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Contents

Intelle	ectual Property Rights	2
Legal	Notice	2
Moda	ıl verbs terminology	2
Forew	vord	7
Introd	luction	7
1	Scope	
	•	
2	References	
3 3.1	Definitions and abbreviations	
3.2	Abbreviations	
4	Trace/UE measurements activation and deactivation.	10
4.1	Trace Session activation / deactivation for Trace and MDT	
4.1.1	Management activation	
4.1.1 4.1.1.1		
4.1.1.2		
4.1.1.2		1 2
T.1.1.2	selection	12
4.1.1.3	PS Domain activation mechanisms	15
4.1.1.4		
4.1.1.5		
4.1.1.6		
4.1.1.6		
	selection	
4.1.1.7	7 EPC Domain activation mechanisms	21
4.1.2	Signalling activation	
4.1.2.1	— — — — — — — — — — — — — — — — — — —	
4.1.2.2		
4.1.2.3		
4.1.2.4		
4.1.2.5	5 PS Domain activation mechanisms	25
4.1.2.6	5 CS Domain activation mechanisms	29
4.1.2.7	7 Void	30
4.1.2.8	B Tracing roaming subscribers	30
4.1.2.9	yoid	30
4.1.2.9	9.1 void	30
4.1.2.9	9.2 Void	30
4.1.2.9	9.3 Void	31
4.1.2.9	9.4 Void	31
4.1.2.1	10 EPC activation mechanism	32
4.1.2.1	10.1 UE attached to EPC via E-UTRAN	32
4.1.2.1	UE attached to EPC via <i>non-3GPP</i> accesses with DSMIPv6 on S2c or PMIP on S2a/S2b	35
4.1.2.1	10.3 UE attached to EPC via non-3GPP accesses with GTP on S2b interface	36
4.1.2.1	10.4 Inter-RAT handover from E-UTRAN to UTRAN	38
4.1.2.1	11 E-UTRAN activation mechanisms	40
4.1.2.1	12 EPC and E-UTRAN Activation mechanism for MDT	41
4.1.2.1	12.1 General	41
4.1.2.1	12.2 Activation of MDT task before UE attaches to the network	42
4.1.2.1	12.3 Activation of MDT task after UE attachment	44
4.1.2.1	12.4 Handling of various scenarios during MDT activation	45
4.1.2.1		
4.1.2.1	13.1 General	46
4.1.2.1	13.2 Activation of MDT task before UE attaches to the network	46
4.1.2.1	13.2a Activation of MDT task after UE attaches to the network	48

	51 54 55 55 55 55 56 57 57 58 58 61 62 62 62 62 62 62 62
	54 55 55 55 56 57 57 57 58 58 61 62 62 62 62 62 62 62
	55 55 55 55 56 57 57 58 58 61 62 62 62 62 62 62 62
	55 55 55 56 57 57 58 58 61 62 62 62 62 62 62 62 62
	55 55 56 57 57 58 58 61 62 62 62 62 62 62 62 62
	55 56 57 57 58 58 61 62 62 62 62 62 62 62 62
	55 56 57 57 58 58 61 62 62 62 62 62 62 62
	56 57 57 58 58 61 62 62 62 62 62 62 62 62
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	70 73 74 76 76 76 76 76 76 77 77
	70 70 73 74 76 76 76 76 76 77 77 77
	70 73 74 76 76 76 76 76 76 77 77
	70 73 74 76 76 76 76 76 77 77 77 78
	70 73 74 76 76 76 76 76 76 77 77 78 78

4.2.4.5	E-UTRAN stopping mechanisms	80
4.2.4.6	EPC Domain stopping mechanisms	81
4.2.4.7	E-UTRAN stopping mechanisms for MDT	81
4.2.4.8	Stopping mechanisms at UE for MDT	81
4.2.5	Stopping a trace recording session - signalling based	82
4.2.5.1	UTRAN stopping mechanisms	82
4.2.5.2	PS Domain stopping mechanisms	82
4.2.5.3	CS Domain stopping mechanisms	84
4.2.5.4	Void	
4.2.5.5	void	
4.2.5.5.1	void	
4.2.5.5.2	void	
4.2.5.5.3	void	
4.2.5.6	void	
4.2.5.7	E-UTRAN stopping mechanisms	
4.2.5.8	EPC Domain stopping mechanisms	
4.2.5.9	EPC stopping mechanisms for MDT	
4.2.5.10	E-UTRAN stopping mechanisms for MDT	
4.2.5.11	Stopping mechanisms at UE for MDT	
4.2.6	Void	
4.2.7	Void	
4.2.8	Void	
4.2.8.1	Void	
4.2.8.2	Void	
4.2.9	Void	
4.3	RLF reporting	
	ce session activation for RLF reporting	
	ce session deactivation for RLF reporting	
4.3.2 11a 4.4	Handling of MDT Trace sessions at handover for Immediate MDT	
4.5	Handling of MDT Trace sessions at handover for Logged MDT	
4.6	User consent handling in MDT	
4.6.1	Signalling based MDT	
4.6.2	Area based MDT	
4.7	Anonymization of MDT data for area based MDT	
4.8	RCEF reporting	
	ce session activation for RCEF reporting	
	ce session deactivation for RCEF reporting	
	, c	
	race/UE measurement control and configuration parameters	
5.1	Triggering events (M)	97
5.2	void	
5.3	Trace Depth (M)	102
5.4	List of NE types (M)	102
5.5	List of interfaces (O)	104
5.6	Trace Reference (M)	106
5.7	Trace Recording Session Reference (M)	106
5.8	Void	106
5.9	IP Address of Trace Collection Entity (CM,CO)	106
5.9a	Job type (CM)	106
5.9b	PLMN Target (CM)	107
5.10	MDT specific configuration parameters (CM)	107
5.10.1	Void	107
5.10.2	Area Scope	
5.10.3	List of measurements	
5.10.4	Reporting Trigger	
5.10.5	Report Interval	
5.10.6	Report Amount	
5.10.7	Event Threshold for RSRP	
5.10.7a	Event Threshold for RSRQ	
5.10.8	Logging Interval	
5.10.9	Logging Duration	
5 10 10	Void	111

5.10.11	1 Trace Collection Entity Id	111
5.10.12	2 Anonymization of MDT data	111
5.10.13	Event Threshold for Event 1F	112
5.10.14	Event threshold for Event 1I	112
5.10.15	5 Measurement quantity	112
5.10.16	6 void	113
5.10.17	7 void	113
5.10.18	8 void	113
5.10.19	Positioning Method	113
5.10.20	Collection period for RRM measurements LTE	113
5.10.21	Collection period for RRM measurements UMTS	113
5.10.22	2 Measurement period UMTS	114
5.10.23	3 Measurement period LTE	115
5.10.24	4 MDT PLMN List	115
6	MDT Reporting	116
Annex	x A (normative): Trace failure notification file format	118
A.1	Global structure	118
A.2	XML elements fileHeader and fileFooter	118
A.2.1	XML elements fileHeader	118
A.2.2	XML element fileFooter	118
A.3	Trace failure notification specific XML elements	118
	4 Trace IRP XML File Name Conventions	
A.4	Trace IRP XML File Name Conventions	118
	Trace IRP XML File Name Conventions Trace failure notification file XML schema	
A.5	Trace failure notification file XML schema	119
A.5 Annex		119

Foreword

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Introduction

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

- TS 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";

Additionally, there is a GSM only Subscriber and Equipment Trace specification: 3GPP TS 52.008 [5].

Subscriber and Equipment 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 purposes.

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, UTRAN, EPC and E-UTRAN UMTS procedure validation.

The capability to log data on any interface at call level for a specific user (e.g. IMSI) 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 Equipment Trace is the easy way to go deeper into investigation and network optimisation.

In order to produce this data, Subscriber and Equipment 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 the mechanisms used for the control and configuration of the Trace, Minimization of Drive Test (MDT) and Radio Link Failure (RLF) reporting functionality at the EMs, NEs and UEs. For Trace functionality, it covers the triggering events for starting/stopping of subscriber/UE activity traced over 3GPP standardized signalling interfaces, the types of trace mechanisms, configuration of a trace, level of detail available in the trace data, the generation of Trace results in the Network Elements (NEs) and User Equipment (UE) and the transfer of these results to one or more EM(s) and/or Network Manager(s) (NM(s)). For MDT, it also covers logged MDT and immediate MDT mechanims in both area based and signalling based scenarios. GSM is excluded from the RAT systems which the present document can be applied to.

The mechanisms for Trace, MDT and RLF reporting activation/deactivation are detailed in clause 4; clause 5 details the various Trace, MDT and RLF reporting control and configuration parameters and the triggering events that can be set in a network. Trace, MDT and RLF reporting concepts and requirements are covered in 3GPP TS 32.421 [2] while Trace and MDT data definition and management is covered in 3GPP TS 32.423 [3].

The conditions for supporting Network Sharing are stated in 3GPP TS 32.421 [2].

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*.

NOTE: Overall management principles are defined in 3GPP TS 32.101 [1].

[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 32.423: "Telecommunication management; Subscriber and equipment trace: Trace data definition and management".
[4]	3GPP TR 21.905: "Vocabulary for 3GPP Specifications".
[5]	3GPP TS 52.008: "Telecommunication management; GSM subscriber and equipment trace".
[6]	3GPP TS 23.060: "General Packet Radio Service (GPRS) Service description; Stage 2".
[7]	3GPP TS 23.205: "Bearer-independent circuit-switched core network; Stage 2".
[8]	3GPP TS 23.108: "Mobile radio interface layer 3 specification, core network protocols; Stage 2 (structured procedures)".
[9]	3GPP TS 23.246: "Multimedia Broadcast/Multicast Service (MBMS); Architecture and functional description".
[10]	3GPP TS 29.232: "Media Gateway Controller (MGC) - Media Gateway (MGW); interface; Stage 3".
[11]	3GPP TS 29.002: "Mobile Application Part (MAP) specification".

[12]	3GPP TS 29.060: "General Packet Radio Service (GPRS); GPRS Tunnelling Protocol (GTP) across the Gn and Gp interface".
[13]	3GPP TS 25.413: "UTRAN Iu interface Radio Access Network Application Part (RANAP) signalling".
[14]	3GPP TS 23.218: "IP Multimedia (IM) session handling; IM call model; Stage 2".
[15]	3GPP TS 23.228: "IP Multimedia Subsystem (IMS); Stage 2".
[16]	3GPP TS 29.228: "IP Multimedia (IM) Subsystem Cx and Dx Interfaces; Signalling flows and message contents".
[17]	3GPP TS 29.328: "IP Multimedia Subsystem (IMS) Sh interface; Signalling flows and message contents".
[18]	Void.
[19]	Void.
[20]	Void.
[21]	3GPP TS 23.401: "General Packet Radio Service (GPRS) enhancements for Evolved Universal Terrestrial Radio Access Network (E-UTRAN) access".
[22]	3GPP TS 23.402: "Architecture enhancements for non-3GPP accesses".
[23]	3GPP TS 36.401: "Evolved Universal Terrestrial Radio Access Network (E-UTRAN); Architecture description".
[24]	3GPP TS 32.442: "Telecommunication management; Trace management Integration Reference Point (IRP); Information Service (IS)".
[25]	3GPP TS 29.273: "Evolved Packet System (EPS); 3GPP EPS AAA interfaces".
[26]	3GPP TS 29.272: "Evolved Packet System (EPS); Mobility Management Entity (MME) and Serving GPRS Support Node (SGSN) related interfaces based on Diameter protocol".
[27]	3GPP TS 32.615: "Telecommunication management; Configuration Management (CM); Bulk CM Integration Reference Point (IRP): eXtensible Markup Language (XML) definitions".
[28]	3GPP TS 32.342: "Telecommunication management; File Transfer (FT) Integration Reference Point (IRP): Information Service (IS)".
[29]	3GPP TS 29.212: " Policy and Charging Control (PCC);Reference points".
[30]	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".
[31]	3GPP TS 25.331: "Radio Resource Control (RRC); Protocol specification"
[32]	3GPP TS 36.331: "Evolved Universal Terrestrial Radio Access (E-UTRA); Radio Resource Control (RRC); Protocol specification".
[33]	3GPP TS 24.301: "Non-Access-Stratum (NAS) protocol for Evolved Packet System (EPS); Stage 3".
[34]	3GPP TS 29.274: "3GPP Evolved Packet System (EPS); Evolved General Packet Radio Service (GPRS) Tunnelling Protocol for Control plane (GTPv2-C); Stage 3".
[35]	3GPP TS 32.622: "Telecommunication management; Configuration Management (CM); Generic network resources Integration Reference Point (IRP): Network Resource Model (NRM)".
[36]	3GPP TS 36.413: "Evolved Universal Terrestrial Radio Access Network (E-UTRAN); S1 Application Protocol".

