |
| Encoded\* | **X** | **X** | **M** | Raw N31 Messages: messages between the traced NSSF and NSSF. The encoded content of the message is provided |

Encoded\* - the messages are left encoded in the format it was received.

## 4.25 UDM Trace Record Content

The following table shows the trace record content for UDM.

The trace record is the same for management based activation and for signalling based activation.

UDM shall support at least one of the following trace depth levels – Maximum, Medium or Minimum.

Table 4.25.1 : UDM Trace Record Content

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Interface (specific messages)** | **Format** | **Level of details** | | | **Description** |
| **Min** | **Med** | **Max** |
| N8 | Decoded | **M** | **M** | **O** | Message name |
| **O** | **O** | **O** | Record extensions |
| **M** | **M** | **X** | AMF ID of the connected AMF UDM ID of the traced UDM |
| **O** | **O** | **X** | IE extracted from N8 messages between the traced UDM and AMF. |
| Encoded\* | **X** | **X** | **M** | Raw N8 Messages: messages between the traced UDM and AMF. The encoded content of the message is provided |
| N10 | Decoded | **M** | **M** | **O** | Message name |
| **O** | **O** | **O** | Record extensions |
| **M** | **M** | **X** | SMF ID of the connected SMF UDM ID of the traced UDM |
| **O** | **O** | **X** | IE extracted from N10 messages between the traced UDM and the SMF. |
| Encoded\* | **X** | **X** | **M** | Raw N10 messages between the traced UDM and the SMF. The encoded content of the message is provided |
| N13 | Decoded | **M** | **M** | **O** | Message name |
| **O** | **O** | **O** | Record extensions |
| **M** | **M** | **X** | AUSF ID of the connected AUSF UDM ID of the traced UDM |
| **O** | **O** | **X** | IE extracted from N13 messages between the traced UDM and the AUSF |
| Encoded\* | **X** | **X** | **M** | Raw N13 messages between the traced UDM and the AUSF. The encoded content of the message is provided |
| N21 | Decoded | **M** | **M** | **O** | Message name |
| **O** | **O** | **O** | Record extensions |
| **M** | **M** | **X** | SMSF ID of the connected SMSF UDM ID of the traced UDM |
| **O** | **O** | **X** | IE extracted from N21 messages between the traced UDM and SMSF |
| Encoded\* | **X** | **X** | **M** | Raw N21 messages between the traced UDM and SMSF. The encoded content of the message is provided |
| NU1 | Decoded | M | **M** | **O** | Message name |
| O | **O** | **O** | Record extensions |
| M | **M** | **X** | HSS ID of the connected HSS UDM ID of the traced UDM |
| O | **O** | **X** | IE extracted from NU1 messages between the traced UDM and the HSS |
| Encoded | X | **X** | **M** | Raw NU1 messages between the traced UDM and the HSS. The encoded content of the message is provided |

Encoded\* - the messages are left encoded in the format it was received.

## 4.26 UPF Trace Record Content

The following table shows the trace record content for UPF.

The trace record is the same for management based activation and for signalling based activation.

UPF shall support at least one of the following trace depth levels – Maximum, Medium or Minimum.

Table 4.26.1 : UPF Trace Record Content

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Interface (specific messages)** | **Format** | **Level of details** | | | **Description** |
| **Min** | **Med** | **Max** |
| N4 | Decoded | **M** | **M** | **O** | Message name |
| **O** | **O** | **O** | Record extensions |
| **M** | **M** | **X** | SMF ID of the connected SMF UPF ID of the traced UPF |
| **O** | **O** | **X** | IE extracted from N4 messages between the traced UPF and the SMF. |
| Encoded\* | **X** | **X** | **M** | Raw Messages: N4 messages between the traced UPF and the SMF. The encoded content of the message is provided. |

Encoded\* - the messages are left encoded in the format it was received.

## 4.27 SMSF Trace Record Content

The following table shows the trace record content for SMSF.

The trace record is the same for management based activation and for signalling based activation.

SMSF shall support at least one of the following trace depth levels – Maximum, Medium or Minimum.

Table 4.27.1 : SMSF Trace Record Content

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Interface (specific messages)** | **Format** | **Level of details** | | | **Description** |
| **Min** | **Med** | **Max** |
| N20 | Decoded | **M** | **M** | **O** | Message name |
| **O** | **O** | **O** | Record extensions |
| **M** | **M** | **X** | AMF ID of the connected AMF SMSF ID of the traced SMSF |
| **O** | **O** | **X** | IE extracted from N20 messages between the traced AMF and the SMSF. |
| Encoded\* | **X** | **X** | **M** | Raw Messages: N20 messages between the traced AMF and the SMSF. The encoded content of the message is provided. |
| N21 | Decoded | **M** | **M** | **O** | Message name |
| **O** | **O** | **O** | Record extensions |
| **M** | **M** | **X** | UDM ID of the connected UDM SMSF ID of the traced SMSF |
| **O** | **O** | **X** | IE extracted from N21 messages between the traced SMSF and UDM. |
| Encoded\* | **X** | **X** | **M** | Raw N21 Messages: messages between the traced SMSF and UDM. The encoded content of the message is provided |

Encoded\* - the messages are left encoded in the format it was received.

## 4.28 AF Trace Record Content

The following table shows the trace record content for AF.

The trace record is the same for management based activation and for signalling based activation.

AF shall support at least one of the following trace depth levels – Maximum, Medium or Minimum.

Table 4.28.1 : AF Trace Record Content

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Interface (specific messages)** | **Format** | **Level of details** | | | **Description** |
| **Min** | **Med** | **Max** |
| N5 | Decoded | **M** | **M** | **O** | Message name |
| **O** | **O** | **O** | Record extensions |
| **M** | **M** | **X** | PCF ID of the connected PCF AF ID of the traced AF |
| **O** | **O** | **X** | IE extracted from N5 messages between the traced AF and the PCF. |
| Encoded\* | **X** | **X** | **M** | Raw Messages: N5 messages between the traced AF and the PCF. The encoded content of the message is provided. |
| N33 | Decoded | **M** | **M** | **O** | Message name |
| **O** | **O** | **O** | Record extensions |
| **M** | **M** | **X** | NEF ID of the connected NEF AF ID of the traced AF |
| **O** | **O** | **X** | IE extracted from N33 messages between the traced AF and NEF. |
| Encoded\* | **X** | **X** | **M** | Raw N33 Messages: messages between the traced AF and NEF. The encoded content of the message is provided |

Encoded\* - the messages are left encoded in the format it was received.

## 4.29 Void

## 4.30 gNB-CU-CP Trace Record Content

The following table shows the trace record content for gNB-CU-CP network element

The trace record is the same for management based activation and for signalling based activation.

gNB-CU-CP shall support at least one of the following trace depth levels – Maximum, Medium or Minimum.

Table 4.30.1 : gNB-CU-CP Trace Record Content

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Interface (specific messages)** | **Format** | **Level of details** | | | **Description** |
| **Min** | **Med** | **Max** |
| Uu | Decoded | **M** | **M** | **O** | Message name |
| **O** | **O** | **O** | Record extensions |
| **M** | **M** | **X** | ID of traced gNB-CU-CP node |
| **O** | **O** | **X** | IE extracted from RRC messages between the traced gNB-CU-CP node and the UE as per 3GPP TS 38.331 [21] |
| Encoded\* | **X** | **X** | **M** | Raw Uu Messages: RRC messages between the traced gNB-CU-CP node and the UE. The encoded content of the message is provided |
| NG-C | Decoded | **M** | **M** | **O** | Message name |
| **O** | **O** | **O** | Record extensions |
| **M** | **M** | **X** | ID of traced gNB-CU-CP node AMF ID of the connected AMF |
| **O** | **O** | **X** | IE extracted from NGAP messages between the traced gNB-CU-CP node and Core Network as per 3GPP TS 38.413 [23] |
| Encoded\* | **X** | **X** | **M** | Raw NG-C Messages NGAP: messages between the traced gNB-CU-CP node and Core Network The encoded content of the message is provided |
| Xn-C | Decoded | **M** | **M** | **O** | Message name |
| **O** | **O** | **O** | Record extensions |
| **M** | **M** | **X** | ID of traced gNB-CU-CP node ID of neighbouring gNB-CU-CP/ng-eNB node |
| **O** | **O** | **X** | IE extracted from XnAP messages between the traced gNB-CU-CP node and the neighbouring gNB-CU-CP/ng-eNB node as per 3GPP TS 38.423 [24] |
| Encoded\* | **X** | **X** | **M** | Raw Xn-C Messages: XnAP messages between the traced gNB-CU-CP node and the neighbouring gNB-CU-CP/ng-eNB node. The encoded content of the message is provided |
| X2-C | Decoded | **M** | **M** | **O** | Message name |
| **O** | **O** | **O** | Record extensions |
| **M** | **M** | **X** | ID of traced gNB-CU-CP node ID of connected NSA eNB node (Option 3) |
| **O** | **O** | **X** | IE extracted from EN-DC X2AP messages between the traced gNB-CU-CP node and the connected NSA eNB node as per 3GPP TS 36.423 [17] |
| Encoded\* | **X** | **X** | **M** | Raw EN-DC X2-C Messages: EN-DC X2AP messages between the traced gNB-CU-CP node and the connected NSA eNB node. The encoded content of the message is provided |
| F1-C | Decoded | **M** | **M** | **O** | Message name |
| **O** | **O** | **O** | Record extensions |
| **M** | **M** | **X** | ID of traced gNB-CU-CP  ID of connected gNB-DU |
| **O** | **O** | **X** | IE extracted from F1AP messages between the traced gNB-CU-CP and the gNB-DU as per 3GPP TS 38.473 [26] |
| Encoded\* | **X** | **X** | **M** | Raw F1-C Messages: F1AP messages between the traced gNB-CU-CP and the gNB-DU. The encoded content of the message is provided |
| E1 | Decoded | **M** | **M** | **O** | Message name |
| **O** | **O** | **O** | Record extensions |
| **M** | **M** | **X** | ID of traced gNB-CU-CP ID of connected gNB-CU-UP |
| **O** | **O** | **X** | IE extracted from E1AP messages between the traced gNB-CU-CP and the gNB-CU-UP as per TS 37.483 [46] |
| Encoded\* | **X** | **X** | **M** | Raw E1 Messages: E1AP messages between the traced gNB-CU-CP and the gNB-CU-UP. The encoded content of the message is provided |

Encoded\* - the messages are left encoded in the format it was received.

## 4.31 gNB-CU-UP Trace Record Content

The following table shows the trace record content for gNB-CU-UP network element

The trace record is the same for management based activation and for signalling based activation.

gNB-CU-UP shall support at least one of the following trace depth levels – Maximum, Medium or Minimum.

Table 4.31.1 : gNB-CU-UP Trace Record Content

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Interface (specific messages)** | **Format** | **Level of details** | | | **Description** |
| **Min** | **Med** | **Max** |
| E1 | Decoded | **M** | **M** | **O** | Message name |
| **O** | **O** | **O** | Record extensions |
| **M** | **M** | **X** | ID of traced gNB-CU-UP ID of connected gNB-CU-CP |
| **O** | **O** | **X** | IE extracted from E1AP messages between the traced gNB-CU-UP and the gNB-CU-CP as per 3GPP TS 38.483 [46] |
| Encoded\* | **X** | **X** | **M** | Raw E1 Messages: E1AP messages between the traced gNB-CU-UP and the gNB-CU-CP. The encoded content of the message is provided |

Encoded\* - the messages are left encoded in the format it was received.

## 4.32 gNB-DU Trace Record Content

The following table shows the trace record content for gNB-DU network element

The trace record is the same for management based activation and for signalling based activation.

gNB-DU shall support at least one of the following trace depth levels – Maximum, Medium or Minimum.

Table 4.32.1 : gNB-DU Trace Record Content

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Interface (specific messages)** | **Format** | **Level of details** | | | **Description** |
| **Min** | **Med** | **Max** |
| F1 | Decoded | **M** | **M** | **O** | Message name |
| **O** | **O** | **O** | Record extensions |
| **M** | **M** | **X** | ID of traced gNB-DU ID of connected gNB-CU-CP |
| **O** | **O** | **X** | IE extracted from F1AP messages between the traced gNB-DU and the gNB-CU-CP as per 3GPP TS 38.473 [26] |
| Encoded\* | **X** | **X** | **M** | Raw F1-C Messages: F1AP messages between the traced gNB-DU and the gNB-CU-CP. The encoded content of the message is provided |

Encoded\* - the messages are left encoded in the format it was received.

## 4.33 ng-eNB Trace Record Content

The following table shows the trace record content for ng-eNB network element

The trace record is the same for management based activation and for signalling based activation.

ng-eNB shall support at least one of the following trace depth levels – Maximum, Medium or Minimum.

Table 4.33.1 : ng-eNB Trace Record Content

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Interface (specific messages)** | **Format** | **Level of details** | | | **Description** |
| **Min** | **Med** | **Max** |
| Uu | Decoded | **M** | **M** | **O** | Message name |
| **O** | **O** | **O** | Record extensions |
| **M** | **M** | **X** | ID of traced ng-eNB node |
| **O** | **O** | **X** | IE extracted from RRC messages between the traced ng-eNB node and the UE as per 3GPP TS 36.331 [28] |
| Encoded\* | **X** | **X** | **M** | Raw Uu Messages: RRC messages between the traced ng-eNB node and the UE. The encoded content of the message is provided |
| NG-C | Decoded | **M** | **M** | **O** | Message name |
| **O** | **O** | **O** | Record extensions |
| **M** | **M** | **X** | ID of traced ng-eNB node AMF ID of the connected AMF |
| **O** | **O** | **X** | IE extracted from NGAP messages between the traced ng-eNB node and Core Network as per 3GPP TS 38.413 [23] |
| Encoded\* | **X** | **X** | **M** | Raw NG-C Messages NGAP: messages between the traced ng-eNB node and Core Network The encoded content of the message is provided |
| Xn-C | Decoded | **M** | **M** | **O** | Message name |
| **O** | **O** | **O** | Record extensions |
| **M** | **M** | **X** | ID of traced ng-eNB node ID of neighbouring NG-RAN node (i.e. ng-eNB or gNB) |
| **O** | **O** | **X** | IE extracted from XnAP messages between the traced ng-eNB and the neighbouring NG-RAN node as per 3GPP TS 38.423 [24] |
| Encoded\* | **X** | **X** | **M** | Raw Xn-C Messages: XnAP messages between the traced ng-eNB node and the neighbouring NG-RAN node. The encoded content of the message is provided |

Encoded\* - the messages are left encoded in the format it was received.