- [37] 3GPP TS 36.300: "Evolved Universal Terrestrial Radio Access (E-UTRA) and Evolved Universal Terrestrial Radio Access Network (E-UTRAN): Overall description stage 2".
- [38] 3GPP TS 36.214:"Evolved Universal Terrestrial Radio Access (E-UTRA); Physical layer Measurements".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in TR 21.905 [4] and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in TR 21.905 [4].

Area based MDT: MDT data is collected from UEs in a specified area. The area is defined as a list of cells (UTRAN or E-UTRAN) or as a list of tracking/routing/location areas. The area based MDT is an enhancement of the management based trace functionality. Area based MDT can be either a logged MDT or Immediate MDT.

Immediate MDT: Collection of UE measurements in connected mode.

Logged MDT: Collection of UE measurements in idle mode.

Signalling based MDT:MDT data is collected from one specific UE. The UE that is participating in the MDT data collection is specified as IMEI(SV) or as IMSI. The signalling based MDT is an enhancement of the signalling based subscriber and equipment trace. A signalling based MDT can be either a logged MDT or Immediate MDT.

3.2 Abbreviations

For the purposes of the present document, the abbreviations given in TR 21.905 [4], 3GPP TS 32.101 [1] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in TR 21.905 [4].

AS Application Server

BGCF Breakout Gateway Control Function
CSCF Call Session Control Function

I-CSCF Interrogating-CSCF

IM CN SS IP Multimedia Core Network Subsystem

IMEI-TAC IMEI Type Allocation Code

MRFC Multimedia Resource Function Controller

MDT Minimization of Drive Tests

P-CSCF Proxy - CSCF

RCEF RRC Connection Establishment Failure

RLF Radio Link Failure S-CSCF Serving-CSCF TAU Tracking Area Update

4 Trace/UE measurements activation and deactivation

4.1 Trace Session activation / deactivation for Trace and MDT

4.1.1 Management activation

4.1.1.1 General

In Management activation, the Trace Control and Configuration parameters are sent directly to the concerned NE (by its EM). This NE shall not propagate the received data to any other NE's - whether or not it is involved in the actual recording of the call.

Once the parameters have been provided, the NE looks for the IMSI or IMEI (IMEISV) passing through it. If it does not have them, these shall be provided to the NE (that performs the trace recording) as part of traffic signalling by the CN.

The following figure represents the management based trace functionality within a PLMN. The figure represents a typical PLMN network. A dotted arrow with "Trace Parameter Configuration" represents the availability of the management based trace functionality at the EM for that domain.

NOTE: There is no propagation of trace parameters in management based trace activation.

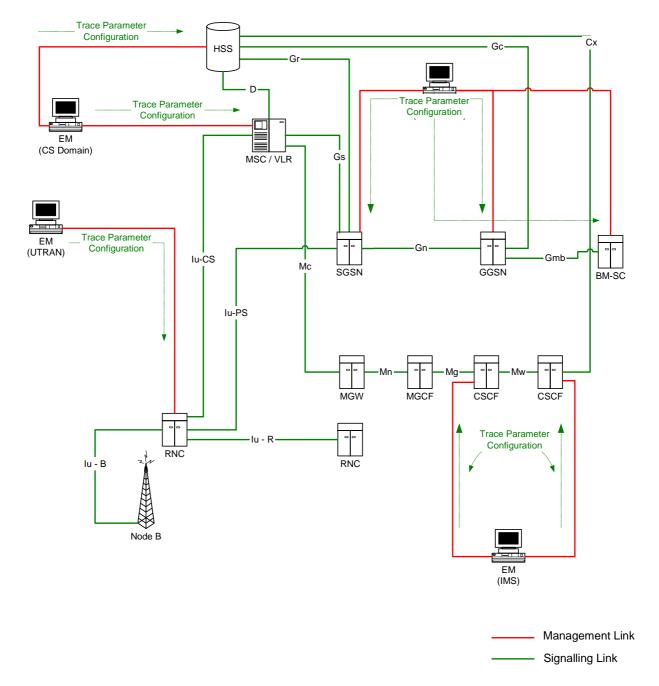


Figure 4.1.1.1: Overview of management activation for an UMTS system

If the NE failed to activate the Trace Session, a Trace failure notification shall be sent to the TCE, and the Trace failure notification has the the same parameters as the notification notifyTraceRecordingSessionFailure defined in 3GPP TS 32.442 [24], the Trace failure notification file XML schema is defined in Annex A.

4.1.1.2 UTRAN activation mechanisms

When an RNC receives Trace Session activation from the EM it shall start a Trace Session. The trace control and configuration parameters of the Trace Session are received in Trace Session activation from the EM. The RNC shall not forward these trace control and configuration parameters to other nodes. The received trace control and configuration parameters shall be saved and used to determine when and how to start a Trace Recording Session. (Starting a Trace Recording Session is described in subclause 4.2.2.1). A Trace Session may be requested for a limited geographical area.

Since a RNC has visibility of an IMSI, it can start an IMSI Trace all by itself when a Trace session is requested for an IMSI or a list of IMSI's. However, a RNC does not have visibility of the IMEI(SV). Hence, when a Trace session is requested for an IMEI(SV) or a list of IMEI(SV), the RNC shall send the requested IMEI(SV) / list of IMEI(SV)s in an 'Uplink Information Exchange Request' message to the interacting MSC Server(s) and SGSN(s). The MSC Servers and SGSNs shall store the requested IMEI(SV)s per RNC. For each subscriber/UE activity the MSC Servers and SGSNs shall request IMEI(SV), if it is not already provided. For each subscriber/UE activity the MSC server/SGSN shall check whether a trace request is active in an RNC for the IMEI(SV). If a match is found, the MSC Server/SGSN shall inform the RNC about the IMEI(SV) in CN Invoke Trace, so that the RNC can trace the control signalling according to the trace control and configuration parameters that are received from its EM.

If an Inter-MSC SRNS Relocation or an Inter-SGSN SRNS relocation occurs, the anchor MSC Server or source SGSN shall transfer the IMSI and IMEI(SV) for the subscriber/UE activity to the non anchor MSC Server or target SGSN. The non anchor MSC Server/target SGSN shall check whether it has received a trace request from the target RNC for the transferred IMEI(SV). If a match is found on the IMEI(SV) in the non anchor MSC Server/target SGSN, the MSC Server/SGSN shall inform the RNC about the IMEI(SV) in the CN Invoke Trace. The IMSI shall be transferred from the non anchor MSC Server/target SGSN to the target RNC in Relocation Request. The RNC can then trace the subscriber/UE activity according to the trace control and configuration parameters that are received from its EM.

4.1.1.2a UTRAN activation mechanisms for area based MDT data collections without IMSI/IMEI(SV) selection

In case of area based MDT data collection, the UE selection should be done in the radio network at RNC based on the input information received from OAM, like device capability information and area scope. In this case there is no IMSI, IMEI(SV) selection.

The following figure shows an example scenario how the MDT configuration is done utilising the cell traffic trace functionality:

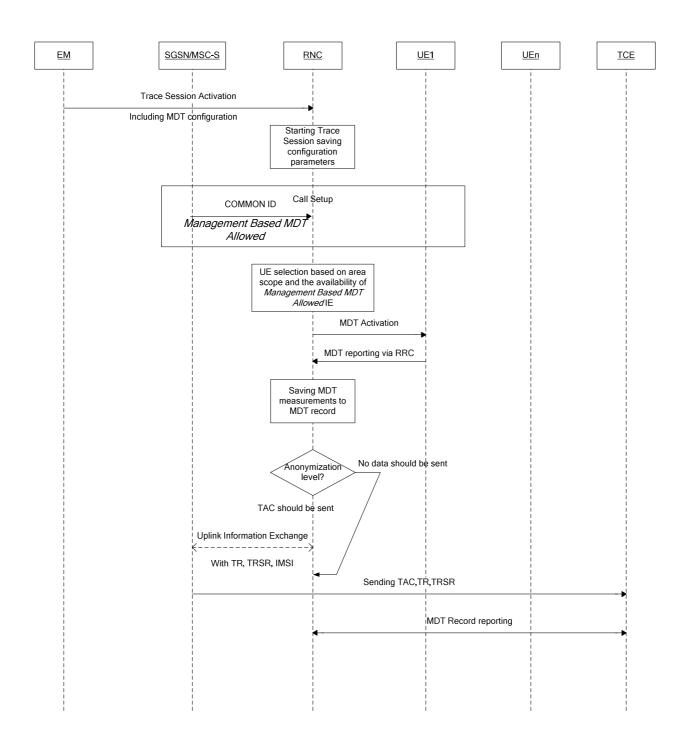


Figure 4.1.1.2a.1: Example for area based MDT activation in UTRAN

1) The EM sends a Trace Session activation request to the RNC. This request includes the parameters for configuring MDT data collection:

- The area where the MDT data should be collected: list of UTRAN cells. Routing Area or Location Area should be converted to UTRAN cells.
- Job type
- List of measurements
- Reporting Trigger (only in case of Immediate MDT)
- Report Interval (only in case of Immediate MDT)
- Report Amount (only in case of Immediate MDT)
- Event Threshold (Only in case of Immediate MDT)
- Logging Interval (Only in case of Logged MDT)
- Logging Duration (Only in case of Logged MDT)
- Trace Reference
- IP address of TCE
- Anonymization of MDT data.
- Measurement quantity
- Measurement Period UMTS (Only in case of Immediate MDT and if either of the measurements M6, M7 is requested in the list of measurement parameter).
- Collection period for RRM measurements UMTS (present only if any of M3, M4 or M5 measurements are requested).
- Positioning method
- 2) When RNC receives the Trace Session activation request from its EM, it shall start a Trace Session and should save the parameters associated to the Trace Session.
- 3) Void.
- 4) RNC shall select the suitable UEs for MDT data collection. The selection is based on the area received from the EM and the area where UE is roaming, user consent information received from the core network (As described in clause 4.6.2 of the present document). If the user is not in the specified area or if the *Management Based MDT Allowed* IE is not received from the Core Network (which indicates lacking user consent) the UE shall not be selected by the RNC for MDT data collection. During UE selection, the RNC shall take into account also the UE capability (MDT capability) when it selects UE for logged MDT configuration. If the UE does not support logged MDT the UE shall not be selected. The RNC should also start the Data Volume measurement if it is requested in the MDT configuration.
- 5) RNC shall activate the MDT functionality to the selected UEs. As part of this operation the RNC shall allocate a Trace Recording Session Reference and send at least the following configuration information to the UE in case of Logged MDT:
 - Trace Reference
 - Trace Recording Session Reference
 - TCE Id (The value signalled as IP address of TCE from the EM is mapped to a TCE Id, using a configured mapping in the RNC)
 - Logging Interval
 - Logging duration
 - Absolute time reference
 - The area where the MDT data should be collected: list of UTRAN cells/RA/LA

In case of Immediate MDT only the measurements and their parameters needs to be sent to the UE:

- List of measurements
- Reporting trigger
- Report Interval
- Report Amount
- Event threshold (only if event based reporting is configured in reporting trigger)
- 6) When UE receives the MDT activation it shall start the MDT functionality based on the received configuration parameters. The MDT related measurements are reported to the RNC via RRC signalling. In case of Logged MDT the MDT reporting is done when the network requests the log The MDT log is requested if UE's rPLMN matches the PLMN where TCE used to collect MDT data resides (e.g. RNC's primary PLMN) by sending the UEInformationRequest message. The MDT log is sent by the UE in the UEInformationResponse message. If the MDT anonymization requires the IMEI-TAC in the MDT record, RNC shall send the Trace Recording Session Reference, Trace Reference, serving Cell Identifier (containing serving cell PLMN and Cell ID, for immediate MDT only), TCE IP address and IMSI in the UPLINK INFORMATION EXCHANGE REQUEST message to the SGSN/MSC Server via Iu connection. When SGSN/MSC Server receives this Iu signalling message containing the Trace Recording Session Reference, Trace Reference, TCE IP address, IMSI, the SGSN/MSC Server shall look up the corresponding equipment identities (IMEI (SV)) of the given IMSI from its database, and send the IMEI-TAC together with the Trace Recording Session Reference and Trace Reference to the TCE, as described in section 4.7 of the present document. For logged MDT, SGSN/MSC Server shall send the IMEI-TAC together with the Trace Recording Session Reference to the TCE.

For immediate MDT, RNC shall include the serving cell identifier in the UPLINK INFORMATION EXCHANGE REQUEST message.

The UE should report the Trace Reference, Trace Recording Session Reference and TCE Id together with the MDT reports to the network in case of Logged MDT.

- 7) When RNC receives the MDT report from the UE the RNC shall compare the Trace PLMN (PLMN portion of Trace Reference) with the PLMN where TCE used to collect MDT data resides (e.g. its primary PLMN). In case of a match, for immediate MDT, it shall capture it and put the UE's serving cell CGI together with the MDT report from the UE to the trace record. In case of a match, for logged MDT, the RNC shall capture it and put it to the trace record. Otherwise it shall discard the MDT report.
- NOTE: For area based Immediate MDT, TRSR may be duplicated among different RNCs when multiple cells are selected as the area scope for the same MDT job. In this case, the combination of TRSR and the UE's serving cell CGI in the MDT report can uniquely identify one trace recording session.
- 8) The Trace Records shall be forwarded to the Trace Collection Entity indicated in the MDT report received from the UE in case of Logged MDT. The RNC translates the TCE Id received from the UE to the TCE IP address before it forwards the measurement records to the TCE. (The address translation is done by using configured mapping in the RNC.) The RNC shall not provide the IMSI in the MDT.

The Immediate MDT measurement configuration is deleted in the UE together with the RRC context when entering idle mode.

The Logged MDT trace session is preserved in the UE until the duration time of the trace session expires, including also multiple idle periods interrupted by idle-connected-idle state transitions.

The Logged MDT trace session context of the UE is stored in the network as long as the trace session is active, including also the periods when the UE is in connected state.

EM shall validate that the MCC and MNC in the Trace reference is the same as the PLMN supported by all the RNCs specified in the area scope. If the RNC receives a request with a PLMN in the TraceReference that does not match any PLMN in its list, it shall ignore the request.

4.1.1.3 PS Domain activation mechanisms

When a SGSN, GGSN or BM-SC receives Trace Session activation from the EM it shall start a Trace Session. The trace control and configuration parameters of the Trace Session are received in the Trace Session activation from the

EM. The SGSN/GGSN/BM-SC shall not forward these trace control and configuration parameters to other nodes. The received trace control and configuration parameters shall be saved and used to determine when and how to start a Trace Recording Session. (Starting a Trace Recording Session is described in subclause 4.2.2.2).

4.1.1.4 CS Domain activation mechanisms

When a MSC Server receives Trace Session activation from the EM it shall start a Trace Session. The trace control and configuration parameters of the Trace Session are received in the Trace Session activation from the EM. The MSC Server shall not forward these trace control and configuration parameters to other nodes. The received trace control and configuration parameters shall be saved and used to determine when and how to start a Trace Recording Session. (Starting a Trace Recording Session is described in subclause 4.2.2.3).

4.1.1.5 IP Multimedia Subsystem activation mechanisms

When a S-CSCF/P-CSCF receives Trace Session activation from EM, the S-CSCF/P-CSCF shall start a Trace Session. The Trace control and configuration parameters of the Trace Session, received from EM in the Trace Session activation, shall be saved. The Trace control and configuration parameters define when the S-CSCF and P-CSCF shall start and stop a Trace Recording Session. For detailed information on starting and stopping Trace Recording Session in IMS see sub clauses 4.2.2.4 and 4.2.4.4.

The following figure illustrates the Trace Session activation in S-CSCF and in P-CSCF in case of Management based activation.

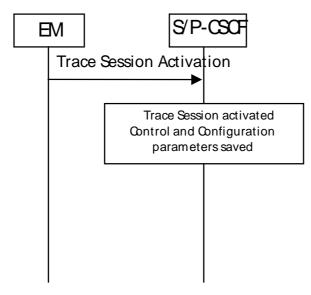


Figure 4.1.1.5.1: Trace Session activation in IMS

4.1.1.6 E-UTRAN activation mechanisms

In E-UTRAN the Management Based Trace Activation can be fulfilled with the E-UTRAN Cell Traffic trace functionality. In this case the Trace Session Activation is done to one or a list E-UTRAN cells within one eNodeB, where Trace Session is activated.

The following trace control and configuration parameters of the Trace Session are received by eNodeB in the Trace Session activation message from the EM:

- Trace Reference
- Trace Depth
- E-UTRAN cells list
- List of interfaces for eNB
- IP address of Trace Collection Entity

When eNodeB receives the Trace Session Activation message from the EM for a given or a list of E-UTRAN cell(s) the eNodeB shall start a Trace Session for the given or list of E-UTRAN cell(s).

4.1.1.6a E-UTRAN activation mechanisms for area based MDT data collections without IMSI/IMEI(SV) selection

For area based MDT data collection with no IMSI/IMEI(SV) criteria, the UE selection can be done in the radio network at eNB based on the input information received from EM and the user consent information stored in the eNB. This mechanism works for the following OAM input parameters:

• Area information only

The following figure summarizes the flow how the MDT configuration is done utilising the cell traffic trace functionality for this scenario:

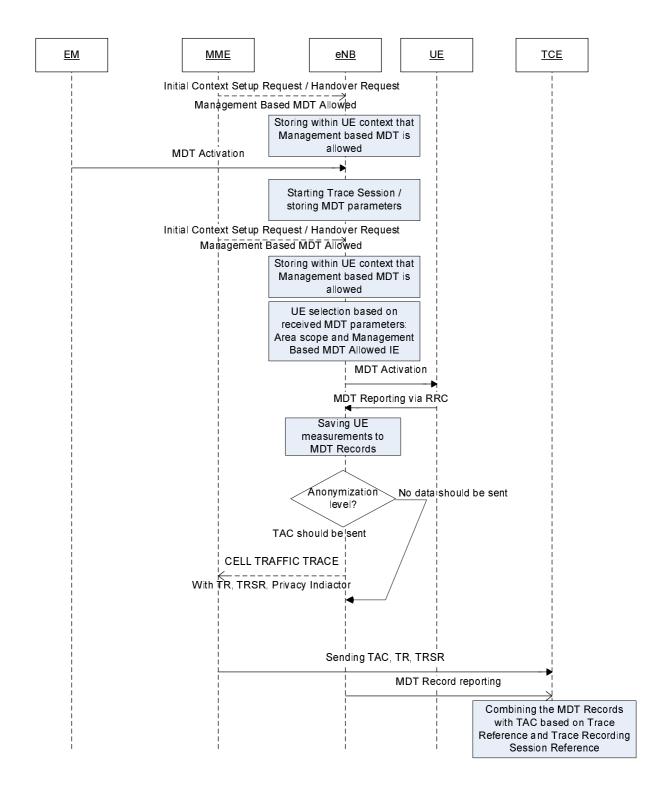


Figure 4.1.1.6a.1: Example for area based logged MDT activation in E-UTRAN

- 0. Whenever the eNB receives the Management based MDT allowed IE in Initial Context Setup Request or in Handover Request message, it shall save it for possible later usage.
- 1. The EM sends a Trace Session activation request to the eNB. This request includes the parameters for configuring UE measurements:
 - Job type

- Area scope where the UE measurements should be collected: list of E-UTRAN cells. Tracking Area should be converted to E-UTRAN cell.
- List of measurements
- Reporting Trigger
- Report Interval
- Report Amount
- Event Threshold
- Logging Interval
- Logging Duration
- Trace Reference
- IP address of TCE
- Anonymization of MDT data.
- Measurement period LTE (if either of the measurements M4, M5 is requested)
- Collection period for RRM measurements LTE (present only if any of M2 or M3 measurements are requested).
- Positioning method
- MDT PLMN List

Note that at the same time not all the parameters can be present. The criteria for which parameters are present are described in clause 5 of the present document.

- 2. When eNB receives the Trace Session activation request from its EM, it shall start a Trace Session and should save the parameters associated to the Trace Session.
- 3. eNB shall select the suitable UEs for MDT data collection. The selection is based on the area received from the EM and the area where UE islocated, user consent information received from the core network as part of the Management Based MDT Allowed IE (As described in section in 4.6. of this document). If the user is not in the specified area or if the Management Based MDT Allowed IE is not present in the UE context the UE shall not be selected by the eNB for MDT data collection. During UE selection, the eNB shall take into account also the UE capability (MDT capability) when it selects UE for logged MDT configuration. If the UE does not support logged MDT the UE shall not be selected.
 - If M4 or M5 measurements are requested in the MDT configuration, eNB should start the measurement according to the received configuration. Details of the measurements are defined in TS 36.314 [35].
- 4. eNB shall activate the MDT functionality to the selected UEs. When eNB selects a UE it shall take into account the availability of Management Based MDT Allowed IE in the user context and the area scope parameter received in MDT configuration (Trace Session activation). Detailed description about user consent handling and how it is provided to the eNB is described in section 4.6.2. If there is no Management Based MDT Allowed IE in the user context or the user is outside the area scope defined in the MDT configuration, the UE shall not be selected for MDT data collection. The eNB shall assign Trace Recording Session Reference corresponding to the selected UE. The eNB shall send at least the following configuration information to the UE in case of Logged MDT:
 - Trace Reference
 - Trace Recording Session Reference
 - TCE Id (The value signalled as IP address of TCE from the EM is mapped to a TCE Id, using a configured mapping in the eNB)
 - Logging Interval
 - Logging Duration

- Absolute time reference
- Area scope where the UE measurements should be collected: list of E-UTRAN cells/TA.
- MDT PLMN List

NOTE: For UEs currently being in idle mode and camping in the cell the logged MDT configuration cannot be sent. These UEs may be configured when they initiate some activity (e.g., Service Request or Tracking Area Update) at next time.

In case of Immediate MDT the following parameters shall be sent to the UE:

- List of measurements
- Reporting trigger
- Report Interval
- Report Amount
- Event Threshold

Note that at the same time not all the parameters can be present. Conditions of the parameters are described in clause 5 of the present document.

- If positioning method indicates GNSS positioning, eNB should activate the GNSS module of the UE via RRC as specified in TS 36.331 [32]. If positioning method indicates E-Cell ID positioning, the eNB should collect the UE reported UE Rx-Tx time difference measurements as specified in TS 36.331[32] measurement procedures, as well as, any available eNB measured eNB Rx-Tx time difference, Angle of Arrival measurements as specified in TS 36.214[38] and capture it in MDT trace record.
- If Reporting Trigger parameter indicates that all configured RRM measurement trigger should be reported in MDT, then eNB should ask the UE to provide the "best effort" location information together with the measurement reporting by setting the <code>includeLocationInfo</code> IE in all RRC measurement reporting configurations.
- 5. When UE receives the MDT activation it shall start the MDT functionality based on the received configuration parameters.
- 6. The eNodeB shall not retrieve MDT report from the UE if UE's rPLMN does not match the PLMN where TCE used to collect MDT data resides (e.g. eNodeB's primary PLMN). When the eNodeB receives the MDT report from UE, the eNodeB shall get the Trace Recording Session Reference, Trace Reference and TCE Id from the report, and compare the Trace PLMN (PLMN portion of Trace Reference) with the PLMN where TCE used to collect MDT data resides (e.g. its primary PLMN) and discard MDT report in case of a mismatch. Otherwise if the MDT anonymization requires the IMEI-TAC in the MDT record eNodeB shall send the Trace Recording Session Reference, Trace Reference, serving cell CGI, and TCE IP address in the CELL TRAFFIC TRACE message to the MME via the S1 connection. When MME receives this S1 signalling message containing the Trace Recording Session Reference, Trace Reference, serving cell CGI, and the Privacy Indicator (that shall be set to *Logged MDT* or *Immediate MDT* depending on the configured job type) if so indicated in the privacy indicator, the MME shall look up the subscriber identities (IMEI (SV)) of the given call from its database, and send the IMEI-TAC together with the Trace Recording Session Reference and Trace Reference and for immediate MDT also the serving cell CGI to the TCE, as described in section 4.7 of the present document. For logged MDT, MME will send the IMEI-TAC together with the Trace Recording Session Reference, Trace Reference to the TCE.

NOTE: For area based Immediate MDT, TRSR may be duplicated among different eNodeBs when multiple cells are selected as the area scope for the same MDT job. In this case, the combination of TRSR and the UE's serving cell CGI in the MDT report can uniquely identify one trace recording session.

7. For Immediate MDT when the eNB receives the MDT report from the UE in the RRC message the eNB shall capture it and put the UE's serving cell CGI together with the MDT report from the UE to the trace record. A UE configured to perform Logged MDT measurements in IDLE indicates the availability of MDT measurements, by means of a one bit indicator, in *RRCConnectionSetupComplete* message during connection establishment as specified in [2]. The eNB can decide to retrieve the logged measurements based on this

indication by sending the UEInformationRequest message to the UE. The UE can answer with the collected MDT logs in UEInformationResponse message.

8. The eNB shall forward the Trace Records to the Trace Collection Entity (TCE). In case of logged MDT, the TCE Id is indicated in the MDT report is translated to the actual IP address of the TCE by the eNB before it forwards the measurement records. (The address translation is using configured mapping in the eNB.) In case of immediate MDT, the IP address of the TCE is indicated for the eNB in the trace configuration.