## 4.34 NR MDT Trace Record Content

### 4.34.1 Trace Record for Immediate MDT measurements

The following table contains the Trace record description for NR immediate MDT measurements.   
The trace record is the same for management based activation and for signalling based activation.

| MDT measurement  name | Measurement  attribute name(s) | Measurement attribute definition | Notes |
| --- | --- | --- | --- |
| M1 | RSRPs | List of RSRP values received in RRC measurement report. One value per measured cell. For beam level granularity, one value per measured beam. | TS 32.422 [3]  TS 37.320 [32]  TS 38.331 [21] |
| RSRQs | List of RSRQ values received in RRC measurement report. One value per measured cell. For beam level granularity, one value per measured beam. | TS 32.422 [3]  TS 37.320 [32]  TS 38.331 [21] |
| PCIs | List of Physical Cell Identity of measured cells. The order of PCI values in the list should be the same as the corresponding measured values in the RSRPs, RSRQs and SINRs attributes. | TS 38.331 [21] |
| SINRs | List of SINR values received in RRC measurement report. One value per measured cell. | TS 38.215 [42]  TS 32.422 [3]  TS 37.320 [32] |
| Triggering event | Event that triggered the M1 measurement report, used only in case of RRM configured measurements (events A1, A2, A3, A4, A5, A6, B1 or B2) | TS 32.422 [3]  TS 37.320 [32] |
| UE location | UE positioning information and sensors data | TS 38.331 [21] |
| in-device coexistence interference | See clause 4.34.3 | TS 38.331 [21] |
| M2 | PH distr | Distribution of the power headroom samples reported by the UE during the collection period. | TS 38.213 [37]  TS 32.422 [3]  TS 37.320 [32] |
| in-device coexistence interference | See clause 4.34.3 | TS 38.331 [21] |
| M3 (Not supported in rel. 16) |  |  |  |
| M4 | UL volumes | List of measured UL volumes in bytes per DRB. One value per DRB per UE. | TS 32.422 [3]  TS 37.320 [32]  TS 28.552 [36]  TS 32.425 [39] |
| DL volumes | List of measured DL volumes in bytes per DRB. One value per DRB per UE. | TS 32.422 [3]  TS 37.320 [32]  TS 28.552 [36] |
| QoS level (QCI in option 3 or mapped 5QI in other options). | List of QoS levels of the DRBs for which the volume and throughput measurements apply. The order of QoS values in the list should be the same as the corresponding measured values in the UL volumes and DL volumes attributes. | TS 32.422 [3]  TS 37.320 [32]  TS 28.552 [36]  TS 32.425 [39]  TS 32.425 [39] |
| in-device coexistence interference | See clause 4.34.3 | TS 38.331 [21] |
| M5 | UL Thp Time | Throughput time used for calculation of the uplink throughput (per UE). | TS 38.314 [35]  TS 32.422 [3]  TS 37.320 [32] |
| UL Thp Volume | Throughput volume used for calculation of the uplink throughput (per UE). | TS 38.314 [35]  TS 32.422 [3]  TS 37.320 [32] |
| UL LastTTI Volume | Volume transmitted in the last TTI and excluded from throughput calculation in the uplink. | TS 38.314 [35]  TS 32.422 [3]  TS 37.320 [32] |
| DL Thp Times | List of throughput times used for calculation of the downlink throughput per DRB per UE. One value per DRB. | TS 38.314 [35]  TS 32.422 [3]  TS 37.320 [32]  TS 32.425 [39] |
| DL Thp Volumes | List of throughput times used for calculation of the downlink throughput per DRB per UE. One value per DRB. | TS 38.314 [35]  TS 32.422 [3]  TS 37.320 [32]  TS 32.425 [39] |
| QoS level (QCI in option 3 or mapped 5QI in other options). | List of QoS levels of the DRBs for which the volume and throughput measurements apply. The order of QoS values in the list should be the same as the corresponding measured values in the UL volumes and DL volumes attributes. | TS 32.422 [3]  TS 37.320 [32]  TS 28.552 [36]  TS 32.425 [39] |
| DL Thp Time UE | Throughput time used for calculation of the downlink throughput (per UE). | TS 38.314 [35]  TS 32.422 [3]  TS 37.320 [32] |
| DL Thp Volume UE | Throughput volume used for calculation of the downlink throughput (per UE). | TS 38.314 [35]  TS 32.422 [3]  TS 37.320 [32] |
| DL LastTTI Volume | Volume transmitted in the last TTI and excluded from the throughput calculation in the downlink (per UE). | TS 38.314 [35]  TS 32.422 [3]  TS 37.320 [32] |
| in-device coexistence interference | See clause 4.34.3 | TS 38.331 [21] |
| M6 | DL packet delay per QoS level (per QCI in option 3 or mapped 5QI in other options). | L2 Packet Delay for OAM performance observability or for QoS verification of MDT per DRB per UE | TS 37.320 [32]  TS 28.552 [36]  TS 32.425 [39] |
| UL packet delay per QoS level (per QCI in option 3 or mapped 5QI in other options). | Excess Packet Delay Ratio in Layer PDCP for QoS verification of MDT per DRB per UE . | TS 38.314 [W]  TS 37.320 [32]  TS 28.552 [36]  TS 32.425 [39] |
| in-device coexistence interference | See clause 4.34.3 | TS 38.331 [21] |
| M7 | DL packet loss rate per QoS level (per QCI in option 3 or mapped 5QI in other options). | packets that are lost at Uu transmission, for OAM performance observability per DRB per UE. | TS 37.320 [32]  TS 28.552 [36]  TS 32.425 [39] |
| UL packet loss rate per QoS level (per QCI in option 3 or mapped 5QI in other options). | packets that are lost in the UL, for OAM performance observability or QoS verification of MDT per DRB per UE. | TS 38.314 [W]  TS 37.320 [32]  TS 28.552 [36]  TS 32.425 [39] |
| in-device coexistence interference | See clause 4.34.3 | TS 38.331 [21] |
| M8 | RSSI (WLAN, Bluetooth®) | RSSI measurement by UE. | TS 37.320 [32] |
| in-device coexistence interference | See clause 4.34.3 | TS 38.331 [21] |
| M9 | RTT (WLAN) | RTT measurement by UE. | TS 37.320 [32] |
| in-device coexistence interference | See clause 4.34.3 | TS 38.331 [21] |

### 4.34.2 Trace Record for UE location information

The following table contains the Trace record description for NR UE location information. The trace record is the same for management based activation and for signalling based activation.

| MDT measurement  name | Measurement  attribute name(s) | Measurement attribute definition | Notes |
| --- | --- | --- | --- |
| UE location | GNSS pos | GNSS based coordinates, including (latitude, longitude), as reported by the UE. The IE can be any of ellipsoidPoint, ellipsoidPointWithUncertaintyCircle, ellipsoidPointWithUncertaintyEllipse, ellipsoidPointWithAltitude, ellipsoidPointWithAltitudeAndUncertaintyEllipsoid, ellipsoidArc, polygon depending on the IE present in the RRC message. | TS 32.422 [3]  TS 37.320 [32]  TS 38.305 [44] |
| UE rx-tx | The UE reported UE rx-tx time difference measurement. If available. | TS 32.422 [3]  TS 37.320 [32]  TS 38.305 [44] |
| gNB rx-tx | The gNB measured gNB rx-tx time difference.If available. | TS 32.422 [3]  TS 37.320 [32]  TS 38.305 [44] |
| AoA | The gNB measured angle of arrival measurement. If available. | TS 32.422 [3]  TS 37.320 [32]  TS 38.305 [44] |
| Sensor information | The UE reported sensor data (such as barometric pressure and/or motion). If available: a gyroscope, an accelerometer and a barometer data. | TS 32.422 [3]  TS 37.320 [32]  TS 38.305 [44] |

### 4.34.3 Trace Record for in-device coexistence interference

The following table contains the Trace record description for NR in-device coexistence interference. The trace record is the same for management based activation and for signalling based activation.

| MDT measurement  name | Measurement  attribute name(s) | Measurement attribute definition | Notes |
| --- | --- | --- | --- |
| in-device coexistence interference | IDC assistance information | It is applied as polluted measurement indication in which interference factors of IDC (In-Device Coexistence) shall be included in the case of immediate MDT measurement if available | TS 38.331 [21] |

# 5 Trace format

## 5.1 Introduction

Trace data reporting consists of trace records that may be written to files or output to streams.

Trace Records are used to carry the captured trace data being reported or to convey various administrative messages associated with the data collection. Administrative messages are intended for the consumer of files from the TCE for the file reporting case, or for the MnS Consumer in the case of stream output. Cases where MnS Consumer may transfer data or convey administrative messages to the MnS Producer are out of scope of the present document.

Encoding of trace records may be performed using XML (binary form) or GPB (Google Protocol Buffers).

GPB encoded trace records are preceded by length indicator to facilitate decoding by the receiver. Streamed trace records use a transport protocol to facilitate framing of the messages.

## 5.2 Trace Record

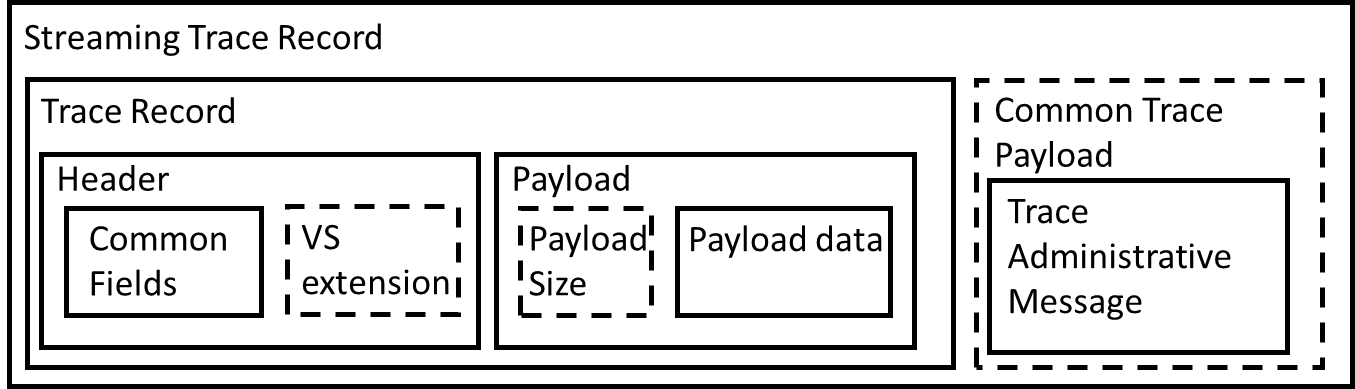
### 5.2.1 Introduction

GPB encoded trace records are formatted in GPB version 3 (proto3) [45]. Individual Trace records are preceded with a GPB variable length 32 bit integer that indicates the size of the GPB encoded trace record.

**Logical Layout**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Delimiter | Trace Record | Delimiter | Trace Record | Delimiter | Trace Record |

The Streaming Trace Record comprises a header, payload and an optional common trace payload that contains the trace administrative message as shown in Figure 5.2.1-1.



Trace Record

Payload

Header

Vendor specific  
extension

Common  
fields

Vendor Specified  
Content

Size

Trace Record

Payload

Header

Vendor specific  
extension

Common  
fields

Vendor Specified  
Content

Size

Figure 5.2.1.1: Streaming Trace Record

The format of the Trace Record Header in Trace Record specified in the clause 5.2.2. The format of the Payload and the Common Trace Payload carrying Trace Administrative Message in Streaming Trace Record specified in the clause 5.2.3 and 5.2.4 respectively.

### 5.2.2 Trace Record Header

The trace record header contains the common fields as specified in the Table 5.2.2-1, in addition it may also contain vendor specific extensions.