The Immediate MDT measurement configuration is deleted in the UE together with the RRC context when entering idle mode.

The Logged MDT trace session is preserved in the UE until the duration time of the trace session expires, including also multiple idle periods interrupted by idle-connected-idle state transitions.

The Logged MDT trace session context of the UE is stored in the network as long as the trace session is active, including also the periods when the UE is in connected state.

EM shall validate that the MCC and MNC specified in the Trace reference is the same as the PLMN supported by all the cells specified in the area scope. If the eNodeB receives a request with a PLMN in the TraceReference that does not match any PLMN in its list, it shall ignore the request.

4.1.1.7 EPC Domain activation mechanisms

When a MME, SGW or PGW receives Trace Session activation from the EM, it shall start a Trace Session. The following trace control and configuration parameters of the Trace Session are received in the Trace Session activation from the EM:

- IMSI or IMEISV
- Trace Reference
- Triggering events for this network element
- Trace Depth
- List of Interfaces for this network element
- IP address of Trace Collection Entity

The MME, SGW or PGW shall not forward these trace control and configuration parameters to other nodes. The received trace control and configuration parameters shall be saved and used to determine when and how to start a Trace Recording Session. (Starting a Trace Recording Session is described in subclause 4.2.2.6).

4.1.2 Signalling activation

4.1.2.1 General

In Signalling activation, the Trace Activation shall be carried out from the Core Network EM only [EM (PS), EM (CS), EM (HSS) and EM(EPC) are generally considered to be in the Core Network. A Core Network EM can be any of these or their combinations].

In case of home subscriber trace (i.e. in the HPLMN) the Trace Session activation shall go to the HSS / MSC Server / SGSN / MME. Instances where the home subscriber is roaming in a VPLMN, the HSS may initiate a trace in that VPLMN. The VPLMN may reject such requests.

In case of foreign subscriber trace (i.e. the HPLMN operator wishes to trace foreign subscribers roaming in his PLMN) the Trace Session activation shall go the MSC Server/VLR, SGSN / MME. Depending on the Trace Control and Configuration parameters received, the Core Network shall propagate the activation to selected NE's in the entire network – RAN and Core Network.

If the NE failed to activate the Trace Session, a Trace failure notification shall be sent to the TCE, and the Trace failure notification has the the same parameters as the notification notifyTraceRecordingSessionFailure defined in 3GPP TS 32.442 [24], the Trace failure notification file XML schema is defined in Annex A.

4.1.2.2 Intra PLMN signalling activation

The following figure represents the signalling based trace functionality within a PLMN. The figure represents a typical PLMN network. A dotted arrow with "Trace Parameter Configuration" represents the availability of the trace functionality at the EM for that domain. You can however do it from the EM (CS Domain). Similarly "Trace Parameter Propagation" is allowed only for the interfaces indicated in the figure. E.g. there is no parameter propagation over Iu-B.

The trace propagation across multiple PLMNs of the same operator (e.g. deployment scenario where UMTS part of the network has one PLMN and LTE part of the network as another PLMN) follows the rules of the Intra-PLMN signalling activation.

NOTE: For tracing on the basis of IMEI(SV), the signalling based activation can be only initiated from the MSC/VLR or SGSN.

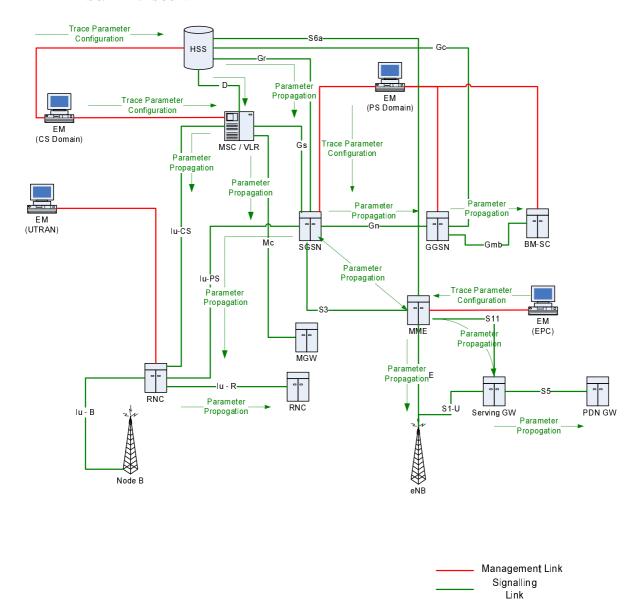
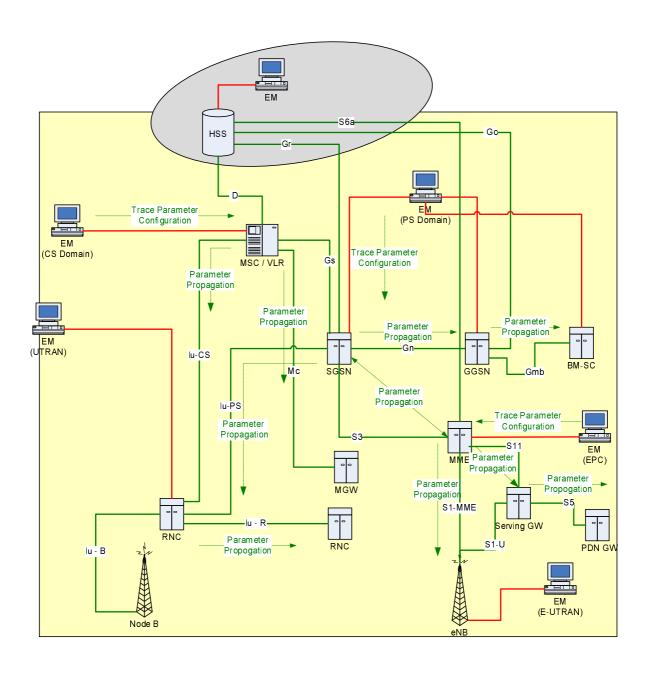


Figure 4.1.2.2.1: Overview of Intra-PLMN Signalling Activation

4.1.2.3 Inter PLMN Signalling Activation

The following figure represents the signalling based trace functionality between PLMNs. This is particularly useful when a roaming subscriber needs to be traced in a network. The figure represents a typical PLMN network and its connections with another PLMN's HSS. A dotted arrow with "Trace Parameter Configuration" represents the availability of the trace functionality at the EM for that domain. E.g. you cannot invoke a Signalling Trace at the EM (UTRAN) because there is no such arrow shown in the figure. You can however do it from the EM (CS Domain). Similarly "Trace Parameter Propagation" is allowed only for the interfaces indicated in the figure. E.g. there is no parameter propagation over Iu-B.

NOTE: There is no intention to allow tracing of a home subscriber roaming in a foreign network i.e. the trace function is limited to PLMNs of a single operator.



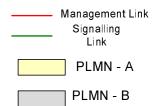


Figure 4.1.2.3.1: Overview of Inter-PLMN Signalling Activation

4.1.2.4 UTRAN activation mechanisms

See subclause 4.2.3.1.

4.1.2.5 PS Domain activation mechanisms

The following figure shows the Trace Session activation in the PS domain. The figure is an example of tracing PDP context.

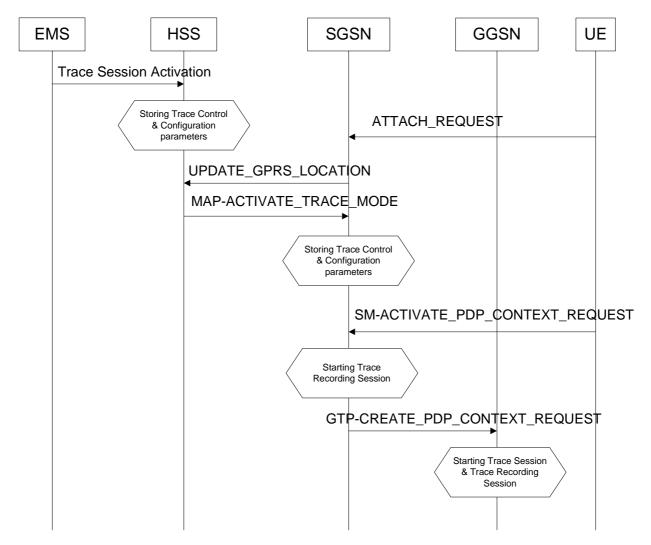


Figure 4.1.2.5.1: Trace session activation in PS domain for PDP Context

When a UE registers with the network by sending an ATTACH_REQUEST message to the SGSN, it updates the location information in the HSS by sending the UPDATE_GPRS_LOCATION message to the HSS. The HSS checks if the UE is being traced. If it is being traced, the HSS shall propagate the trace control and configuration parameters to the SGSN by sending a MAP-ACTIVATE_TRACE_MODE - see 3GPP TS 29.002 [11] message to the SGSN. When an inter-SGSN routing area update occurs, HSS shall send the MAP-ACTIVATE_TRACE_MODE message to the new SGSN.

When SGSN receives the MAP-ACTIVATE_TRACE_MODE message it shall store the trace control and configuration parameters and shall start a Trace Session.

When any of the triggering events defined in the trace control and configuration parameters occur, (e.g. PS session is started (i.e. a ACTIVATE PDP CONTEXT REQUEST message is received from the UE)) the SGSN shall propagate the trace control and configuration parameters to the GGSN (by sending a GTP-

CREATE_PDP_CONTEXT_REQUEST message) and to the radio network (by sending a RANAP-CN_INVOKE_TRACE message), if it is defined in the trace control and configuration parameters (NE types to trace). The Trace Session activation to UTRAN is described in clauses 4.1.2.4.

When HSS sends the MAP-ACTIVATE_TRACE_MODE message to SGSN it shall include the following parameters to the message (The values related to the EPS domain shall be used for the Trace Session activation through the S3 interface in case of an Inter-RAT handover event.):

- IMSI (M).
- Trace reference (M).
- Triggering events for SGSN (M), GGSN (M), MME (M), Serving GW(M) and PDN GW(M).
- Trace Depth (M).
- List of NE types to trace (M).
- List of interfaces for SGSN (O), GGSN (O) and/or RNC (O), MME (O), Serving GW (O), PDN GW(O), eNB(O).
- IP address of Trace Collection Entity (O).

When the SGSN sends the GTP-CREATE_PDP_CONTEXT_REQUEST message to GGSN it shall include the following parameters to the message:

- IMSI or IMEI (SV) (M).
- Trace reference (M).
- Trace Recording Session Reference (M).
- Triggering events for GGSN (M).
- Trace Depth (M).
- List of interfaces for GGSN (O).
- IP address of Trace Collection Entity (O).

Figure 4.1.2.5.2 is an example of tracing for MBMS Context.

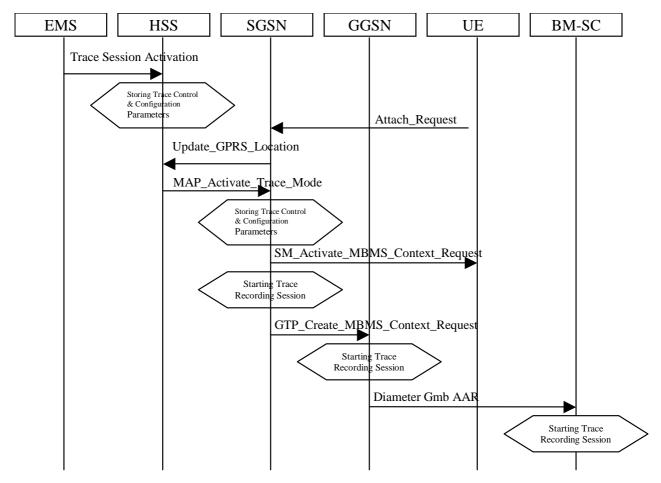


Figure 4.1.2.5.2: Trace session activation in PS domain for MBMSContext

When HSS receives a Trace Session activation from its EMS, it shall store the received trace control and configuration parameters. At this point a Trace Session shall be started in the HSS.

When a UE registers with the network by sending an ATTACH_REQUEST message to the SGSN, it updates the location information in the HSS by sending the UPDATE_GPRS_LOCATION message to the HSS. The HSS checks if the UE is being traced. If it is being traced, the HSS shall propagate the trace control and configuration parameters to the SGSN by sending a MAP-ACTIVATE_TRACE_MODE message to the SGSN. When an inter-SGSN routing area update occurs, HSS shall send the MAP-ACTIVATE TRACE MODE message to the new SGSN.

When SGSN receives the MAP-ACTIVATE_TRACE_MODE message it shall store the trace control and configuration parameters and shall start a Trace Session.