Table 5.2.2.1 : Common fields in the trace record header

|  |  |
| --- | --- |
| Trace Record Header field name | Description |
| timeStamp (M) | Time stamp (in milliseconds since Epoch) of when the streaming trace record is produced internally in the Producer encoded as (64 bit integer) |
| nfInstanceId (M) | Unique id of the Producer NF instance that produced this trace record represented by a (String) |
| nfType (M) | Type of the Producer NF that produced this trace record represented by a (String) |
| traceReference (M) | Trace Reference (see clause 5.6 of 3GPP TS 32.422 [23]) (represented by a 3 bytes octet string) |
| traceRecordingSessionReference (M) | Trace Recording Session Reference (see clause 5.7 of 3GPP TS 32.422 [23]) represented by a (2 byte octet string. See Note 1.) |
| traceRecordTypeId (M) | Identifier of the trace record type (see clause 5.2.4 for details) represented by an ENUM with the following values: NORMAL  TRACE\_SESSION\_START,  TRACE\_SESSION\_STOP, TRACE\_RECORDING\_SESSION\_START, TRACE\_RECORDING\_SESSION\_STOP, TRACE\_STREAM\_HEARTBEAT.  TRACE\_RECORDING\_SESSION\_NOT\_STARTED, TRACE\_RECORDING\_SESSION\_DROPPED\_EVENTS,  TRACE\_FILE\_OPEN,  TRACE\_FILE\_CLOSE,  TRACE\_FILE\_ABNORMAL\_CLOSED  TRACE\_RECORDING\_SESSION\_THROTTLED\_START  TRACE\_RECORDING\_SESSION\_THROTTLED\_STOP  (See Note 2). |
| ranUeId (O) | RAN defined id to represent a UE (8 byte octet string. See Note 3.) |
| payloadSchemaURI (O) | URI identifying the schema to be used in order to decode the payload represented by a (String. See Note 4.) |
| globalGnbId (CM) | Global gNB ID, as defined in [23]. Applied for trace reported by gNB-CU-CP, gNB-CU-UP, gNB-DU. |
| vendorExtension (O) | Vendor-specific extension(s) represented by a (Arraylist of String. See Note 5.) |
| NOTE 1: The *traceRecordingSessionReference* must be present for the Streaming Trace Records with non-zero size payload where the payload carries data captured for a Trace Recording Session and in administrative messages related to a Trace Recording Session (e.g. "Trace Recording Session Start" or "Trace Recording Session Stop").  NOTE 2: The *traceRecordTypeId* with value "NORMAL" is used for Streaming Trace Records that do not carry an administrative message.  NOTE 3: The *ranUeId* field is present in the trace record header when the identifier is supported by RAN. If RAN UE Id (see 3GPP TS 38.463 [25] and 38.473 [26]) has been captured in the traced signaling messages that value is used.  NOTE 4: The *payloadSchemaURI* is not required for Streaming Trace Records with payload of zero-size, or payload using common payload format (e.g. used to convey Streaming Trace administrative messages).  NOTE 5: The *vendorExtension* is typically a generic list of key-value pairs. | |

### 5.2.3 Trace Record Payload

The streaming trace record payload carries the captured Trace data being reported by the MnS Producer to the MnS Consumer and comprises the fields defined in Table 5.2.3-1.

Table 5.2.3.1 : Fields in the trace record payload

|  |  |
| --- | --- |
| Trace Record Payload parameter name | Description |
| payloadSize (O) | Size of payload, in bytes represented by a (64 bit integer. The field may be omitted if the solution set specific encoding/decoding has its own support for indicating the size.) |
| payload (M) | Sequence of bytes representing the binary encoded data of the specific trace recordArray of bytes. See Note 1. |
| NOTE 1: For example, trace record content per clause 4 of the present document with schema indicated in the header field *payloadSchemaURI* required for decoding.  NOTE 2: Void | |

### 5.2.4 Trace administrative messages

#### 5.2.4.1 Introduction

The following administrative messages are defined for trace management purposes:

- Trace Session Start

- Trace Session Stop

- Trace Recording Session Start

- Trace Recording Session Stop

- Trace Stream Heartbeat (streaming only)

- Trace Session Not Started

- Trace Recording Session Not Started

- Trace Recording Session Dropped Events

- Trace File Open (file based only)

- Trace File Close (file based only)

- Trace File Abnormal Closed (file based only)

- Trace Recording Session Throttled Start

- Trace Recording Session Throttled Stop

#### 5.2.4.2 Trace Session Start administrative message

The Trace Session Start administrative message shall be used to convey the start of a Trace Session (see 3GPP TS 32.422 [3] for details). The Trace Record in this case may have zero-size payload. The value of the traceRecordTypeId field in the Trace Record Header is set to "TRACE\_SESSION\_START". The start trace session administrative message is not used for signalling based activation as there is no separate trigger for starting the session and the trace recording session.

#### 5.2.4.3 Trace Session Stop administrative message

The Trace Session Stop administrative message shall be used to convey the stop of a Trace Session (see 3GPP TS 32.422 [3] for details). The Trace Record in this case may have zero-size payload. The value of the traceRecordTypeId field in the Trace Record Header is set to "TRACE\_SESSION\_STOP".The stop trace session administrative message is not used for signalling based activation as there is no separate trigger for stoping the session and the trace recording session.

#### 5.2.4.3a Trace Recording Session Start administrative message

The Trace Recording Session Start administrative message shall be used to convey the start of a Trace Recording Session (see 3GPP TS 32.422 [3] for details). The Trace Record in this case may have zero-size payload. The value of the traceRecordTypeId field in the Streaming Trace Record Header is set to "TRACE\_ RECORDING\_SESSION\_START".

#### 5.2.4.3b Trace Recording Session Stop administrative message

The Trace Recording Session Stop administrative message shall be used to convey the stop of a Trace Recording Session (see 3GPP TS 32.422 [3] for details). The Trace Record in this case may have zero-size payload in the normal case, For the abnormal case, the trace record should include the reason for the session stop. One of the reasons could be overloaded. The value of the traceRecordTypeId field in the Streaming Trace Record Header is set to "TRACE\_ RECORDING\_SESSION\_STOP".

#### 5.2.4.4 Trace Stream Heartbeat administrative message

The Trace Stream Heartbeat administrative message may be used in absence of the captured trace data and other administrative messages from the MnS Producer to the MnS Consumer. The message is intended to indicate that a streaming trace connection is alive and does not indicate whether there is an ongoing Trace Session or not.

Transport protocol level keep-alive mechanisms may be used as an alternative (e.g. use of Ping and Pong WebSocket frames in IETF RFC 6455 [40]) and are out of scope of the present document.

#### 5.2.4.5 Trace Recording Session Not Started administrative message

The Trace Recording Session Not Started administrative message shall be used to convey that a trace recording session could not be started. For example, the number of simultaneous UE traces may be limited so that UE traces are not started when this limit is reached. It includes the detailed reason as string in the payload.

#### 5.2.4.6 Trace Recording Session Dropped Events administrative message

The Trace Recording Session Dropped Events administrative message shall be used to convey the number of dropped trace records. The message provides indication that trace records are dropped from a particular trace recording session. It includes the number of trace records dropped in the payload.

#### 5.2.4.7 Trace File Open administrative message

The Trace File Open administrative message shall be used to convey that trace file is opened for trace recording at the start of ROP period. The message provides indication when a file is opened.

#### 5.2.4.8 Trace File Close administrative message

The Trace File Close administrative message shall be used to convey that trace file is closed for trace recording at the end of ROP period. The message provides indication when a file is closed.

#### 5.2.4.9 Trace File Abnormal Closed administrative message

The Trace File Abnormal Closed administrative message shall be used to convey that trace file is closed abnormally. For example, the trace file is closed due to resource constraint such as out of memory.

#### 5.2.4.10 Trace Recording Session Throttled Start administrative message

The Trace Recording Session Throttled Start administrative message shall be used to convey that the lower priority trace records are missing. A possible reason is due to overload condition for a Trace Recording Session. The Trace Record in this case may have zero-size payload or include which kind of contents are missing. The value of the traceRecordTypeId field in the Trace Record Header is set to "TRACE\_ RECORDING\_SESSION\_THROTTLED\_START".

#### 5.2.4.11 Trace Recording Session Throttled Stop administrative message

The Trace Recording Session Throttled Stop administrative message shall be used to convey that throttling is cleared for a Trace Recording Session. The Trace Record in this case may have zero-size payload. The value of the traceRecordTypeId field in the Trace Record Header is set to "TRACE\_ RECORDING\_SESSION\_THROTTLED\_STOP".

#### 5.2.4.12 Trace Session Not Started administrative message

The Trace Session Not Started administrative message shall be used to convey that a trace session could not be started. It includes the detailed reason as string in the payload.

### 5.2.5 Void

### 5.2.6 Streaming Trace Format

When streaming trace data individual trace records and their associated length delimeter are carried in the payload of the transport protocol messages Figure 5.2.6.1 illustrates the concept.



Figure 5.2.6.1: Transport of Trace Records

As depicted in the Figure 5.2.6.1, each protocol-specific message delivers one or more trace records from the MnS Producer to the MnS Consumer. The header of the transport protocol message is protocol-specific. It may contain protocol specific extensions and/or options related to the transport stream. The payload of the transport protocol carries one of more Trace Records. The format of the individual Trace Records is specified in clause 5.2.

The procedures related to the connection establishment and meta-data exchange between the Streaming Trace data reporting MnS Producer and MnS Consumer are out of scope of the present document and are specified in TS 28.532 [43]

## 5.3 Void

Annex A (normative):  
Trace Report File Format

# A.0 Introduction

This annex describes the format of trace or MDT result files. Those files are to be transferred from the network (NEs or EM) to the NM.

The following conditions have been considered for the definition of this file format:

- The trace data volume and trace duration is not predictable. Depending on the data retrieval and storage mechanisms, several consecutive trace result files could be generated for a single traced call. The file naming convention shall allow rebuilding the temporal file sequences.

- Since the files are transferred via a machine-machine interface, the files should be machine-readable using standard tools.

- The file format should be independent from the data transfer protocol used to carry the file from one system to another.

- The file format should be generic across UMTS and EPS systems.

- The file format should be flexible enough to support further trace data types and decoded IEs, as well as vendor specific trace data.

# A.1 Parameter description and mapping table

The following table describes the XML trace file parameters.

Table A.1-1: XML trace file parameters

| XML element / XML attribute specification | Description |
| --- | --- |
| traceCollecFile | This is the top-level element. It identifies the file as a collection of trace or MDT data. This element includes:  - a file header (element "fileHeader")  - the collection of trace data items (elements "traceRecSession"). |
| fileHeader | This is the trace file header element. This element includes:  - a version indicator (attribute specification "fileFormatVersion")  - the PLMN for the Participating Operator on who's behalf the Trace Session was performed (element "pOPLMN")  - the vendor name of the sending network node (attribute specification "vendorName")  - the name of the sending network node (attribute specification "fileSender elementDn")  - the type of the sending network node (attribute specification "fileSender elementType")  - a time stamp (attribute specification "traceCollec beginTime"). |
| fileHeader fileFormatVersion | This attribute specification identifies the file format version applied by the sender. The format version defined in the present document shall be the abridged number and version of this 3GPP document (see below).  The abridged number and version of a 3GPP document is constructed from its version specific full reference "3GPP […] (yyyy-mm)" by:  - removing the leading "3GPP TS"  - removing everything including and after the version third digit, representing editorial only changes, together with its preceding dot character  - from the resulting string, removing leading and trailing white space, replacing every multi character white space by a single space character and changing the case of all characters to uppercase. |
| fileHeader pOPLMN | Optional element identifies the PLMN for the Participating Operator. This parameter can be used when the node that is recording the data is shared between operators. |
| fileHeader vendorName | Optional attribute specification that has the following value part: vendor of the equipment that provided the trace file. |
| fileSender elementDn | Optional attribute specification that uniquely identifies the NE or EM that assembled this trace file, according to the definitions in 3GPP TS 32.300 [11]. |
| fileSender elementType | Optional attribute specification that identifies type of the network node that generated the file. For MDT case, this attribute only has the type of "RNC" or ""eNodeB". |
| traceCollec beginTime | This attribute specification contains a timestamp that refers to the start of the first trace data that is stored in this file. It is a complete timestamp including day, time and delta UTC hour. E.g. "2001-09-11T09:30:47-05:00". |
| traceRecSession | Optional element that contains the traced data associated to a Trace Recording Session. It includes:  - the DN prefix (attribute specification "dnPrefix")  - the trace session identifier (element specification "traceSessionRef")  - the trace recording session identifier (attribute specification "traceRecSessionRef")  - the start time of the call (attribute specification "stime")  - the ue identifier (element "ue")  - the traced messages (elements "msg") for trace or the UE measurements (elements "meas") for MDT |
| traceRecSession dnPrefix | Optional attribute specification that provides the DN prefix (see 3GPP TS 32.300 [11]). |
| traceRecSession traceSessionRef | This element provides a unique trace session identifier as described in 3GPP TS 32.421 [2]. Trace Reference is composed of MCC digits, MNC digits, and Trace ID where:  - MCC is in BCD format, 3 digits in length (element specification "MCC")  - MNC is in BCD format, 1 to 3 digits in length, with no filler digit for MNCs less than 3 digits (element specification "MNC")  - Trace ID is in hexadecimal format, 6 digits in length, hex letters (A through F) are capitalized(element specification "TRACE\_ID"). |
| traceRecSession traceRecSessionRef | Attribute specification that provides a unique trace recording session identifier as described in 3GPP TS 32.421 [2] and 3GPP TS 32.422 [3]. Trace Recording Session Reference is represented in hexadecimal format. No filler digits for hex numbers of less than four digits. All hex letters (A thru F) are capitalized. |
| traceRecSession stime | Optional attribute specification that provides the start time of the call. |
| ue | This element gives the ue identifier provided in trace activation messages. It includes:  - the ue identifier type (attribute specification "idType")  - the ue identifier value (attribute specification "idValue")  This element shall not be present in the Trace record of E-UTRAN. |
| ue idType | Attribute specification that provides the ue identifier type (IMSI, IMEI (SV), TAC, or Public User Identity). For management based MDT, IMSI or IMEI(SV) can not be selected as ue idType. |
| ue idValue | Attribute specification that provides the ue identifier value, represented in decimal. This attribute is optional for management based MDT. |
| msg | This element contains the information associated to a traced message. This element will not be included if the file is from the MME for retrieving the IMSI/IMEI (SV) information. It includes:  - the function name associated to the traced message (attribute specification "function")  - the time difference with attribute specification "traceCollec beginTime" (attribute specification "changeTime")  - a boolean value that indicates if the message is vendor specific (attribute specification "vendorSpecific")  - the protocol message name (attribute specification "name")  - the NE initiator of the protocol message (element "initiator")  - the NE target(s) of the protocol message (element "target")  - the NE proxy of the protocol message (element "proxy")  - the encoded protocol message (element "rawMsg")  - the traced IEs, either simple (elements "ie") or complex (elements "ieGroup"), in any order  This element is trace specific and not used for MDT. |
| msg function | Attribute specification that provides the function name associated to the traced message (e.g. Iuu, Iu CS, Iub, Intra frequency measurement, Gb, …). This attribute is trace specific and not used for MDT. |
| msg changeTime | Attribute specification that provides the time difference with attribute specification "traceCollec beginTime". It is expressed in number of seconds and milliseconds (nbsec.ms). This attribute is trace specific and not used for MDT. |
| msg vendorSpecific | Attribute specification whose value part is a boolean value that indicates if the message is vendor specific (true) or not (false). This attribute is trace specific and not used for MDT. |
| msg name | Attribute specification that provides the protocol message name. This attribute is trace specific and not used for MDT. |
| initiator | Optional element that identifies the NE initiator of the protocol message. Each includes:  - the type of the network node that initiate the message (attribute specification "type")  - the LDN of NE initiator of the protocol message (element's content). The element's content may be empty in case the initiator is the sender or the mobile  This element is trace specific and not used for MDT. |
| initiator type | Optional attribute specification that provides the type of the network node that initiate the message, e.g. "RNC", "SGSN". This element is trace specific and not used for MDT. |
| target | Optional element that identifies the NE target(s) of the protocol message. It includes:  - the type of the network node that receive the message (attribute specification "type")  - the LDN or IP Address of NE target of the protocol message (element's content). The element's content may be empty in case the target is the sender or the mobile  This element is trace specific and not used for MDT. |
| target type | Optional attribute specification that provides the type of the network node that receive the message, e.g. "RNC", "SGSN". This element is trace specific and not used for MDT. |
| rawMsg NumOfTargets | Optional attribute specification that provides the number of targets that the message is sent to. This is populated **ONLY** if the Target is not explicitly specified and is useful when there are a large number of targets that the message is sent to. This attribute is trace specific and not used for MDT. |
| proxy | Optional element that identifies the NE proxy of the protocol message. Each includes:  - the type of the network node that route the message (attribute specification "type")  - the LDN, FQDN or IP address of NE proxy of the protocol message (element's content).  This element is trace specific and not used for MDT. |
| proxy type | Optional attribute specification that provides the type of the network node that route the message, e.g. "SCP", "SEPP". This element is trace specific and not used for MDT. |
| rawMsg | Optional element that contains the encoded protocol message. It includes:  - the protocol name associated to the event (attribute specification "protocol")  - the protocol version (attribute specification "version")  - the number of targets the message is sent (attribute specification "NumOfTargets")  - the hexadecimal encoded form of the message (element's content)  This element is available only if the trace depth is maximum.  This attribute is trace specific and not used for MDT. |
| rawMsg protocol | Attribute specification that provides the protocol name associated to the event (e.g. "Ranap"). This attribute is trace specific and not used for MDT. |
| rawMsg version | Attribute specification that provides the protocol version. This attribute is trace specific and not used for MDT. |
| ieGroup | Optional element that contains a complex traced IE, i.e. an IE that contains other traced IEs. It includes:  - the IE group name (attribute specification "name")  - the IE group value (attribute specification "value")  - zero or more traced IEs, either simple (elements "ie") or complex (elements "ieGroup"), in any order  This element is available only if the trace depth is medium or minimum.  This attribute is trace specific and not used for MDT. |
| ieGroup name | Optional attribute specification that provides the IE group name (e.g. "RAB parameters"). |
| ieGroup value | Optional attribute specification that provides the IE group value when it exists (e.g. "RAB identifier"). This attribute is trace specific and not used for MDT. |
| ie | Optional element that contains a simple traced IE, i.e. an IE decoded from the traced message. It includes:  - the IE name (attribute specification "name")  - the IE value (element's content)  This element is available only if the trace depth is medium or minimum.  This attribute is trace specific and not used for MDT. |
| ie name | Attribute specification that provides the IE name (e.g. "Minimum DL Power"). This attribute is trace specific and not used for MDT. |
| meas | This element contains the information associated to a UE measurement in MDT task. It includes:  - the measurement name (attribute specification "meas name")  - the measurement value (element's content)  This element is MDT specific and not used for trace. |
| meas name | Attribute specification that provides the IE name. The IEs are specified in the Trace Record for Immediate MDT measurements table (see clauses 4.16, 4.17, 4.34). This attribute is MDT specific and not used for trace. |
| meas changeTime | Attribute specification that provides the time difference with attribute specification "traceCollec beginTime". It is expressed in number of seconds and milliseconds (nbsec.ms). This attribute is MDT specific and not used for trace. |
| meas vendorSpecific | Attribute specification whose value part is a boolean value that indicates if the measurement is vendor specific (true) or not (false). The vendor specific measurements are taken at eNB or RNC. This attribute is MDT specific and not used for trace. |
| meas target Cell | Attribute identifies the serving cell that the UE measurement is taken. This attribute is MDT specific and not used for trace. |
| meas ueLocation | Optional attribute that identifies the UE location information when the measurement is taken. The IEs are specified in the Trace Record for UE location information table.This attribute is MDT specific and not used for trace. |