In case of an inter-SGSN handover the trace control and configuration parameters (both PS domain specific and EPS domain specific parameters) shall be propagated to the target SGSN.

In case of an inter-RAT handover the SGSN shall send the PS and EPS specific Trace control and configuration parameters to the target MME via the S3 interface.

When any of the triggering events defined in the trace control and configuration parameters occur, (i.e. an ACTIVATE MBMS CONTEXT REQUEST message is sent to the UE)) the SGSN shall propagate the trace control and configuration parameters to the GGSN (by sending a GTP-CREATE_MBMS_CONTEXT_REQUEST message) and to the radio network (by sending a RANAP-CN_INVOKE_TRACE message), if it is defined in the trace control and configuration parameters (NE types to trace). The Trace Session activation to UTRAN is described in clauses 4.1.2.4.

The GGSN shall propagate the trace control and configuration parameters to the BM-SC (by sending a Diameter Gmb AAR message) if the BM-SC is defined in the trace control and configuration parameters (NE types to trace).

When HSS sends the MAP-ACTIVATE_TRACE_MODE message to SGSN it shall include the following parameters in the message:

• IMSI (M).

- Trace reference (M).
- Triggering events for SGSN (M), GGSN (M) and BM-SC (M).
- Trace Depth (M).
- List of NE types to trace (M).
- List of interfaces for SGSN (O), GGSN (O), BM-SC (O) and/or RNC (O).
- IP address of Trace Collection Entity (O).

When the SGSN sends the GTP-CREATE_MBMS_CONTEXT_REQUEST message to GGSN it shall include the following parameters in the message:

- IMSI or IMEI (SV) (M).
- Trace reference (M).
- Trace Recording Session Reference (M).
- Triggering events for GGSN (M) and BM-SC (M).
- Trace Depth (M).
- List of interfaces for GGSN (O) and BM-SC (O).
- IP address of Trace Collection Entity (O).

When the GGSN sends the Diameter Gmb AAR message to the BM-SC it shall include the following parameters in the message:

- IMSI or IMEI (SV) (M).
- Trace reference (M).
- Trace Recording Session Reference (M).
- Triggering events for BM-SC (M).
- Trace Depth (M).
- List of interfaces for BM-SC (O).
- IP address of Trace Collection Entity (O).

4.1.2.6 CS Domain activation mechanisms

Figure 4.1.2.6.1 shows the Trace Session activation in the CS domain. The figure is an example of tracing Mobile Originating Call.

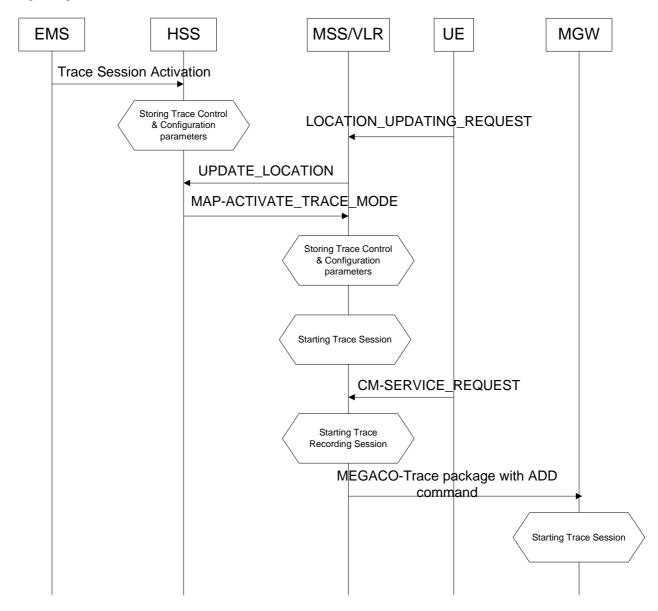


Figure 4.1.2.6.1: Trace Session Activation in CS domain

When HSS receives Trace Session activation from the EMS it should store the trace control and configuration parameters associated to the Trace Session.

If the UE registers to the network, by sending a LOCATION UPDATING REQUEST message to the MSC/VLR, the MSC Server/VLR updates the location information in the HSS by sending the MAP-UPDATE_LOCATION message to the HSS. After receiving the UPDATE_LOCATION message HSS shall propagate the trace control and configuration parameters by sending a MAP-ACTIVATE_TRACE_MODE message to the MSC Server/VLR.

When the MSC Server/VLR receives the MAP-ACTIVATE_TRACE_MODE message from the HSS, it shall store the trace control and configuration parameters.

When any of the triggering event, defined in the trace control and configuration parameters, occurs (e.g. in case of Mobile Originating Call is started (i.e. the MSC Server receives the CM_SERVICE_REQUEST message with service type set to originating call establishment)) the MSC Server should propagate the trace control and configuration parameters to the MGW (by sending an ADD command with a trace package - see 3GPP TS 29.232 [10]) and to the radio network if it is defined in the trace control and configuration parameters (NE types to trace). Trace Session activation for UTRAN is described in clauses 4.1.2.4. In case of inter-MSC Server handover the MSC Server-A should propagate the trace control and configuration parameters to the MSC Server-B.

When HSS sends the MAP-ACTIVATE_TRACE_MODE message to MSC Server it shall include the following parameters to the message:

- IMSI (M).
- Trace reference (M).
- Triggering events for MSC Server (M) and MGW (M).
- Trace Depth (M).
- List of NE types to trace (M).
- List of interfaces for MSC Server (O), MGW (O) and/or RNC (O).
- IP address of Trace Collection Entity (O).

When the MSC Server sends the ADD command with trace package to MGW it shall include the following parameters to the message:

- IMSI or IMEI (SV) (M).
- Trace reference (M).
- Trace Recording Session Reference (M).
- Triggering events for MGW (M).
- Trace Depth (M).
- List of interfaces for MGW (O).
- IP address of Trace Collection Entity (O).

4.1.2.7 Void

4.1.2.8 Tracing roaming subscribers

If a HPLMN operator activates a Trace Session for a home subscriber, while it (MS) is roaming in a VPLMN, it (HSS) may restrict the propagation of the Trace Session activation message to a MSC Server/VLR or to a SGSN located in the VPLMN.

Also, a MSC Server/VLR or a SGSN located in a VPLMN may accept any Trace Session activation message(s) coming from an HSS located in another PLMN. However, there shall be a capability to reject activations from another PLMN.

4.1.2.9	void
4.1.2.9.1	void
4.1.2.9.2	Void

4.1.2.9.3 Void

4.1.2.9.4 Void

4.1.2.10 EPC activation mechanism

4.1.2.10.1 UE attached to EPC via E-UTRAN

Figure 4.1.2.10.1 summarizes the Trace Session activation procedure in EPC:

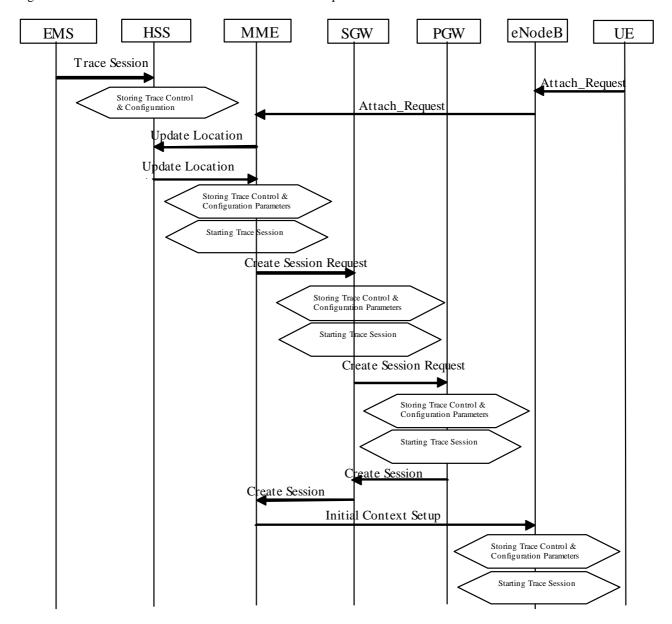


Figure 4.1.2.10.1: Trace Session activation procedure in EPC with GTP based S5 interface:

The Trace Session activation in MME can come for a home subscriber trace from HSS via the S6a interface or for a foreign subscriber from the EM of MME.

When the UE makes an attach request to the MME, it updates the location information in the HSS. The HSS checks if the UE is being traced. If it is being traced, the HSS shall propagate the trace control and configuration data to the MME by including the trace control and configuration parameters into the S6a-Insert subscriber data message or the S6a-Update Location Answer message. If the traced UE has already attached before receiving the Trace Session Activation from the EM/NM, the HSS shall also propagate the trace control and configuration data to the MME by either S6a-Insert subscriber data message or the S6a-Update Location Answer message. When MME receives the trace control and configuration data from the HSS it shall store the information and shall start a Trace Session.

During inter-MME TAU, the MME shall propagate the trace control and configuration parameters to the target MME within an S10- Context Response as part of inter-MME TAU procedures. During attach procedures where the context information is requested from the target MME, the MME shall propagate the trace control and configuration parameters within an S10-Identification Response message. During inter-MME handover, the MME shall propagate the trace control and configuration parameters to the target MME within an S10- Forward Relocation Request message as part of inter-MME handover procedures. During inter-RAT handover procedure, the MME shall propagate the trace control and configuration parameters to the target SGSN via the S3 interface as part of the inter-RAT handover procedure.

If the List of NE Types parameter specifies tracing in the SGW and/or Tracing in the PGW, MME shall propagate the trace control and configuration parameters via the S11 interface to the SGW per one of the following messages:

- 1) if a default bearer connection has not been established, via the S11: Create Session Request message;
- 2) otherwise via the S11-Trace Session Activation message.

The SGW upon receiving the trace control and configuration parameters shall start a trace session.

If the List of NE Types parameter specifies Tracing in the PGW, SGW shall propagate the trace control and configuration parameters via the S5 interface to the PGW per one of the following messages:

- 1) if a default bearer connection has not been established, via the S5: Create Session Request message;
- 2) otherwise via the S5-Trace Session Activation message.

The PGW upon receiving the trace control and configuration parameters shall start a trace session.

When a triggering events, defined in the trace control and configuration data occur (i.e. a session is started) a Trace Recording Session should be started and the trace control and configuration data should be propagated to the radio network to the eNB if the List of NE Types parameter specifies eNB tracing. However if the triggering events parameter at MME indicates that all events should be traced, Trace Recording Session shall be started only when the user specific S1 association is setup to the eNB and the Trace Recording Session is kept as long as the user specific S1 association is released or the Trace Session is deactivated. See section 4.2.3.6.

When HSS activates the trace to the MME the following trace control and configuration parameters shall be included in the message (the values related to the PS domain shall be used for Trace Session Activation during inter-RAT handover procedure):

- IMSI or IMEISV
- Trace Reference
- Triggering events for MME, Serving GW, PDN GW, SGSN, GGSN
- Trace Depth
- List of NE types to trace
- List of Interfaces for MME, Serving GW, PDN GW, eNB, SGSN, GGSN, RNC
- IP address of Trace Collection Entity

When MME activates the trace to the SGW the following trace control and configuration parameters shall be included in the message:

- IMSI or IMEISV
- Trace Reference
- Triggering events for Serving GW, PDN GW
- Trace Depth
- List of NE types to trace
- List of Interfaces for Serving GW, PDN GW

• IP address of Trace Collection Entity

When SGW activates the trace to the PGW the following trace control and configuration parameters shall be included in the message:

- IMSI or IMEISV
- Trace Reference
- Triggering events for PDN GW
- Trace Depth
- List of Interfaces for PDN GW
- IP address of Trace Collection Entity

When MME sends the trace control and configuration parameters to the eNB the following information shall be included in the message:

- Trace Reference
- Trace Recording Session Reference
- Trace Depth
- IP Address of Trace Collection Entity

and the following information may be included in the message:

• List of Interfaces for eNB

Figure 4.1.2.10.1.A illustrates the Trace Session activation in case of PMIP based S5 interface. The figure contains only the difference compare to the GTP based S5 interface.

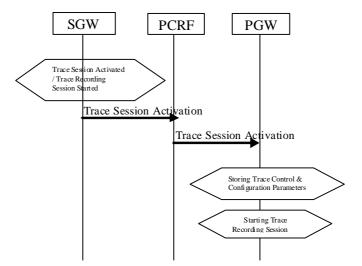


Figure 4.1.2.10.1.A: Trace Session Activation from SWG to PGW in case of PMIP based S5 interface

When the SGW receives the Trace Session activation message and the List of NE Type to trace parameter specifies Tracing in the PDN GW, SGW shall send Trace Session Activation to PDN GW via the PCRF. The Trace Session activation can be done as part of the IP CAN session establishment or as a standalone procedure [29].