# A.2 XML file format definition

For encoding of the information content, XML (see Extensible Markup Language (XML) 1.0, W3C Recommendation [5] , [6], [7], [8] and [9]) will be used. The XML schema contains the mark-up declarations that provide a grammar for the trace file format. The XML schema is defined below.

## A.2.1 XML trace/MDT file diagram

The following figure A.2.1-1 describes the XML element structure of a trace/MDT XML file.

![Diagram, schematic

Description automatically generated](data:image/jpeg;base64,/9j/4AAQSkZJRgABAQEAYABgAAD/4TC4RXhpZgAATU0AKgAAAAgABgALAAIAAAAmAAAIYgESAAMAAAABAAEAAAExAAIAAAAmAAAIiAEyAAIAAAAUAAAIrodpAAQAAAABAAAIwuocAAcAAAgMAAAAVgAAEUYc6gAAAAgAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAFdpbmRvd3MgUGhvdG8gRWRpdG9yIDEwLjAuMTAwMTEuMTYzODQAV2luZG93cyBQaG90byBFZGl0b3IgMTAuMC4xMDAxMS4xNjM4NAAyMDIyOjA5OjMwIDEzOjIxOjQwAAAGkAMAAgAAABQAABEckAQAAgAAABQAABEwkpEAAgAAAAMwNAAAkpIAAgAAAAMwNAAAoAEAAwAAAAEAAQAA6hwABwAACAwAAAkQAAAAABzqAAAACAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA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BRQAUUAFFABRQAUUAFFABRQAUUAFFABRQAUUAFFAEFj/yD7b/rkv8AIVJLGs0TxOCUdSrAHHB9xQBBbabaWkzTQxYkZQhcsWO0dBknoPSrVABUbzBGKhWZgAcDHfPr9Kmc1BXkA0znAPlSHPbjj9aXzvmA8t8evGP51l9Zpdx2YCfk/unGPpz+tJ55258qTPpx/jR9ZpdwswM5wD5Uhz244/WnCXL7djD0JxinGvTk7JhZklFbCCigAooAKKACigAooAKKACigAooAKKAILH/kH23/AFyX+QqegAooAKz9QtEvi0LSTRfKMtE+0nO4Y/WsMS7U7lR3K66QqJtW9vRkHJEvUnv060i6PGvS7vPvFh+96E5yenvXne08kVYpxLZvJNFDqWpzNF+5k2F32sBjnCnmtUXsQAHl3XHrbSf/ABNW6dSX2RXRPHIk0SyRsGRwGVgeCD3p653rj15/KlR/iIb2JqK9YzCigAooAKKACigAooAKKACigAooAKKAKlvPDb6bbPNKkamNQC7ADOPel/tOw/5/rb/v6v8AjQAf2nYf8/1t/wB/V/xo/tOw/wCf62/7+r/jQA5L+zlcJHdwO7cBVkBJpJpBFI7yMqRhB8zHAHJ7/lXPiv4Y47kUd7aTOEiuoXc9FWQEmkly15FGWYIY3YgMRyCuOn1NeZYs57zJbGSaCO301/8ASJJDIdR8t33OSN42E5HA6npVLT430ySBraGyCwDCo+sBxjn1iz37HjtjJz6UcRBRSIcWdRo9s1notlbMys0UKoWU5BwOoq+uN689+Pyrjpu9ZPzKexNRXqkBRQAUUAFFABRQAUUAFFABRQAUUAFFAGfciSxs18mK7ugo2COHZuAxjPJXp9aw7u71uUxm1t9YttpJcfZ7eQOM9OZOPw9vpTW4MpSHxO0iyJca0jBcHFlakHj0MuOvOcZ7ZqveW/iq6tfIF/r0QLhmZLO2ViAwOMiUEdMcEd/pSGty3JDrN5p7Wk8esPPJID9okWGJU+6AcI5+7gsMDOccjrXQ30c0c8c6NNOIiGaJNm4jDjjOB1IPJ7Hvis6skkm+4IzxeXUqmFrbWZC4ABnjhVQR3ynIPv6+lXIrWSC8hQ3c7/upOWIJ6p3IrlxU4NJLUcUZtv5+mvcpHpWpGWS5klkmgMRWUFyVPMgx8uOw71Tsxq1pdWsrDxDcRwrteKYQkSc8EkSjn8+3vnohWp8q1E0zoNEimg0SziuEZJUjCsrHke1aC/6xfr/SuGDTr6dynsT0V6hAUUAFFABRQAUUAFFABRQAUUAFFABRQAUUAFFABUD4+0N1zsXP5mufFfwxx3CoZInadJUcKVVlwVznJHuPSvMLOZgfT7O4uftiTvcSXUjyiTT5ZVC7zjYQhGCuD1PWs83LqkIDQOwRBKW0eUbmwu7H7njkEjjo/QYBr1YqFlsQWje2pitQYV3LblbjZpUoLybcAqfKGPm56j/DrrVmaGBm5YqCxI74qKijzx5e4K9tS3RXSIKKACigAooAKKACigAooAKKACigAooAKKACigAqJ4d77g7KcYO3HP5ionBTVmFw8n5gfMfHpxj+VHkcn965z9OP0rH6rTHzMTyDtx5sn14/woMBwB5sgx345/Sj6rTDmYvk/NnzHx6cY/lSpEVfd5jt7HGP5VUcPCLuguySitxBRQAUUAf/2QD/4THoaHR0cDovL25zLmFkb2JlLmNvbS94YXAvMS4wLwA8P3hwYWNrZXQgYmVnaW49J++7vycgaWQ9J1c1TTBNcENlaGlIenJlU3pOVGN6a2M5ZCc/Pg0KPHg6eG1wbWV0YSB4bWxuczp4PSJhZG9iZTpuczptZXRhLyI+PHJkZjpSREYgeG1sbnM6cmRmPSJodHRwOi8vd3d3LnczLm9yZy8xOTk5LzAyLzIyLXJkZi1zeW50YXgtbnMjIj48cmRmOkRlc2NyaXB0aW9uIHJkZjphYm91dD0idXVpZDpmYWY1YmRkNS1iYTNkLTExZGEtYWQzMS1kMzNkNzUxODJmMWIiIHhtbG5zOnhtcD0iaHR0cDovL25zLmFkb2JlLmNvbS94YXAvMS4wLyI+PHhtcDpDcmVhdG9yVG9vbD5XaW5kb3dzIFBob3RvIEVkaXRvciAxMC4wLjEwMDExLjE2Mzg0PC94bXA6Q3JlYXRvclRvb2w+PHhtcDpDcmVhdGVEYXRlPjIwMjItMDktMzBUMTM6MTY6MzMuMDQyPC94bXA6Q3JlYXRlRGF0ZT48L3JkZjpEZXNjcmlwdGlvbj48L3JkZjpSREY+PC94OnhtcG1ldGE+DQogICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgCiAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAKICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgIAogICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgCiAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAKICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgIAogICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgCiAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAKICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgIAogICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgCiAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAKICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgIAogICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgCiAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAKICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgIAogICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgCiAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAKICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgIAogICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgCiAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgIC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igAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAr5//ZX+GmkXn7Hfw20h7zxAtprHhnSL+5ki8R6jHcRyNaW7FYJ1nEttFlBiGFkjALAKAzA/QFeVfsnf8ms/Bv8A7EzRv/SGGgDqr74aaRqH/CMebeeIF/4R3Z9i8jxHqMXm7dmPteycfbP9WuftPm7svnO99x8NLH+z/Dt5F/wk3/CW7ta1aX+0PN8zyt+o3D/Y873/AOPbd9mxkbfs+NqY2L1deVapZ6x8IdYt77SDp9v8LI/t2oaxpdnoWpatrsupXd40xe28iRyYnmupJHHkt5YjIA2PugAOp17wIdc1rU7l75Y7LVNJOlXdv5JMm3MhV0k3YU/vWyCrZwOlU9E8C65p+rtqd14jgnumt7S0P2fTfKUwwyOzKQ0j8uHIJHTqB2rjf+Fyy6X/AMhHxdp91/wlX/IqfYfBGqH+y9/+r/tXbO+3HmwbvN+xf6uXO35vLP8AhZ2s6l/xR1h468P23j7T/wDSdQ1u88E6kNCuIDyEt2N4kRlAlhztu5TlJfkHIjFpt/W/+bB+9v8A1t/kjyT4t/sa+LviBrXxbvLO/wDD6ReL/E3hzWLRbqaYFbfT1QTpNiE4ZtrbQNwOeStUvG/7E/jLXrrxNqVjrOlpPN8TF8c2GmR6pe6fHd2/2dIGimurZBNazAeYyyRCTBxnOTj2j/hflhqX/FY2HiP7N4B0/wD0bUNEvPA2rjXbic8B7dSySmIGWHO20lGEl+ccmM/4XLLpf/IR8Xafdf8ACVf8ip9h8Eaof7L3/wCr/tXbO+3HmwbvN+xf6uXO35vLUVy2t0t+HJ/8rj+Pcb1vfr/9t/8AJyPAPiR+xn8UvEPw/u/CXhOfQPCfhrWrXVJtW8PJ4x1aZX1W4OI72W+e3a4vVKZ3wSeXGWwSsmOfQ/g3+zX47+F/x0g8R6fqNj4c8F3OnCLxBo1lrk+oRa5epbxxRXS20tpGLOTK5do5n3iONdoyxPef8LO1nUv+KOsPHXh+28faf/pOoa3eeCdSGhXEB5CW7G8SIygSw523cpykvyDkR8vrX7WFppvizTvEMmpNp/wlZU06Y3PgrV21iTVWZlWHyz5csUT+ba+XKtrNG7pPE0kTmEPUXyO67W+Wv5X09F/KrTJc2/r99r/l+fd3Z8ULHwZ/wv3xR/wsfwDqHjHw3f8AhnQPsH/FEXviKz+1W91rXm/6i1nSOVEu4/vYbbNxwTXmHxdvfghp2g2WgfDz4ayeE/G2sato0kAtfhnqGiTT2VtrenT3bGZ7GIeTGqxu5ZtoPl55K59yk+O0Wj6hDY6p440me+8YRST+D7az8F6n5mnRgoofU1E7kKhurQOZfsYB352ZPl+dX3iYWOvaR4H1KWbx54psV1jVNQ8df2PdWlraC5vIbiPT7WWbzVaJkuFUJHcvsGnIrDIARDPV9J/Z78L61pdnqFxqvjiO4u4UuJEtPH2u20KsyhiEijvVSNcnhEUKowAAABWV8J/A+neAP2kviRp+mXOsXVvJ4S8N3DPret3uqzBjea4pAlu5ZXVcKPkDBQSSBliT7B4T/wCRW0b/AK8of/QBXn/ij4Z+OP8AhamqeMvBvi/w/on9qaNYaRd2Wu+HJ9S/49J72VJI3ivrbbu+3OCpVvuKQRkigD5V8K+CPhbrHgL4Bv4p+EuoS+JPDdlp0fiw6p8JdYubi8SHQp7L7O8o01xP5dw9swDNsxAGUkogPunwZ0rRtQ+JXxDHgPw1qXgXwofCWi6Vpxm8KXegwRXS3etTTeRBcQQbtpuopGKDGZRk5Jrtv+Ec+N//AEUP4f8A/hB33/y5o/4Rz43/APRQ/h//AOEHff8Ay5qZRU4uL6lRk4tNHnPh/wCBPxITwTqem3n/AAi2g3lp4Gl8K6BbaLqFxLBFdS/6+7lka2RlMjR27cIxUq2TITmt/wAVfCPxz4p/4Sa1EGg6bYa74ItvDaiPVriQ6bcb5hcCNfsq+ZGY5xiTdGxMCAxruLL0/wDwjnxv/wCih/D/AP8ACDvv/lzR/wAI58b/APoofw//APCDvv8A5c1pJ82/n+PNf/0p/ltdEr3VaOn/AAOW3/pK/wCHOG+KH7PGs65JrGn+HtA8L3fhWXTtA0610XUdQls4HtrC8knks2SO0lWOJ1dRuAfcF2FAPmq63wg8fWFxp3iazh8L3nie48USeItU0ea8nt9PizpxsIVhuBbu8jQxrESWij81tx/dcKOs/wCEc+N//RQ/h/8A+EHff/Lmj/hHPjf/ANFD+H//AIQd9/8ALmkm1fXf9Wm/yXn21bueS/rS35fJ6JqyVuY8L/BXxv4dm8ErLqWk3TW1hrv9t6hDPLA0epahMs/2u2g8phIFfzVCvJGVWUncxGDyXhD9m3xH4X+EbeHX8IaHea/ax2NpZX0nxF1iXYkDJIJreaezlex2zQwSC2iV4m2gMSEAb1T/AIRz43/9FD+H/wD4Qd9/8uaP+Ec+N/8A0UP4f/8AhB33/wAuanvbS/36Ntem726eis+1+n9a9/n+rv6B4UtNW0/wvpFtr1/Fqmtw2kUd9fQwiJLicIBJIqDhQzZOB0zXn/7J3/JrPwb/AOxM0b/0hho/4Rz43/8ARQ/h/wD+EHff/Lmuq+E/gX/hV/wr8G+Dftv9p/8ACO6NZ6R9t8ryvtH2eBIvM2bm27tmdu44zjJ61cnzNslKysdXRRRUjCiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACvKv2Tv+TWfg3/2Jmjf+kMNeq15V+yd/wAms/Bv/sTNG/8ASGGgD1WiiigDgP8AhSuif8/Wof8AfxP/AIij/hSuif8AP1qH/fxP/iK7+igDgP8AhSuif8/Wof8AfxP/AIimTfBvQLeF5Zb2+jijUsztLGAoAySTsr0Ks/xFpX9u+H9T03f5f2y1lt9/93ehXP61nUcowbgru2hcEnJKTsjwz4Zt4S+J19Lawaf4p0J2sotVsG1gWyLqVhKWEd1B5bPhTtGUk2SrvTfGu4Z7zUPgL4Z1fT7mxvjdXtjdRNBPbXHlSRyxsCrI6mPDKQSCDwQa8/8AAOk/EPS73Q9avvAbwX3hvQLTwstlJqtqo1BpLm3F5ewujuBbxxwiRBJslk+ZTGh2knxl+Evi/wCOGnzK3h/QdFvWe60u1v8AV76Sa60eATuq6lYtAmRNPBtzHvhZAVBkO0qd5pL4Nd/wbt965X6t9mlnG+rnpt57pN/c7r5LVtq/UeE/2X/CvhH7VJBqGuX97c7Ulv8AUrxbi5aGPIhhMjJuKRqxCg8ks7uXkkkkfoP+FK6J/wA/Wof9/E/+Iqj8DPhrL8NdHvrU+G/Dng21mdBFofhWZ5rJNgIM+54Yf3smRuGz+Bcs5y1em1LtfQFdrVFfT7JNN0+2tIizR28SxKX5JCgAZ9+KsUUUhhRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABXlX7J3/JrPwb/7EzRv/SGGvVa8q/ZO/wCTWfg3/wBiZo3/AKQw0Aeq0UUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUVz/hHxhH4u0G21aPTr3Tra6RZYFvPK3yRsqsrgRyOACG6Eg8HIFY1a1Oir1JWGk3sdBRXK3XjXULe6mij8G65dRxuyrPFLYhJADgMu65DYPUZAPPIFRf8ACd6n/wBCN4g/7/af/wDJVZfW8P8A8/F96HyvsdfRWTo2vS6patLc6Te6RIrlRBeNCzsMA7h5UjrjnHJzweOmcu68a6hb3U0Ufg3XLqON2VZ4pbEJIAcBl3XIbB6jIB55ApLGYZu3tF94cr7HVUVyH/Cd6n/0I3iD/v8Aaf8A/JVbOja9Lqlq0tzpN7pEiuVEF40LOwwDuHlSOuOccnPB46ZJYzDRV3UX3hyvsa1FcrdeNdQt7qaKPwbrl1HG7Ks8UtiEkAOAy7rkNg9RkA88gVF/wnep/wDQjeIP+/2n/wDyVT+t4f8A5+L70HK+x19FZOja9Lqlq0tzpN7pEiuVEF40LOwwDuHlSOuOccnPB46Zy7rxrqFvdTRR+Ddcuo43ZVnilsQkgBwGXdchsHqMgHnkCksZhm7e0X3hyvsdVRXIf8J3qf8A0I3iD/v9p/8A8lVs6Nr0uqWrS3Ok3ukSK5UQXjQs7DAO4eVI645xyc8HjpkljMNFXdRfeHK+xrUVyt1411C3upoo/BuuXUcbsqzxS2ISQA4DLuuQ2D1GQDzyBUX/AAnep/8AQjeIP+/2n/8AyVT+t4f/AJ+L70HK+x19FZOja9Lqlq0tzpN7pEiuVEF40LOwwDuHlS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u2Oegrlf7UuYfiBpOnJJizuNMvriSPaPmkjltFQ5xkYEr8A4O7noMdVX1mVX+qRv5/mYT+IKKKK9czCiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAK5PwXrM/iPwdoWrXKxpc39hBdSrECEDPGrEKCScZPGSa6yuE+Fn/JMfCH/YHs/wD0QlfNZ2lyQfmzanudRRRRXyJuFFFFABRRRQAUUUUAFeZ6t/ydN8P/APsTPEv/AKXaFXplct44+FPgn4nfYv8AhMfB2geLPsO/7L/bmlwXv2fft3+X5qtt3bEzjGdoz0FdmErrDVo1Wr2/yJkuZWOz1DTbTV7KWzvrWG9tJhtkt7iMSRuPQqRg/jVC48G6BeXlvd3Gh6bPd26LHDPJaRs8SqcqqsRkAHkAdK+Z/wDhhzwJ/wBE98A/+CSD/wCM0f8ADDngT/onvgH/AMEkH/xmvuPr+F/5+I5+WXY+jfGPw88O+PvBOreENc0yO68OarDJb3ljE7wLKjklxujKspJJJKkHJPNZt58G/B+oeIPBGt3Gj+ZqfgqKaHQJ/tMw+xpLCIZBtD7ZMxqF/eBsYyMHmvBP+GHPAn/RPfAP/gkg/wDjNH/DDngT/onvgH/wSQf/ABmksfhU7qov6v8A5v72HLLt3/Hf7+p6z4B/ZZ+GHwv8XJ4m8M+Gm07V4vtYgdtRu5obYXUgkuBDBJK0UIdlBIjVQOQMAmoZP2Tvha2lxWEfhyezSHWbjxBbXNjq97bXdpfT/wCvlguI5llgD55SN1Q/3a8s/wCGHPAn/RPfAP8A4JIP/jNH/DDngT/onvgH/wAEkH/xmj6/hbJc600Xlrf89fXUOWV2+/8Alb8nb0PVJP2Vvh23iOw8Qx2mv2mv2ViNNj1S08V6tBcyW4maby5pI7pWnBkdnJlLFieScCpNT+EviT4laHrPhf4raz4Y8X+C9Ut/Km0vRtAvdInZhIjoWuP7SmO0beQqqScfMACD5P8A8MOeBP8AonvgH/wSQf8Axmj/AIYc8Cf9E98A/wDgkg/+M0/7Qw3/AD8X/DhyyTut9Pw2+49U8Tfsp/DLxh4o1rxBquiX1xe64bb+1oE13UIrLUhbqqQrc2iTiCZVVQNrxsp5yDk59WtLSDT7WG1tYY7a2hRY4oYUCpGgGAqgcAAAAAV8q/8ADDngT/onvgH/AMEkH/xmj/hhzwJ/0T3wD/4JIP8A4zR/aGFtb2iFyPsH7Dn/ACSb4e/9ibp3/oi3r6drz34afDSXwDPHHHHYW2mwWYtLe1sVKJCilNiKm0BVCrgAdMCvQq+QzKrCtiHKm7qyOiCaWpz0v/JU9B/7A2pf+j7Gu0rn49E+0eLLDWPO2/ZLK5tPJ2Z3ebJA27dnjHkYxjnd2xz0FfUZU08JFLpf82Yz+IKKKK9YzCiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAK5PwXo0/hzwdoWk3LRvc2FhBaytESULJGqkqSAcZHGQK6ysPWfA3hvxHdLc6t4f0vVLlUEazXllHM4UEkKCyk4ySce5ry8dg3jFGKlZLyuXGXKWaKx/+FT+CP+hN8P8A/grg/wDiKv6N4G8N+HLprnSfD+l6Xcshjaazso4XKkglSVUHGQDj2FeS8jdtKn4f8E09p5Fmiq2s+BvDfiO6W51bw/peqXKoI1mvLKOZwoJIUFlJxkk49zVD/hU/gj/oTfD/AP4K4P8A4ihZG7a1Pw/4Ie08jYoqto3gbw34cumudJ8P6XpdyyGNprOyjhcqSCVJVQcZAOPYUaz4G8N+I7pbnVvD+l6pcqgjWa8so5nCgkhQWUnGSTj3NL+w5X/iaen/AAQ9p5Fmisf/AIVP4I/6E3w//wCCuD/4ir+jeBvDfhy6a50nw/pel3LIY2ms7KOFypIJUlVBxkA49hTeRu2lT8P+CHtPIs0VW1nwN4b8R3S3OreH9L1S5VBGs15ZRzOFBJCgspOMknHuaof8Kn8Ef9Cb4f8A/BXB/wDEULI3bWp+H/BD2nkbFFVtG8DeG/Dl01zpPh/S9LuWQxtNZ2UcLlSQSpKqDjIBx7CjWfA3hvxHdLc6t4f0vVLlUEazXllHM4UEkKCyk4ySce5pf2HK/wDE09P+CHtPIs0Vj/8ACp/BH/Qm+H//AAVwf/EVf0bwN4b8OXTXOk+H9L0u5ZDG01nZRwuVJBKkqoOMgHHsKbyN20qfh/wQ9p5Fmiq2s+BvDfiO6W51bw/peqXKoI1mvLKOZwoJIUFlJxkk49zVD/hU/gj/AKE3w/8A+CuD/wCIoWRu2tT8P+CHtPI2KKraN4G8N+HLprnSfD+l6Xcshjaazso4XKkglSVUHGQDj2FGs+BvDfiO6W51bw/peqXKoI1mvLKOZwoJIUFlJxkk49zS/sOV/wCJp6f8EPaeRZorH/4VP4I/6E3w/wD+CuD/AOIq/o3gbw34cumudJ8P6XpdyyGNprOyjhcqSCVJVQcZAOPYU3kbtpU/D/gh7TyLNFVtZ8DeG/Ed0tzq3h/S9UuVQRrNeWUczhQSQoLKTjJJx7mqH/Cp/BH/AEJvh/8A8FcH/wARQsjdtan4f8EPaeQv9qXMPxA0nTkkxZ3GmX1xJHtHzSRy2ioc4yMCV+AcHdz0GOqrE0XwR4c8NXT3WkaBpelXLoY2msrKOFyhIJUlVBxkA49hW3Xv4XD/AFWiqV72MpPmdwooorrJCiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooA//9k=)

Figure A.2.1-1 : XML trace/MDT file diagram

NOTE: In case a trace only recording session, the elements/attributes (such as "meas") which are specific to MDT but not used for trace should be excluded from the file; In case a MDT only recording session, the elements/attributes (such as "msg") which are specific to trace but not used for MDT should be excluded from the file: In case of a combined trace and MDT recording session, all the elements/attributes are included in the file.