The Trace Session Activation shall include the following information:

• IMSI or IMEISV

- Trace reference
- Trace Recording Session Reference
- Trace Depth
- Triggering events for PDN GW
- List of Interfaces for PDN GW
- IP address of Trace Collection Entity

When the PCRF receives the Trace Session Activation it shall forward the same trace control and configuration parameters to the PDN GW [29].

4.1.2.10.2 UE attached to EPC via *non-3GPP* accesses with DSMIPv6 on S2c or PMIP on S2a/S2b

Figure 4.1.2.10.2 illustrates the Trace Session activation when the UE is attached from a non-3GPP access network with DSMIPv6 on S2c or PMIP on S2a or S2b interface.

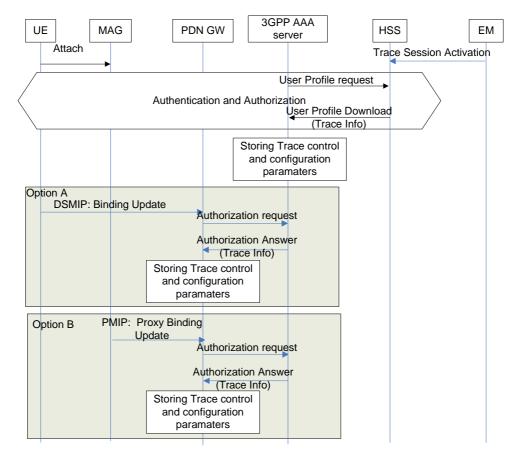


Figure 4.1.2.10.2: Trace Session activation procedure to PGW in case of UE attaches from non-3GPP access network via DSMIPv6 on S2c or PMIP on S2a/S2b

When the UE attaches to the EPC network via a non-3GPP access network the Trace Session activation to the PGW can be done via HSS and AAA server. Therefore when the UE attach is signalled to the HSS via non-3GPP access network, the HSS shall send the Trace control and configuration parameters to the AAA server as part of the user profile download [25]. The following information shall be included in the downloaded user data:

- IMSI, or IMEI(SV)
- Trace Reference
- Triggering event for PGW

- Trace Depth
- List of interface for PGW
- IP address of Trace Collection Entity

When the AAA server receives the user profile, which contains also the trace control and configuration parameters, it shall store the received trace control and configuration parameters. The AAA server shall forward the received trace control and configuration parameters in the authorization when it receives the authorization request from the PGW during the PDN connectivity.

The event, which triggers the authorization in the PDN GW depend on the used IP mobility protocol:

In case of DSMIP (option A), it is a binding update received from the UE,

In case of PMIP (Option B), it is a proxy binding update request received from the Trusted Non-3GPP GW or ePDG playing the role of the Mobile Access Gateway (MAG)

If the UE is already registered to the HSS by a AAA server via the SWx interface, Trace Session activation shall also be possible from the HSS to the PDN GW via the AAA server. In that case the HSS sends the Trace Session activation message with a push profile request.

The AAA server shall examine the received user profile and if Trace Session activation is needed in the PDN GW, it shall initiate a re-authorization procedure towards the PDN GW. The Trace Session is activated to te PDN GW using this re-authorization procedure. When PDN GW receives the Trace Session activation message, it shall save the received trace control and configuration parameters.

4.1.2.10.3 UE attached to EPC via non-3GPP accesses with GTP on S2b interface

Figure 4.1.2.10.3 illustrates the Trace Session activation when the UE is attached from a non-3GPP access with GTP on the S2b interface.

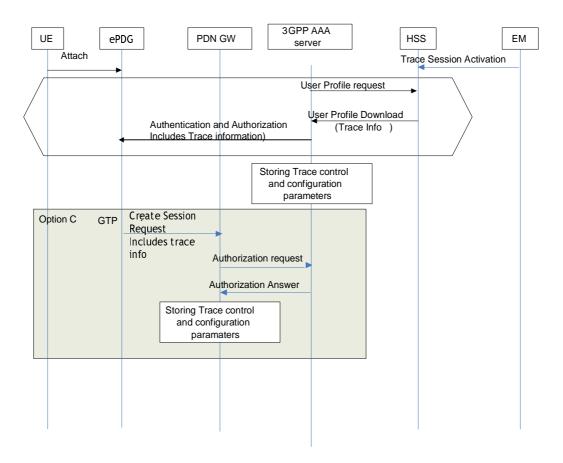


Figure 4.1.2.10.3: Trace Session activation procedure to PGW when the UE is attaches to EPC from a non-3GPP access with GTP based S2b

When the UE attaches to the EPC network via a non-3GPP access network the Trace Session activation to the PGW can be done via HSS, AAA server and ePDG. Therefore when the UE attach is signalled to the HSS via non-3GPP access network, the HSS shall send the Trace control and configuration parameters to the AAA server as part of the user profile download (see [22], [25] and [34]).

The following information shall be included in the downloaded user data:

- IMSI, or IMEI(SV)
- Trace Reference
- Triggering event for PGW
- Trace Depth
- List of interface for PGW
- IP address of Trace Collection Entity

The ePDG sends a GTPv2 Create Session Request which contains trace information message to the PGW. The RAT type indicates the non-3GPP IP access technology type.

Figure 4.1.2.10.4 illustrates the Trace Session activation when the UE is already attached from a non-3GPP access with GTP based S2b, i.e. trace session activation after a session has been created.

If the UE is already registered to the HSS by a AAA server via the SWx interface, Trace Session activation shall also be possible from the ePDG to the PDN GW. In that case the HSS sends the Trace activation message with a push profile request.

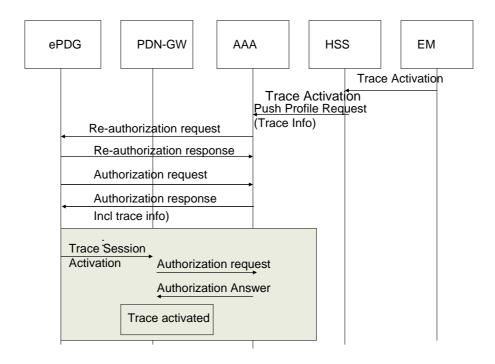


Figure 4.1.2.10.4: Trace Session activation procedure to PGW when the UE is already attached to EPC from a non-3GPP access with GTP based S2b

The AAA shall examine the received information and if Trace Session activation is needed in the PDN GW, it shall initiate a reauthorization request towards the ePDG sends a GTPv2 Trace Session Activation message to the PGW when determining from the updated profile that a trace activation is needed. When PDN GW receives the Trace Session activation message, it shall save the received trace control and configuration parameters.

4.1.2.10.4 Inter-RAT handover from E-UTRAN to UTRAN

The following figure illustrates an example scenario when the UE attaches to the EPC domain, then makes an inter-RAT handover to the UMTS and makes another handover back from UMTS to E-UTRAN.

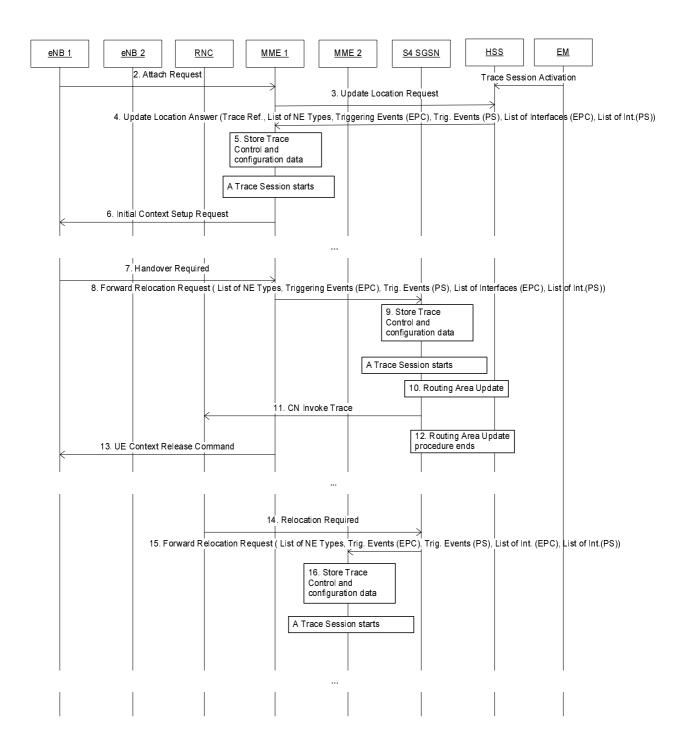


Figure 4.1.2.10.4.1 Example scenario for Trace Session activation in case of inter-RAT handover

In order to support the inter-RAT trace between EPS and PS domain when the HSS sends the Trace Session Activation message to the SGSN/MME respectively it shall send the trace control and configuration parameters that are applicable

for both PS and EPC domains. These parameters shall be transferred in the Trace Session Activation message in the S6a/S6d interface respectively. When MME/SGSN receives the Trace Session Activation message from the HSS or from MME/SGSN the trace control and configuration parameters shall be stored and a Trace Session shall be started.

When the MME sends the Forward Relocation Request messager to the S4-SGSN the MME shall sends the following trace control and configuration parameters for Trace Session activation to the SGSN:

- IMSI or IMEI(SV)
- Trace Reference
- Trace Recording Session Reference
- Trace Depth
- Triggering events for SGSN, GGSN, RNC, MME, Serving GW, PDN GW and eNB
- List of Interfaces for SGSN, GGSN, RNC, MME, Serving GW, PDN GW and eNB
- IP address of Trace Collection Entity

The Trace Control and Configuration parameters shall be propagated during an inter-RAT handover procedure from the source node to the target node. The propagated Trace Control and Configuration parameters shall include values that are applicable for both EPS and PS domain during the inter-RAT handover procedure.

Similarly, in case of Gn SGSN those parameters shall be transferred through S6a/Gn interface from the HSS to the MME/Gn SGSN. The Trace Control and Configuration parameter of both domain shall be stored in the Trace Session in MME/Gn SGSN respectively.

4.1.2.11 E-UTRAN activation mechanisms

The Trace Session should be activated in in an eNB when the eNB receives the TRACE START, INITIAL CONTEXT SETUP REQUEST or HANDOVER REQUEST message with the IE *Trace Activation* from the MME and if some activities have been started on the interfaces that have been requested to be traced.

If the subscriber or equipment which is traced makes a handover to a target eNB using the X2 interface, the source eNB should propagate the trace control and configuration parameters further to the target eNB by using the HANDOVER REQUEST message. When the target eNB receives the HANDOVER REQUEST message it should immediately start a Trace Session according to the trace control and configuration parameters received in the HANDOVER REQUEST message.

If the subscriber or equipment which is traced makes a handover to a target eNB using the S1 interface, it is the MME's responsibility to propagate the trace control and configuration parameters to the target eNB.

Interaction with Relocation

If the tracing shall continue also after the relocation has been performed, the CN Invoke Trace procedure shall be reinitiated from the CN towards the future eNB after the Relocation Resource Allocation procedure has been executed successfully.

The TRACE START, INITIAL CONTEXT SETUP REQUEST or HANDOVER REQUEST message that is received from the MME contains the following information:

- Trace Reference
- including Trace Recording Session Reference
- Trace Depth
- List of interfaces for eNB
- IP address of Trace Collection Entity

If the Trace Reference is the same as an existing Trace Session for the same subscriber or equipment, the eNB shall not activate a new Trace Session and the existing Trace Session will not be impacted. See clause 4.2.3.6 for the conditions on whether or not the Trace Recording Session should be started.

If the Trace Reference is the same as an existing Trace Session for different subscriber(s) or equipment(s), the eNB shall not activate a new Trace Session, and the eNB shall not start a new Trace Recording Session.

4.1.2.12 EPC and E-UTRAN Activation mechanism for MDT

4.1.2.12.1 General

UE measurements activation extends the EPC trace activation procedure, as described in 4.1.2.10. When a Trace Session is activated, configuration parameters of MDT are added into the message.

For IMSI/IMEI(SV)/IMEI-TAC based UE selection, or IMSI/IMEI(SV)/IMEI-TAC combined with geographical area based UE selection, UE performance measurements activation request is propagated to UE finally.

This mechanism works for the following input parameters:

- IMSI only or
- IMSI and area information or
- IMEI(SV) only or
- IMEI(SV) and area information or
- IMEI-TAC only or
- IMEI-TAC and area information

After the IMSI, IMEISV or IMEI-TAC type user attached to the network, the MME shall forward the MDT configurations to the corresponding eNB which serves the IMSI, IMEISV or IMEI-TAC type user. If the area criterion is specified and is not satisfied, the MME shall keep the MDT configuration first and then forward it to the serving eNB only when the area criterion is satisfied.