## A.2.2 Trace data file XML schema

The following XML schema traceData.xsd is the schema for trace or MDT data XML files:

<?xml version="1.0" encoding="UTF-8"?>

<!--

3GPP TS 32.423 Subscriber and Equipment Trace or MDT data definition and management

Trace data file XML schema

traceData.xsd

-->

<schema

targetNamespace=

"http://www.3gpp.org/ftp/specs/archive/32\_series/32.423#traceData"

elementFormDefault="qualified"

xmlns="http://www.w3.org/2001/XMLSchema"

xmlns:td=

"http://www.3gpp.org/ftp/specs/archive/32\_series/32.423#traceData"

>

<!-- XML types specific for Trace data file -->

<complexType name="TraceReference">  
 <sequence>  
 <element name="MCC" type="td:MCCtype"/>

<element name="MNC" type="td:MNCtype"/>

<element name="TRACE\_ID" type="td:Trace\_IDtype"/>

</sequence>

</complexType>

<simpleType name="traceRecSessionRef">

<restriction base="hexBinary">

<maxLength value="2"/>

</restriction>

</simpleType>

<simpleType name="MCCtype">

<restriction base="string">

<pattern value="\d{3}"/>

</restriction>

</simpleType>

<simpleType name="MNCtype">

<restriction base="positiveInteger">

<maxExclusive value="1000"/>

</restriction>

</simpleType>

<complexType name="PLMNtype">

<sequence>

<element name="MCC" type="td:MCCtype"/>

<element name="MNC" type="td:MNCtype"/>

</sequence>

</complexType>

<simpleType name="Trace\_IDtype">

<restriction base=" hexBinary">

<length value="3"/>

</restriction>

</simpleType>

<!-- Trace data file root XML element -->

<element name="traceCollecFile">

<complexType>

<sequence>

<element name="fileHeader">

<complexType>

<sequence>

<element name="fileSender">

<complexType>

<attribute name="elementDn" type="string" use="optional"/>

<attribute name="elementType" type="string" use="optional"/>

</complexType>

</element>

<element name="traceCollec">

<complexType>

<attribute name="beginTime" type="dateTime" use="required"/>

</complexType>

</element>

<element name="pOPLMN" type="td:PLMNtype" minOccurs="0" maxOccurs="1"/> </sequence>

<attribute name="fileFormatVersion" type="string" use="required"/>

<attribute name="vendorName" type="string" use="optional"/>

</complexType>

</element>

<element name="traceRecSession" minOccurs="0" maxOccurs="unbounded">

<complexType>

<sequence>

<element name="ue" minOccurs="0">

<complexType>

<attribute name="idType" type="string" use="required" />

<attribute name="idValue" type="long" use="required"/>

</complexType>

</element>

<!-- Element specific to trace data file -->

<element name="msg" minOccurs="0" maxOccurs="unbounded">

<complexType>

<sequence>

<element name="initiator" minOccurs="0">

<complexType>

<simpleContent>

<extension base="string">

<attribute name="type" type="NCName" use="optional"/>

</extension>

</simpleContent>

</complexType>

</element>

<element name="target" minOccurs="0" maxOccurs="unbounded">

<complexType>

<simpleContent>

<extension base="string">

<attribute name="type" type="NCName" use="optional"/>

</extension>

</simpleContent>

</complexType>

</element>

<element name="proxy" minOccurs="0" maxOccurs="unbounded">

<complexType>

<simpleContent>

<extension base="string">

<attribute name="type" type="NCName" use="optional"/>

</extension>

</simpleContent>

</complexType>

</element>

<element name="rawMsg" minOccurs="0">

<complexType>

<simpleContent>

<extension base="hexBinary">

<attribute name="protocol" type="string" use="required"/>

<attribute name="version" type="string" use="required"/>

<attribute name="NumOfTargets" type="integer" use="optional"/>

</extension>

</simpleContent>

</complexType>

</element>

<choice minOccurs="0" maxOccurs="unbounded">

<element ref="td:ie"/>

<element ref="td:ieGroup"/>

</choice>

</sequence>

<attribute name="function" type="string" use="required"/>

<attribute name="name" type="string" use="required"/>

<attribute name="changeTime" type="float" use="required"/>

<attribute name="vendorSpecific" type="boolean" use="required"/>

</complexType>

</element>

<!-- Element specific to MDT data file -->

<element name="meas" minOccurs="0" maxOccurs="unbounded">

<complexType>

<simpleContent>

<extension base="string">

<attribute name="name" type="string" use="required"/>

<attribute name="changeTime" type="float" use="required"/>

<attribute name="vendorSpecific" type="boolean" use="required"/>

<attribute name="targetCell" type="string" use="required"/>

<attribute name="ueLocation" type="string" use="optional"/>

</extension>

</simpleContent>

</complexType>

</element>

<element name="traceSessionRef" type="td:TraceReference"/>

</sequence>

<attribute name="dnPrefix" type="string" use="optional"/>

<attribute name="traceRecSessionRef" type="td:traceRecSessionRef" use="required"/>

<attribute name="stime" type="dateTime" use="optional"/>

</complexType>

</element>

</sequence>

</complexType>

</element>

<!-- Additional supporting XML elements -->

<element name="ieGroup">

<complexType>

<choice minOccurs="0" maxOccurs="unbounded">

<element ref="td:ie"/>

<element ref="td:ieGroup"/>

</choice>

<attribute name="name" type="string" use="optional"/>

<attribute name="value" type="string" use="optional"/>

</complexType>

</element>

<element name="ie">

<complexType>

<simpleContent>

<extension base="string">

<attribute name="name" type="string" use="required"/>

</extension>

</simpleContent>

</complexType>

</element>

</schema>

Annex B (normative):  
Trace Report File Conventions and Transfer Procedure

# B.0 Introduction

This annex describes naming conventions of files containing trace results and the procedure to transfer these files from the network to the NM.

# B.1 File naming convention

The following convention shall be applied for trace result file naming:

<Type><Startdate>.<Starttime>‑<SenderType>.<SenderName>.[<TraceReference>].[<TraceRecordingSessionRef>]

1) The Type field indicates if the file contains trace data for single or multiple calls, where:

- "A" means single Trace Recording Session, single sender NE;

- "B" means multiple Trace Recording Sessions, single sender NE;

- "C" means IMSI/IMEI (SV) information for cell traffic trace or IMEI-TAC if area based MDT trace is involved (3GPP TS 32.422 [3] clause 4.4) .

2) The Startdate field indicates the date of the first record in the trace file. The Startdate field is of the form YYYYMMDD, where:

- YYYY is the year in four-digit notation;

- MM is the month in two digit notation (01 - 12);

- DD is the day in two digit notation (01 - 31).

3) The Starttime field indicates the time of the first record in the trace file. The Starttime field is of the form HHMMSSshhmm, where:

- HH is the two digit hour of the day (local time), based on 24 hour clock (00 - 23);

- MM is the two digit minute of the hour (local time) (00 – 59);

- SS is the two digit second of the minute (local time) (00 – 59);

- s is the sign of the local time differential from UTC (+ or -), in case the time differential to UTC is 0 then the sign may be arbitrarily set to "+" or "-";

- hh is the two digit number of hours of the local time differential from UTC (00-23);

- mm is the two digit number of minutes of the local time differential from UTC (00-59).

4) SenderType field is the type of NE defined by IOC attribute managedElementType in 3GPP TS 32.622 [12] that recorded and sent the trace file; SenderName field is the identifier of the NE that recorded and sent the trace file.

5) TraceRecordingSessionReference field is set only if the type field is A, and is represented in hexa-decimal format. TraceRecordingSessionReference is a 4 digit hexadecimal number and will not include filler digits for values less than 4 digits in length. All hexadecimal letters (A thru F) are capitalized.

6) TraceReference field is set if the type field is A. For type B the Trace Reference is optional and will be used when one trace file is created per trace session with multiple trace recording session. Trace Reference is represented in hexadecimal format. Trace Reference as defined in 3GPP TS 32.422 [3] is composed of PLMN ID (MCC, MNC) and Trace ID. The PLMN identity consists of 3 digits for MCC followed by either - a filler digit plus 2 digits from MNC (in case of 2 digit MNC) or 3 digits from MNC (in case of a 3 digit MNC). MCC and MNC are in BCD format.

Example: If MCC: 405, MNC: 139

octet 1: 0x04 (MCC digit 2, MCC digit 1)

octet 2: 0x15 (MNC digit 1, MCC digit 3)

octet 3: 0x93 (MNC digit 3, MNC digit 2)

Also if the MNC is 2 digits (MCC: 405 and MNC 39)

octet 1: 0x04 (MCC digit 2, MCC digit 1)

octet 2: 0xF5 (MNC digit 1, MCC digit 3)

octet 3: 0x93 (MNC digit 3, MNC digit 2)

7) Trace Reference is set if the type field is C.

See bullet 6 above for details regarding the representation of the Trace Reference.Some examples describing file naming convention:

1) file name: A20090928.231500+0200-MME.MME5. 13F23200056.125,

meaning: file produced by MME< MME5> on September 28, 2009, first trace record at 23:15:00 local time with a time differential of +2 hours against UTC. The file contains trace data for the Trace Session with the Trace reference 13F232000056 (where MCC is 312, MNC is 23, and Trace ID is 000056, all in hexadecimal format) and for the Trace Recording Session with the reference 125.

2) file name: B20030115.170000-0300-RNC.RNC02,

meaning: file produced by RNC<RNC02> on January 15, 2003, first trace record at 17:00:00 local time with a time differential of -3 hours against UTC. The file contains trace data for several Trace Recording Sessions.

3) file name: B20030115.170000-0300-RNC.RNC02. 4358070034D7,

meaning: file produced by RNC<RNC02> on January 15, 2003, first trace record at 17:00:00 local time with a time differential of -3 hours against UTC. The file contains trace 4358070034D7 (where MCC is 348, MNC is 570, and Trace ID is 0034D7) data for Trace reference and several Trace Recording Sessions.

4) file name C20030115.170000-0300-MME.MME02. 26F452550021

Meaning: file produced by MME<MME02> on January 15, 2003, first trace record at 17:00:00 local time with a time differential of -3 hours against UTC. The file contains IMSI/IMEI (SV) or IMEI-TAC information for one or more UEs traced at eNB with Trace Reference26F452550021 (where MCC is 624, MNC is 25, and Trace ID is 550021).

# B.2 File transfer

- Data retrieval and storage mechanisms are vendor specific.

- There is no constraint on data retrieval periodicity.

Annex C (informative):  
Trace Functional Architecture: Reporting

# C.1 Figure of Trace Reporting

The following represents the trace reporting procedures.

OSS/NM/TCE

S-CSCF

P-CSCF

GGSN

SGSN

MGW

MSC Server

HSS

EMx

**EMy**

RNC

Figure C.1.1: Trace Reporting in System context A

OSS/NM/TCE

S-CSCF

P-CSCF

RNCS

GGSN

SGSN

MGW

MSC Server

HSS

**EM**

**EM**

**EM**

**EM**

**EM**

**EM**

**EM**

**EM**

Figure C.1.2: Trace Reporting in System Context B

Annex D (informative):  
Examples of trace files

# D.1 Examples of trace XML file

## D.1.1 Example of XML trace file with the maximum level of details

<?xml version="1.0" encoding="UTF-8"?>

<traceCollecFile xmlns="http://www.3gpp.org/ftp/specs/archive/32\_series/32.423#traceData" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:schemaLocation="http://www.3gpp.org/ftp/specs/archive/32\_series/32.423#traceData http://www.3gpp.org/ftp/specs/archive/32\_series/32423#traceData">

<fileHeader fileFormatVersion="32.423 V6.0" vendorName="Company NN">

<pOPLMN>

<MCC>460</MCC>

<MNC>10</MNC>

</pOPLMN>

<fileSender elementDn="DC=a1.companyNN.com,SubNetwork=1, ManagedElement=RNC-1" elementType="RNC"/>

<traceCollec beginTime="2001-09-11T09:30:47-05:00"/>

</fileHeader>

<traceRecSession dnPrefix="DC=a1.companyNN.com,SubNetwork=1" traceRecSessionRef=" A1" stime="2001-09-11T09:30:47-05:00">

<ue idType="IMSI" idValue="32795"/>

<msg function="Iub" name="Radio LinkSetup Request" changeTime="0.005" vendorSpecific="false">

<target type="Cell">SubNetwork=1,ManagedElement=Cell-1</target>

<rawMsg protocol="Nbap" version="001">A9FD64E12C</rawMsg>

</msg>

<traceSessionRef>

<MCC>460</MCC>

<MNC>10</MNC>

<TRACE\_ID>000122</TRACE\_ID>

</traceSessionRef>

</traceRecSession>

</traceCollecFile>

An additional example added;

<?xml version="1.0" encoding="UTF-8"?>

<traceCollecFile xmlns="http://www.3gpp.org/ftp/specs/archive/32\_series/32.423#traceData" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:schemaLocation="http://www.3gpp.org/ftp/specs/archive/32\_series/32.423#traceData http://www.3gpp.org/ftp/specs/archive/32\_series/32423#traceData">

<fileHeader fileFormatVersion="32.423 V9.0" vendorName="Company NN">

<pOPLMN>

<MCC>460</MCC>

<MNC>10</MNC>

</pOPLMN>

<fileSender elementDn="DC=a1.companyNN.com,SubNetwork=1, ManagedElement=MME-1 " elementType="MME"/>

<traceCollec beginTime="2001-09-11T09:30:47-05:00"/>

</fileHeader>

<traceRecSession dnPrefix="DC=a1.companyNN.com,SubNetwork=1" traceRecSessionRef=" B2" stime="2001-09-11T09:30:47-05:00">

<ue idType="IMSI" idValue="32795"/>

<msg function="S1AP" name="Handover Request" changeTime="0.005" vendorSpecific="false">

<target type="Cell">SubNetwork=1,ManagedElement=Cell-1</target>

<target type="Cell">SubNetwork=1,ManagedElement=Cell-2</target>

<target type="Cell">123.222.213.5 </target>

<rawMsg protocol="S1AP" version="001" NumOfTargets="3">A9FD64E12C</rawMsg>

</msg>

<traceSessionRef>

<MCC>460</MCC>

<MNC>10</MNC>

<TRACE\_ID>000122</TRACE\_ID>

</traceSessionRef>

</traceRecSession>

</traceCollecFile >

## D.1.2 Example of XML trace file with the minimum level of details

<?xml version="1.0" encoding="UTF-8"?>

<traceCollecFile xmlns="http://www.3gpp.org/ftp/specs/archive/32\_series/32.423#traceData" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:schemaLocation="http://www.3gpp.org/ftp/specs/archive/32\_series/32.423#traceData http://www.3gpp.org/ftp/specs/archive/32\_series/32.423#traceData">

<fileHeader fileFormatVersion="32.423 V6.0" vendorName="Company NN">

<pOPLMN>

<MCC>460</MCC>

<MNC>10</MNC>

</pOPLMN>

<fileSender elementDn="DC=a1.companyNN.com,SubNetwork=1, ManagedElement=RNC-1" elementType="RNC"/>

<traceCollec beginTime="2001-09-11T09:30:47-05:00"/>

</fileHeader>

<traceRecSession dnPrefix="DC=a1.companyNN.com,SubNetwork=1" traceRecSessionRef="C3" stime="2001-09-11T09:30:47-05:00">

<ue idType="IMSI" idValue="32795"/>

<msg function="Iub" name="Radio Link Setup Request" changeTime="0.005" vendorSpecific="false">

<target type="Cell">SubNetwork=1,ManagedElement=Cell-1</target>

<ie name="UL Scrambling Code">54</ie>

<ie name="UL SIR Target">17.3</ie>

<ie name="Min UL Channelisation Code Length">8</ie>

<ie name="Poncture Limit">2</ie>

<ieGroup name="RadioLink" value="1">

<ie name="DL Scrambling Code">1</ie>

<ie name="DL Channelisation Code Number">15</ie>

<ie name="Maximum DL Power">9.3</ie>

<ie name="Minimum DL Power">-10.1</ie>

</ieGroup>

</msg>

<msg function="IuPs" name="RAB Assignment Response" changeTime="0.010" vendorSpecific="false">

<ieGroup name="RAB" value="1">

<ieGroup name="RAB Failed To Setup Or Modify">

<ie name="cause">2</ie>

</ieGroup>

</ieGroup>

</msg>

<traceSessionRef>

<MCC>460</MCC>

<MNC>10</MNC>

<TRACE\_ID>000130</TRACE\_ID>

</traceSessionRef>

</traceRecSession>

</traceCollecFile>

### D.1.3 Example of XML trace file for IMSI information from the MME

<?xml version="1.0" encoding="UTF-8"?>

<traceCollecFile xmlns=http://www.3gpp.org/ftp/specs/archive/32\_series/32.423#traceData xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:schemaLocation="http://www.3gpp.org/ftp/specs/archive/32\_series/32.423#traceData http://www.3gpp.org/ftp/specs/archive/32\_series/32423#traceData">

<fileHeader fileFormatVersion="32.423 V8**.**0" vendorName="Company NN">

<pOPLMN>

<MCC>460</MCC>

<MNC>10</MNC>

</pOPLMN>

<fileSender elementDn="DC=a1.companyNN.com,SubNetwork=1, ManagedElement=MME" elementType="MME"/>

<traceCollec beginTime="2001-09-11T09:30:47-05:00"/>

</fileHeader>

<traceRecSession dnPrefix="DC=a1.companyNN.com,SubNetwork=1" traceRecSessionRef=" A1" stime="2001-09-11T09:30:47-05:00">

<ue idType="IMSI" idValue="32795"/>

<traceSessionRef>

<MCC>460</MCC>

<MNC>10</MNC>

<TRACE\_ID>000130</TRACE\_ID>

</traceSessionRef>

</traceRecSession>

<traceRecSession dnPrefix="DC=a1.companyNN.com,SubNetwork=1" traceRecSessionRef=" B2" stime="2001-09-11T09:30:47-05:00">

<ue idType="IMSI" idValue="12345"/>

<traceSessionRef>

<MCC>460</MCC>

<MNC>10</MNC>

<TRACE\_ID>000150</TRACE\_ID>

</traceSessionRef>

</traceRecSession>

</traceCollecFile>

# D.1.4 Example of MDT XML file

<?xml version="1.0" encoding="UTF-8"?>

<traceCollecFile xmlns="http://www.3gpp.org/ftp/specs/archive/32\_series/32.423#traceData" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:schemaLocation="http://www.3gpp.org/ftp/specs/archive/32\_series/32.423#traceData http://www.3gpp.org/ftp/specs/archive/32\_series/32.423#traceData">

<fileHeader fileFormatVersion="32.423 V6.0" vendorName="Company NN">

<pOPLMN>

<MCC>460</MCC>

<MNC>10</MNC>

</pOPLMN>

<fileSender elementDn="DC=a1.companyNN.com,SubNetwork=1, ManagedElement=RNC-1" elementType="RNC"/>

<traceCollec beginTime="2001-09-11T09:30:47-05:00"/>

</fileHeader>

<traceRecSession dnPrefix="DC=a1.companyNN.com,SubNetwork=1" traceRecSessionRef=" A1", stime="2001-09-11T09:30:47-05:00">

<ue idType="IMSI" idValue="32795"/>

<meas name="RSRP" changeTime="0.005" vendorSpecific="false" targetCell="Cell-1"> 97 </meas>

<meas name="RSRQ" changeTime="0.010" vendorSpecific="false" targetCell="Cell-2"> 34 </meas>

<meas name="Power Headroom" changeTime="0.015" vendorSpecific="false" targetCell="Cell-1"> 5 </meas>

<traceSessionRef>

<MCC>460</MCC>

<MNC>10</MNC>

<TRACE\_ID>000150</TRACE\_ID>

</traceSessionRef>

</traceRecSession>

</traceCollecFile>

Annex E (informative):  
Void

Annex F (Informative):  
Void

Annex G (normative):  
Trace Record Protocol Buffer (GPB)

# G.1 Transport Protocol Payload Format

The payload of one transport protocol message can carry one or more trace records as specified in clause 5.1. For GPB trace payload, the overall encoding format shall adhere to the following rules:

- Each trace record is encoded as a single TraceRecord GPBv3 message following the schema in clause G.2.

- Each TraceRecord message is preceded by a length field indicating the size in bytes of the following GPB message. This length field is encoded using the GPB ‘varint’ wire format.

- If the transport message payload includes multiple trace records, the length field for the next TraceRecord message shall immediately follow the preceding message.

- No extra padding (unused bytes) is allowed anywhere in the transport message payload.

NOTE: The total length of the transport message payload is assumed to be available but encoding of this value is specific to the transport protocol in use.

# G.2 Trace Record Protocol Buffer (GPB) definitions

Normative GPB Trace Record schema, defined per clause 5.2:

syntax = “proto3”;

/\* Trace Record per 3GPP 32.423 specification.

\* v16

\*/

enum TraceRecordType {

    NORMAL = 0;

    TRACE\_SESSION\_START = 1;

    TRACE\_SESSION\_STOP = 2;

    TRACE\_RECORDING\_SESSION\_START = 3;

    TRACE\_RECORDING\_SESSION\_STOP = 4;

    TRACE\_STREAM\_HEARTBEAT = 5;

    TRACE\_RECORDING\_SESSION\_DROPPED\_EVENTS = 6;

    TRACE\_RECORDING\_SESSION\_NOT\_STARTED = 7;

TRACE\_FILE\_OPEN = 8;

    TRACE\_FILE\_CLOSE = 9;

    TRACE\_FILE\_ABNORMAL\_CLOSED = 10;

TRACE\_RECORDING\_SESSION\_THROTTLED\_START = 11;

TRACE\_RECORDING\_SESSION\_THROTTLED\_STOP = 12;

TRACE\_SESSION\_NOT\_STARTED = 13;

}

message GlobalGnbId {

    bytes plmn\_identity = 1;

    int64 gnb\_id = 2;

}

message TraceRecordHeader {

int64 time\_stamp = 1;

string nf\_instance\_id = 2;

string nf\_type = 3;

bytes trace\_reference = 4;

bytes trace\_recording\_session\_ref = 5;

TraceRecordType trace\_rec\_type\_id = 6;

optional bytes ran\_ue\_id = 7;

optional string payload\_schema\_uri = 8;

  GlobalGnbId global\_gnb\_id = 9;

map<string, string> vendor\_extension = 10;

}

message TraceSessionStart {

  map<string, string> vendor\_extension = 1;

}

message TraceSessionStop {

  map<string, string> vendor\_extension = 1;

}

message TraceRecordingSessionStart {

map<string, string> vendor\_extension = 1;

}

message TraceRecordingSessionStop {

string reason = 2;

  map<string, string> vendor\_extension = 1;

}

message TraceStreamHeartbeat {

  map<string, string> vendor\_extension = 1;

}

message TraceRecordingSessionDroppedEvents {

  int64 number\_of\_dropped\_events = 1;

  map<string, string> vendor\_extension = 2;

}

message TraceRecordingSessionNotStarted {

string reason = 1;

  map<string, string> vendor\_extension = 2;

}

message TraceFileOpen {

map<string, string> vendor\_extension = 1;

}

message TraceFileClose {

map<string, string> vendor\_extension = 1;

}

message TraceFileAbnormalClosed {

string reason = 1;

  map<string, string> vendor\_extension = 2;

}

message TraceRecordingSessionThrottledStart {

string reason = 1;

  map<string, string> vendor\_extension = 2;

}

message TraceRecordingSessionThrottledStop {

  map<string, string> vendor\_extension = 1;

}

message TraceSessionNotStarted {

string reason = 1;

  map<string, string> vendor\_extension = 2;

}

message CommonTracePayload {

  oneof record\_payload {

    TraceSessionStart trace\_session\_start = 1;

    TraceSessionStop trace\_session\_stop = 2;

    TraceRecordingSessionStart trace\_recording\_session\_start = 3;

    TraceRecordingSessionStop trace\_recording\_session\_stop = 4;

    TraceStreamHeartbeat trace\_stream\_heartbeat = 5;

    TraceRecordingSessionDroppedEvents trace\_recording\_session\_dropped\_events = 6;

    TraceRecordingSessionNotStarted trace\_recording\_session\_not\_started = 7;

  TraceFileOpen trace\_file\_open = 8;

    TraceFileClose trace\_file\_close = 9;

    TraceFileAbnormalClosed trace\_file\_abnormal\_closed = 10;

TraceRecordingSessionThrottledStart trace\_recording\_session\_throttled\_start = 11;

TraceRecordingSessionThrottledStop trace\_recording\_session\_throttled\_stop = 12;

TraceSessionNotStarted trace\_session\_not\_started = 13;

}

}

message TraceRecordPayload {

optional int64 payload\_size = 1;

bytes binary\_payload = 2;

}

message TraceRecord {

TraceRecordHeader header = 1;

TraceRecordPayload payload = 2;

}

message StreamingTraceRecord {

TraceRecord record = 1;

optional CommonTracePayload administrative\_message = 2;

}

Annex H (informative):  
Examples of Protocol Buffer (GPB) encoded Streaming Trace administrative messages

The following examples illustrate the use of Prococol Buffer encoding for Streaming Trace administrative messages according to the definitions in clause 5.2.4.

The examples are in compact GPB format, using the schema defined in Annex G.