MDT criteria checking on eNB:

- For immediate MDT, after eNB got the MDT configuration, the eNB can detect the area information and decide whether the selected IMSI/IMEISV can fit into the criteria for initiating MDT data collection. If the area information criterion is not met, the eNB keeps the MDT configuration and propagates it during handover as specified in section 4. 4.
- For logged MDT, the eNB will forward the MDT configuration criteria to the selected IMSI/IMEISV. The area criteria checking will be done at UE side after UE received the MDT configuration criteria.

MDT criteria checking on UE:

- For immediate MDT, there is no need to do MDT criteria checking on UE.
- For logged MDT, The area criteria checking will be done at UE side after UE received the MDT configuration criteria.

In case of logged MDT, after UE receives from eNodeB the configuration parameters via the message RRC Connection Reconfiguration, it detects whether it stays within the specified area. If yes the UE will execute measurement job. Otherwise UE will do nothing but waiting.

In case of Immediate MDT trace (e.g., IMSI/IMEI based selection), the Immediate MDT trace session context of the UE shall be preserved in the network when the UE enters idle mode.

The Logged MDT trace session is preserved in the UE until the duration time of the trace session expires, including also multiple idle periods interrupted by idle-connected-idle state transitions.

The Logged MDT trace session context of the UE is stored in the network as long as the trace session is active, including also the periods when the UE is in connected state.

Two scenarios shall be considered according to UE status when EMS activates MDT job: before UE attachment, after UE attachment, different procedures are described in 4.1.2.12.2, 4.1.2.12.3.

4.1.2.12.2 Activation of MDT task before UE attaches to the network

As shown in figure 4.1.2.12.1, by adding configurations of MDT EMS activate the Trace Session for MDT job.

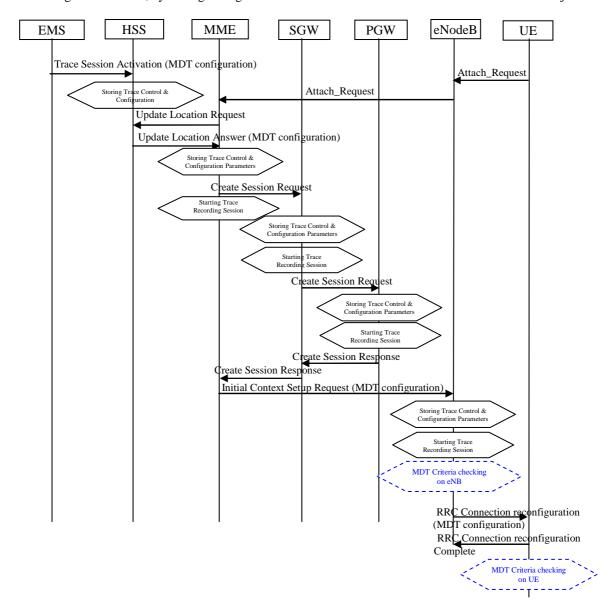


Figure 4.1.2.12.1: MDT activation procedure in EPC

When HSS activates the trace, for MDT job, to the MME the following configuration parameters shall be included in the message:

- jobType
- IMSI or IMEISV or IMEI-TAC
- Area scope (e.g. TA, Cell)
- Trace Reference
- List of measurements
- Reporting Trigger

- Report Interval
- Report Amount
- Event Threshold
- Logging Interval
- Logging duration
- Measurement period LTE (if either of the measurements M4, M5 is requested)
- Collection period for RRM measurements LTE (present only if any of M2 or M3 measurements are requested).
- Positioning method
- MDT PLMN List

Note that at the same time not all the parameters can be present. The conditions are described in clause 5.10 of the present document.

- IP address of Trace Collection Entity

The Specified geographical area field is available when IMSI/IMEI(SV)/IMEI-TAC combined with geographical area are needed for UE selection.

When MME activate MDT activation to eNodeB, the MDT configuration parameters can be included in the message in the Initial Context Setup:

- Area scope (TA, Cell)
- Trace Reference
- Trace Recording Session Reference
- List of measurements
- Reporting Trigger
- Report Amount
- Report Interval
- Event Threshold
- Logging Interval
- Logging Duration
- IP address of Trace Collection Entity
- Collection period for RRM measurements LTE (present only if any of M2 or M3 measurements are requested).
- Measurement period LTE (if either of the measurements M4, M5 is requested)
- Positioning method
- MDT PLMN List

Note that at the same time not all the parameters can be present. The conditions are described in clause 5.10 of the present document.

The MME receives and stores MDT user consent indication from HSS as part of subscriber information when user context is established in MME at UE attachment. The MME shall consider the MDT user consent information when activating an MDT trace session for the UE. Details on the user consent handling are described in section 4.6.

If positioning method indicates GNSS positioning, eNB should activate the GNSS module of the UE via RRC as specified in TS 36.331 [32]. If positioning method indicates E-Cell ID positioning, the eNB should collect the UE

reported UE Rx-Tx time difference measurements as specified in TS 36.331[32] measurement procedures, as well as, any available eNB measured eNB Rx-Tx time difference, Angle of Arrival measurements as specified in TS 36.214 [38] and capture it in MDT trace record.

If Reporting Trigger parameter indicates that all configured RRM measurement trigger should be reported in MDT, then eNodeB should ask the UE to provide the "best effort" location information together with the measurement reporting by setting the <code>includeLocationInfo</code> IE in all RRC measurement reporting configurations.

4.1.2.12.3 Activation of MDT task after UE attachment

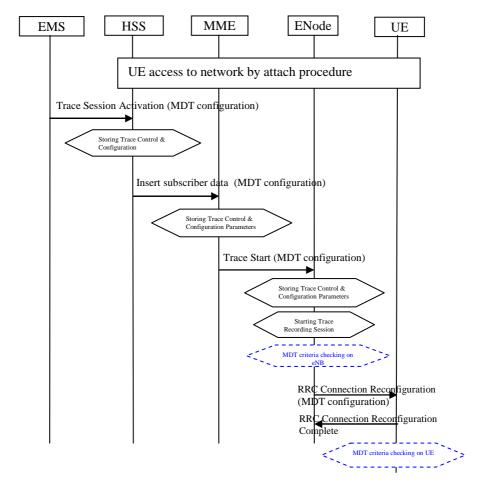


Figure 4.1.2.12.2: MDT activation in EPC after UE attachment

The messages propagated to HSS, MME and eNodeB are the same as described in clause 4.1.2.12.2.

When MME can send Trace Start to eNodeB, the following configuration parameters shall be included in the message:

- Area scope (TA, Cell)
- Trace Reference
- Trace Recording Session Reference
- List of measurements
- Reporting Trigger
- Report Amount
- Report Interval

- Event Threshold
- Logging Interval
- Logging Duration
- IP address of Trace Collection Entity
- Measurement period LTE (if either of the measurements M4, M5 is requested)
- Positioning method
- Collection period for RRM measurements LTE (present only if any of M2 or M3 measurements are requested).
- MDT PLMN List

Note that at the same time not all the parameters can be present. The conditions are described in clause 5.10 of the present document.

The MME shall consider the MDT user consent information when activating an MDT trace session for the UE. Detailed procedures about user consent is described in Section 4. 6.1.

In case of logged MDT and the UE is currently being in idle mode, the MME is not required to initiate paging of the UE in order to send the configuration.

Then eNodeB initiates RRC Connection Reconfiguration Request in case of immediate MDT or the IdleMDTConfiguration RRC message in case of logged MDT toward the UE and sends the MDT measurement configuration parameters as received from the MME.

Immediate/Logged signalling based MDT criteria may consist of a cell list. MME shall validate whether the serving cell is controlled by the same eNodeB as any other cell in the cell list. If yes, the MDT activation shall be sent to the serving eNodeB.

If positioning method indicates GNSS positioning, eNB should activate the GNSS module of the UE via RRC as specified in TS 36.331 [32]. If positioning method indicates E-Cell ID positioning, the eNB should collect the UE reported UE Rx-Tx time difference measurements as specified in TS 36.331[32] measurement procedures, as well as, any available eNB measured eNB Rx-Tx time difference, Angle of Arrival measurements as specified in TS 36.214 [38] and capture it in MDT trace record.

4.1.2.12.4 Handling of various scenarios during MDT activation

Handling of various scenarios for Signalling based Logged/Immediate MDT are addressed below:

- 1) EM initiating MDT activation shall validate that PLMNs specified in the MDT PLMN List are supported by all the cells specified in the area scope. If the eNodeB receives a request where none of the PLMNs in the MDT PLMN List match any PLMN in its list, it shall ignore the request
- 2) Void.
- 3) MME shall be informed with a TRACE FAILURE INDICATION message if the eNodeB could not configure the UE because it was in the middle of a handover (refer to TS 36.413[36]). MME shall try to reactivate MDT in the target cell if the target cell scope meets the MDT criteria.
- 4) Void.
- 5) When the UE re-enters PLMN (specified in the MDT PLMN List) then the MME shall be responsible for restarting the Immediate MDT activation (if it is as a result of an X2 handover then one option is MME could use the path switch request as trigger). However this is best effort. There can be cases where MME may not be able to restart the MDT when the UE re-enters the PLMN (specified in the MDT PLMN List): for example: If the UE performs intra eNB handover where path switch is not necessarily sent, the MME may not be able to restart MDT

4.1.2.13 PS domain activation mechanism for MDT

4.1.2.13.1 General

MDT activation in PS domain extends the trace activation procedure, as described in 4.1.2.5. When a Trace Session is activated, configuration parameters of MDT are added into the Trace Session Activation message(s).

For IMSI/IMEI(SV) based UE selection, or IMSI/IMEI(SV) combined with geographical area based UE selection, UE performance measurements activation request is propagated to UE finally.

Detailed behaviour of the UE when it receives the configuration parameters is described in 3GPP TS 37.320 [30].

In case of Immediate MDT trace (e.g., IMSI/IMEI based selection), the Immediate MDT trace session context of the UE shall be preserved in the network when the UE enters idle mode.

The Logged MDT trace session is preserved in the UE until the duration time of the trace session expires, including also multiple idle periods interrupted by idle-connected-idle state transitions.

The Logged MDT trace session context of the UE is stored in the network as long as the trace session is active, including also the periods when the UE is in connected state.

Two scenarios shall be considered according to UE status when the network activates MDT job: before UE attachment, after UE attachment, different procedures are described in 4.1.2.13.2 and 4.1.2.13.2a.

4.1.2.13.2 Activation of MDT task before UE attaches to the network

The MDT activation procedure is shown in figure 4.1.2.13.2.1.

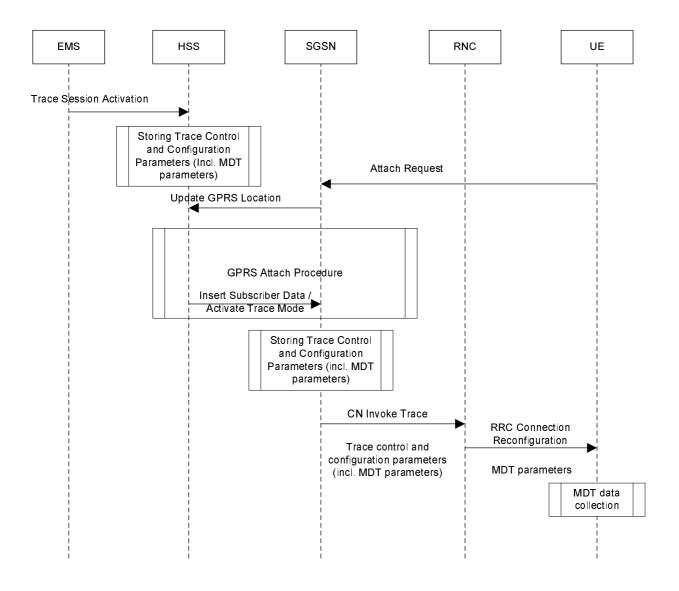


Figure 4.1.2.13.2.1: MDT activation procedure in PS domain during attach procedure

The Trace Session activation is started from the EMS, when it activates the Trace Session to the HSS. The HSS stores the trace control and configuration parameters in its database.