**Example 1, Decoded Trace Session start message:**

  TraceRecord {  
    header {  
      time\_stamp: 1584103023591,  
      nf\_instance\_id: NETWORK\_MANAGED\_ELEMENT\_ID,  
      nf\_type: RadioNode,  
      trace\_reference: ''H,  
      trace\_recording\_session\_reference: ''H,

      trace\_rec\_type\_id: TRACE\_SESSION\_START,

      ran\_ue\_id: ''H,  
    },  
    payload: ''H  
  },  
  CommonTracePayload

}

**Example 2, Decoded Trace Session stop message:**

TraceRecord {  
    header {  
      time\_stamp: 158415623591,  
      nf\_instance\_id: NETWORK\_MANAGED\_ELEMENT\_ID,  
      nf\_type: RadioNode,  
      trace\_reference: ''H,  
      trace\_recording\_session\_reference: ''H,

      trace\_rec\_type\_id: TRACE\_SESSION\_STOP,

      ran\_ue\_id: ''H,  
    },  
    payload: '0A 01 09 11'H  
  },  
  CommonTracePayload {  
    trace\_session\_stop {  
    }  
  }

**Example 3, Decoded Trace Recording Session Dropped Events message:**

TraceRecord {  
    header {  
      time\_stamp: 1584103023591,  
      nf\_instance\_id: NETWORK\_MANAGED\_ELEMENT\_ID,  
      nf\_type: RadioNode,  
      trace\_reference: ''H,  
      trace\_recording\_session\_reference: ''H,

      trace\_rec\_type\_id: TRACE\_RECORDING\_SESSION\_DROPPED\_EVENTS,

      ran\_ue\_id: ''H,  
    },  
    payload: '0A'H  
  },  
  CommonTracePayload {  
    trace\_recording\_session\_dropped\_events {

number\_of dropped\_events: 6  
    }  
  }

Annex I (informative):  
Change history

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Change history** | | | | | | | | |
| **Date** | **TSG #** | **TSG Doc.** | **CR** | **Rev** | **Subject/Comment** | **Cat** | **Old** | **New** |
| Sep 2005 | SA\_29 | SP-050623 | 0004 | 1 | Clarify Trace Messages for FDD and TDD modes | B | 6.2.0 | 7.0.0 |
| Dec 2005 | SA\_30 | SP-050690 | 0007 | -- | Differentiate Trace Contents for FDD and TDD | B | 7.0.0 | 7.1.0 |
| Dec 2005 | SA\_30 | SP-050709 | 0008 | -- | Remove SFN-SFN observed time difference - Align with 25.331 | A | 7.0.0 | 7.1.0 |
| Dec 2005 | SA\_30 | SP-050709 | 0009 | -- | Correction to name space URI | A | 7.0.0 | 7.1.0 |
| Jun 2006 | SA\_32 | SP-060258 | 0011 | -- | Correction for compilation errors of schema and addition of the missing link | A | 7.1.0 | 7.2.0 |
| Sep 2006 | SA\_33 | SP-060533 | 0013 | -- | Correct UTRA Carrier RSSI for trace contents- Align with RAN2's 25.331 | A | 7.2.0 | 7.3.0 |
| Sep 2006 | SA\_33 | SP-060533 | 0015 | -- | Correct CFN-SFN observed time difference for trace IE - Align with RAN2's 25.331 | A | 7.2.0 | 7.3.0 |
| Sep 2006 | SA\_33 | SP-060552 | 0016 | -- | Add Trace IEs to differentiate UARFCN for FDD and TDD - Align with RAN2's 25.331 | C | 7.2.0 | 7.3.0 |
| Sep 2006 | SA\_33 | SP-060552 | 0018 | -- | Correction in XML schema and examples | F | 7.2.0 | 7.3.0 |
| Dec 2006 | SA\_34 | SP-060728 | 0019 | -- | Correct the errors in figure and examples | F | 7.3.0 | 7.4.0 |
| Mar 2009 | SA\_43 | SP-090207 | 0020 | -- | Constraint of the presence for the "ue" element | F | 7.4.0 | 8.0.0 |
| Mar 2009 | SA\_43 | SP-090207 | 0021 | -- | Adding PGW trace record content | B | 7.4.0 | 8.0.0 |
| Mar 2009 | SA\_43 | SP-090207 | 0022 | -- | Alignment with 32.421 and 32.422. Introduction medium and minimum trace dept IEs for the GTP and S1AP protcols in MME | B | 7.4.0 | 8.0.0 |
| Mar 2009 | SA\_43 | SP-090207 | 0023 | -- | Alignment with 32.421 and 32.422. Introduction of E-UTRAN | B | 7.4.0 | 8.0.0 |
| Jun 2009 | SA\_44 | SP-090289 | 0024 | -- | Alignment with 32.421 and 32.422 - Introduction medium and minimum trace depth IEs in MME. | F | 8.0.0 | 8.1.0 |
| Jun 2009 | SA\_44 | SP-090289 | 0025 | -- | Add missing SGW Trace Record content | F | 8.0.0 | 8.1.0 |
| Jun 2009 | SA\_44 | SP-090289 | 0026 | -- | Add missing PGW Trace Record content for Gx and S6b interfaces | F | 8.0.0 | 8.1.0 |
| Jun 2009 | SA\_44 | SP-090289 | 0027 | -- | Alignment with 32.421 and 32.422 - Introduction medium and minimum trace dept IEs for NAS in MME. | F | 8.0.0 | 8.1.0 |
| Sep 2009 | SA\_45 | SP-090534 | 0028 | -- | Correction in TS 32.423 Trace Depth requirements for MME, SGW and PGW | F | 8.1.0 | 8.2.0 |
| Sep 2009 | SA\_45 | SP-090534 | 0030 | -- | Unable to uniquely identify file name when one file per UE trace | F | 8.1.0 | 8.2.0 |
| Sep 2009 | SA\_45 | SP-090534 | 0031 | -- | Added a file format and example for sending the IMSI/IMEI (SV) information from the MME | F | 8.1.0 | 8.2.0 |
| Sep 2009 | SA-45 | SP-090542 | 0029 | -- | Correction on XML file format for Trace failure notification | F | 8.2.0 | 9.0.0 |
| Dec 2009 | SA-46 | SP-090719 | 0032 | -- | Clarify Trace Reference and Trace Recording Session Reference format | F | 9.0.0 | 9.1.0 |
| Jan 2010 | -- | -- | -- | -- | Removal of track changes | -- | 9.1.0 | 9.1.1 |
| Mar 2010 | SA-47 | SP-100034 | 0034 | -- | Align with 32.421 and 33.401 | A | 9.1.1 | 9.2.0 |
| Sep 2010 | SA-49 | SP-100487 | 0039 | -- | Correcting references | A | 9.2.0 | 9.3.0 |
| Sep 2010 | SA-49 | SP-100489 | 0036 | -- | Add Diameter in HSS Trace Record Content | B | 9.2.0 | 9.3.0 |
| Sep 2010 | SA-49 | SP-100488 | 0035 | -- | Correct call trace file format to allow multiple targets | F | 9.3.0 | 10.0.0 |
| Dec 2010 | SA-50 | SP-100833 | 0040 | 1 | Add trace Record Content in MME trace and SGSN trace - Align with 32.421 and 32.422 | C | 10.0.0 | 10.1.0 |
| Dec 2010 | SA-50 | SP-100858 | 0042 | -- | Correcting the Trace Reference definition - Align with RAN3 TS 36.423, 36.413 | A | 10.0.0 | 10.1.0 |
| Dec 2010 | SA-50 | SP-100833 | 0043 | -- | Adding the S6a trace interface for HSS | B | 10.0.0 | 10.1.0 |
| Dec 2010 | SA-50 | SP-100833 | 0044 | -- | Correcting the Identification of IMS Subscriber Tracing - Align with 32.421 | F | 10.0.0 | 10.1.0 |
| Dec 2010 | SA-50 | SP-100831 | 0047 | -- | Add missing interfaces S3, S4 and S6d trace record contents of SGSN - Align with 32.422 | A | 10.0.0 | 10.1.0 |
| Mar 2011 | SA-51 | SP-110095 | 0049 | - | Addition of trace Record Content of EIR Trace | B | 10.1.0 | 10.2.0 |
| May 2011 | SA-52 | SP-110292 | 0050 | 1 | Applying trace data file to MDT data format | B | 10.2.0 | 10.3.0 |
| Dec 2011 | SA-54 | SP-110715 | 0054 | -- | Correcting the description of meas vendorSpecific attribute in the XML trace file | F | 10.3.0 | 10.4.0 |
| Dec 2011 | SA-54 | SP-110716 | 0047 |  | Clarification of eNB ID in E-UTRAN Trace Record | B | 10.4.0 | 11.0.0 |
| Dec 2011 | SA-54 | SP-110716 | 0053 | -- | Rel11 CR to 32423 Update the trace record content for Uu and X2 interfaces | C | 10.4.0 | 11.0.0 |
| March 2012 | SA55 | SP-120053 | 0058 | 1 | Correct IMSI retrieval file to include MDT anonymization info | A | 11.0.0 | 11.1.0 |
| March 2012 | SA-55 | SP-120044 | 0061 | 1 | Modify E-UTRAN Trace Record Content | A | 11.0.0 | 11.1.0 |
| Sep-2012 | SA-57 | SP-120627 | 0064 | 1 | Reference list correction to align with the corrected TS 29.212 title | F | 11.1.0 | 11.2.0 |
| Dic-2012 | SA-58 | SP-120783 | 0065 | 1 | Correction of inconsistent specification of data type for Trace Recording Session Reference Length (TRSR) | F | 11.2.0 | 11.3.0 |
| SP-120796 | 0066 | 1 | Specifying trace record content for immediate MDT measurements | B |
| SP-120796 | 0067 | - | Add RCEF in Uu interface trace | C |
| SP-120795 | 0068 | 1 | Correction on the scope and reference related to MDT | F |
| Mar-2013 | SA-59 | SP-130057 | 0069 | - | RCEF reporting in UMTS | F | 11.3.0 | 11.4.0 |
| June-2013 | SA-60 | SP-130265 | 0072 | 1 | Correct trace file name format | A | 11.4.0 | 11.5.0 |
| SP-130304 | 0073 | 2 | Correct the XML shcema for MDT data | F |
| Sep-2013 | SA-61 | SP-130432 | 0075 | 2 | Correction on some inconsistent definitons for trace data file parameters | A | 11.5.0 | 11.6.0 |
| Mar-2014 | SA-63 | SP-140029 | 0079 | 1 | Corrections of Trace Session identifier | A | 11.6.0 | 11.7.0 |
| Jun-2014 | SA-64 | SP-140344 | 0083 | - | Corrections on the trace record content for immediate MDT measurements | F | 11.7.0 | 11.8.0 |
| Sep-2014 | SA-65 | SP-140560 | 0092 | 1 | Correct the File naming convention | B | 11.8.0 | 12.0.0 |
| Dec-2014 | SA-66 | SP-140798 | 0093 | - | Remove characters in the Trace file name | F | 12.0.0 | 12.1.0 |
| SP-140800 | 0094 | 1 | Introduction of network sharing. | B |
| Jan 2016 |  |  |  |  | Update to Rel-13 (MCC) |  | 12.1.0 | 13.0.0 |

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| **Change history** | | | | | | | |
| **Date** | **Meeting** | **TDoc** | **CR** | **Rev** | **Cat** | **Subject/Comment** | **New version** |
| 2017-03 | SA#75 |  |  |  |  | Promotion to Release 14 without technical change | 14.0.0 |
| 2018-06 | SA#80 | SP-180434 | 0095 | - | B | Add support for 5G Trace | 15.0.0 |
| 2019-06 | SA#84 | SP-190385 | 0097 | 1 | F | Update Trace Record Content to reflect the NR NRM in 28.541 for NSA support | 15.1.0 |
| 2020-03 | SA#87E | SP-200165 | 0099 | 1 | F | Add missing MDT trace record for LTE measurements | 15.2.0 |
| 2020-03 | SA#87E | SP-200173 | 0100 | 1 | B | Add MDT trace record for NR measurements | 16.0.0 |
| 2020-03 | SA#87E | SP-200175 | 0101 | 1 | B | Add streaming format for Trace Record Reporting | 16.0.0 |
| 2020-07 | SA#88E | SP-200488 | 0112 | - | A | clean up of the editor notes | 16.1.0 |
| 2020-07 | SA#88E | SP-200485 | 0113 | 1 | F | Adding SINR measurement in M1 for Immediate MDT | 16.1.0 |
| 2020-07 | SA#88E | SP-200483 | 0115 | 1 | F | Correction of the Trace streaming format definitions | 16.1.0 |
| 2020-09 | SA#89e | SP-200723 | 0116 | - | F | Add support for new administration messages when streaming trace data | 16.2.0 |
| 2020-12 | SA#90e | SP-201074 | 0117 | - | F | Correct streaming trace record concept figure | 16.3.0 |
| 2020-12 | SA#90e | SP-201063 | 0118 | - | F | Fix inconsistencies in NR positioning method | 16.3.0 |
| 2020-12 | SA#90e | SP-201052 | 0119 |  | C | Add GPB trace record for file based support | 17.0.0 |
| 2021-03 | SA#91e | SP-210167 | 0121 | 1 | C | Add new parameters for trace record header | 17.1.0 |
| 2021-03 | SA#91e | SP-210168 | 0122 | 1 | A | Correct trace record information for immediate MDT measurement in NR | 17.1.0 |
| 2021-04 | SA#91e |  |  |  |  | Editorial in clause 5.2.4.7 | 17.1.1 |
| 2021-06 | SA#92e | SP-210403 | 0123 | - | C | Add abnormal case for trace recording session stop in GPB trace record format | 17.2.0 |
| 2021-06 | SA#92e | SP-210403 | 0124 | 1 | B | Add MDT polluted measurement indication for trace record in NR | 17.2.0 |
| 2021-12 | SA#94e | SP-211483 | 0125 | 1 | B | Add MDT polluted measurement indication for trace record in NR | 17.3.0 |
| 2021-12 | SA#94e | SP-211483 | 0126 |  | B | Add new adminstrative messages in GPB trace record format | 17.3.0 |
| 2021-12 | SA#94e | SP-211458 | 0128 | 1 | A | Introduce missing IEs for HSS and UDM Trace Record | 17.3.0 |
| 2022-06 | SA#96 | SP-220516 | 0130 | 1 | A | Adding missing interface related to SMF for trace record content | 17.4.0 |
| 2022-09 | SA#97e | SP-220853 | 0134 | - | A | Rel-17 CR 32.423 GPB schema fix for trace streaming | 17.5.0 |
| 2022-12 | SA#98e | SP-221196 | 0138 | - | A | Fixing the representation of the payload size in the figure for trace payload | 17.6.0 |
| 2022-12 | SA#98e | SP-221168 | 0139 | - | F | Indicate SCP/SEPP info in UE Trace Record | 17.6.0 |
| 2023-09 | SA#101 | SP-230942 | 0146 | - | A | Correcting the reference to E1AP specification | 17.7.0 |
| 2023-12 | SA#102 | SP-231491 | 0147 | - | F | Rel-17 CR TS 32.423 Correcting the reference to E1AP specification for gnb-DU record content | 17.8.0 |
| 2023-12 | SA#102 | SP-231489 | 0154 | - | A | Rel-17 CR TS32.423 Align N38 in SMF requirement with TS23.501 | 17.8.0 |
| 2023-12 | SA#102 | SP-231496 | 0161 | 1 | A | Rel-17 CR 32.423 Correct trace administrative message definitions | 17.8.0 |
| 2024-03 | SA#103 | SP-240141 | 0175 | - | A | Rel-17 32.423 Correct trace record header definition | 17.9.0 |
| 2024-06 | SA#104 | SP-240812 | 0183 | 1 | A | Rel-17 CR 32.423 Alignment of parameters used in XML trace file parameters table and trace data file XML schema | 17.10.0 |