When a UE registers with the network by sending an ATTACH_REQUEST message to the SGSN, it updates the location information in the HSS by sending the UPDATE_GPRS_LOCATION message to the HSS. The HSS checks if the UE is being traced. If it is being traced, the HSS shall propagate the trace control and configuration parameters to the SGSN by sending a MAP-ACTIVATE_TRACE_MODE - see 3GPP TS 29.002 [11] message to the SGSN (This message can be embedded also in the MAP INSERT SUBSCRIBER DATA message). The SGSN receives and stores MDT user consent indication from HSS as part of subscriber information when user context is established in SGSN at UE attachment (details are available in clause 4. 6.1). When an inter-SGSN routing area update occurs, HSS shall send the MAP-ACTIVATE_TRACE_MODE message to the new SGSN. The Trace Session Activation from HSS to SGSN shall contain the following MDT specific parameters in addition to the existing trace parameters:

- Job type
- Area Scope
- List of measurements
- Reporting Trigger
- Report Interval

- Report Amount
- Event Threshold
- Logging Interval
- Logging Duration
- IP address of Trace Collection Entity
- Measurement quantity
- Measurement period UMTS (if either of the measurements M6, M7 is requested)
- Collection period for RRM measurements UMTS (present only if any of M3, M4 or M5 measurements are requested).
- Positioning Method
- MDT PLMN List

Note that at the same time not all of the parameters can be present. The condition which parameters shall be present is described in clause 5 of the present document.

When SGSN receives the MAP-ACTIVATE_TRACE_MODE message it shall store the trace control and configuration parameters and shall start a Trace Session and shall send the CN_INVOKE_TRACE message to the RNC. The SGSN shall consider the MDT user consent information when activating an MDT trace session for the UE. The SGSN shall send the following parameters to the RNC beside the existing trace parameters:

- Job type
- Area Scope
- List of measurements
- Reporting Trigger
- Report Interval
- Report Amount
- Event Threshold
- Logging Interval
- Logging Duration
- IP address of Trace Collection Entity
- Measurement quantity
- Measurement period UMTS (if either of the measurements M6, M7 is requested)
- Collection period for RRM measurements UMTS (present only if any of M3, M4 or M5 measurements are requested).
- Positioning method
- MDT PLMN List

Note that at the same time not all of the parameters can be present. The conditions which parameters shall be present is described in clause 5 of the present document.

4.1.2.13.2a Activation of MDT task after UE attaches to the network

The MDT activation procedure after UE attaches to the network is shown in figure 4.1.2.13.2a.1.

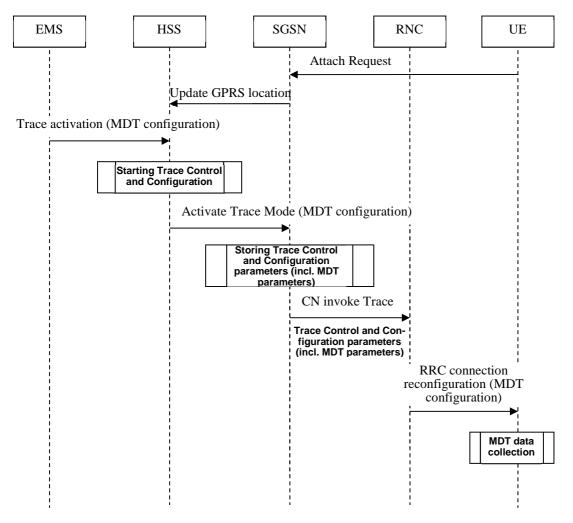


Figure 4.1.2.13.2a.1 MDT activation procedure in PS domain after UE attachs to the network

When a UE registers with the network by sending an ATTACH_REQUEST message to the SGSN, it updates the location information in the HSS by sending the UPDATE_GPRS_LOCATION message to the HSS.

The Trace Session activation is started from the EMS, when it activates the Trace Session to the HSS. When the HSS send trace activation to the SGSN, the HSS shall propagate the trace control and configuration parameters to the SGSN by sending a MAP-ACTIVATE_TRACE_MODE - see 3GPP TS 29.002 [11] message to the SGSN (This message can be embedded also in the MAP INSERT SUBSCRIBER DATA message). The SGSN receives and stores MDT user consent indication from HSS as a part of subscriber information (details are available in Section 4. 6.1). When an inter-SGSN routing area update occurs, HSS shall send the MAP-ACTIVATE_TRACE_MODE message to the new SGSN. The Trace Session Activation from HSS to SGSN shall contain the following MDT specific parameters in addition to the existing trace parameters:

- Job type
- Area Scope
- List of measurements
- Reporting Trigger
- Report Interval
- Report Amount
- Event Threshold
- Logging Interval

- Logging Duration
- IP address of Trace Collection Entity
- Measurement quantity
- Measurement period UMTS (if either of the measurements M6, M7 is requested)
- Collection period for RRM measurements UMTS (present only if any of M3, M4 or M5 measurements are requested).
- Positioning method
- MDT PLMN List

Note that at the same time not all of the parameters can be present. The condition which parameters shall be present is described in clause 5 of the present document.

When SGSN receives the MAP-ACTIVATE_TRACE_MODE message it shall store the trace control and configuration parameters and shall start a Trace Session and shall send the CN_INVOKE_TRACE message to the RNC. The SGSN shall consider the MDT user consent information when activating an MDT trace session for the UE. The SGSN shall send the following parameters to the RNC beside the existing trace parameters:

- Job type
- Area Scope
- List of measurements
- Reporting Trigger
- Report Interval
- Report Amount
- Event Threshold
- Logging Interval
- Logging Duration
- IP address of Trace Collection Entity
- Measurement quantity
- Measurement period UMTS (if either of the measurements M6, M7 is requested)
- Collection period for RRM measurements UMTS (present only if any of M3, M4 or M5 measurements are requested).
- Positioning method
- MDT PLMN List

Note that at the same time not all of the parameters can be present. The conditions which parameters shall be present is described in clause 5 of the present document.

4.1.2.13.3 Handling of various scenarios during MDT activation

Handling of various scenarios for Signalling based Logged/Immediate MDT is addressed below:

1) EM initiating MDT activation shall validate that the MCC and MNC specified in the Trace reference is the same as the PLMN supported by all the RNCs specified in the area scope. If the RNC receives a request with a PLMN in the TraceReference that does not match any PLMN in its list, it shall ignore the request.

- 2) SGSN shall trigger the MDT activation only when the MDT area criterion is satisfied. But if the RNC receives a request that is outside the area scope then the RNC shall store the MDT configuration and forward the request when a handover occurs (intra PLMN).
- 3) When the UE re-enters the PLMN (in trace reference) which matches the area scope defined in the MDT configuration then the SGSN shall be responsible for restarting the Immediate MDT activation. However, this is best effort.
- 4) Void.
- 5) SGSN shall re-initiate CN Invoke Trace procedure to reactivate MDT job after successful SRNS relocation if the RNC could not configure the UE since it was in the middle of inter-RNC handover (refer to TS 25.413 [13]). SGSN shall try to reactivate MDT in the target cell if the target cell scope meets the MDT criteria.
- 6) Void.
- 7) Area based MDT criteria may consist of a cell list. SGSN shall validate whether the UE is controlled by the same RNC as any other cell in the cell list. If yes, the MDT activation shall be sent to the serving RNC. If the RNC receives a Signalling Based MDT activation request when the UE is served by a cell that is in the RNC but not in the MDT area scope then the RNC shall store the MDT configuration and configure the UE when the UE moves to a cell in the RNC (intra RNC handover) that satisfies the area scope in the request.

4.1.2.14 CS domain activation mechanism for MDT

4.1.2.14.0 Activation of MDT task before UE attaches to the network

In UMTS it is also possible to send the MDT job activation via the CS domain instead of the PS domain. The activation mechanism is shown in figure 4.1.2.14.1.

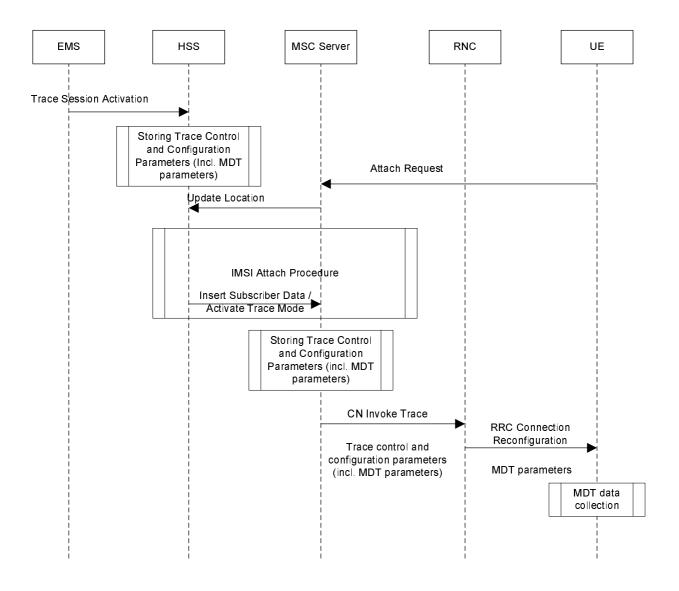


Figure 4.1.2.14.1: MDT activation procedure in CS domain during attach procedure

The Trace Session activation is started from the EMS, when it activates the Trace Session to the HSS. The HSS stores the trace control and configuration parameters in its database.

When a UE registers with the network by sending an ATTACH_REQUEST message to the MSC Server, it updates the location information in the HSS by sending the UPDATE_LOCATION message to the HSS. The HSS checks if the UE is being traced. If it is being traced, the HSS shall propagate the trace control and configuration parameters to the MSC Server by sending a MAP-ACTIVATE_TRACE_MODE - see 3GPP TS 29.002 [11] message to the MSC Server (This message can be embedded also in the MAP INSERT SUBSCRIBER DATA message). The MSC Server receives and stores MDT user consent indication from HSS as part of subscriber information at UE attachment (details are available in Section 4.2.8.1). When an inter-VLR Location Area update occurs, HSS shall send the MAP-ACTIVATE_TRACE_MODE message to the new VLR / MSC Server. The Trace Session Activation from HSS to

MSC Server shall contain the following MDT specific parameters in addition to the existing trace parameters:

- Job type
 - Area Scope
 - List of measurements
 - Reporting Trigger
 - Report Interval

- Report Amount
- Event Threshold
- Logging Interval
- Logging Duration
- IP address of Trace Collection Entity
- Measurement quantity
- Measurement period UMTS (if either of the measurements M6, M7 is requested)
- Collection period for RRM measurements UMTS (present only if any of M3, M4 or M5 measurements are requested).
- Positioning method
- MDT PLMN List

Note that at the same time not all of the parameters can be present. The condition under which parameters shall be present is described in clause 5 of the present document.

When MSC Server receives the MAP-ACTIVATE_TRACE_MODE message it shall store the trace control and configuration parameters and shall start a Trace Session and shall send the CN_INVOKE_TRACE message to the RNC. The MSC Server shall consider the MDT user consent information when activating an MDT trace session for the UE. The MSC Server shall send the following parameters to the RNC beside the existing trace parameters:

- Job type
- Area Scope
- List of measurements
- Reporting Trigger
- Report Interval
- Report Amount
- Event Threshold
- Logging Interval
- Logging Duration
- IP address of Trace Collection Entity
- Measurement quantity
- Measurement period UMTS (if either of the measurements M6, M7 is requested)
- Collection period for RRM measurements UMTS (present only if any of M3, M4 or M5 measurements are requested).
- Positioning method
- MDT PLMN List

Note that at the same time not all of the parameters can be present. The condition under which parameters shall be present is described in clause 5 of the present document.

In case of Immediate MDT trace (e.g., IMSI/IMEI based selection), the Immediate MDT trace session context of the UE shall be preserved in the network when the UE enters idle mode.

The Logged MDT trace session is preserved in the UE until the duration time of the trace session expires, including also multiple idle periods interrupted by idle-connected-idle state transitions.

The Logged MDT trace session context of the UE is stored in the network as long as the trace session is active, including also the periods when the UE is in connected state.

4.1.2.14.1 MDT Error Handling

Handling of various scenarios for Signalling based Logged/Immediate MDT is addressed below:

- 1. EM initiating MDT activation shall validate that the MCC and MNC specified in the Trace reference is the same as the PLMN supported by all the cells specified in the area scope. If the RNC receives a request with a PLMN in the TraceReference that does not match any PLMN in its list, it shall ignore the request
- 2. MSC-S shall trigger the activation only when the MDT area criterion is satisfied. But if for some reason the RNC receives a request that is outside the area scope then the RNC shall store the MDT configuration and forward the request when a handover occurs (intra PLMN).
- 3. When the UE re-enters the PLMN (in trace reference) which matches the area scope defined in the MDT configuration then the MSC shall be responsible for restarting the Immediate MDT activation. However this is best effort.
- 4. Void.
- 5. MSC-S shall re-initiate CN Invoke Trace procedure to reactivate MDT job after SRNS relocation (refer to TS 25.413 [13]) if the RNC could not configure the UE since it was in the middle of inter RNC handover. MSC-S shall try to reactivate MDT in the target cell if the target cell scope meets the MDT criteria.
- 6. Void.
- 7. Area based MDT criteria may consist of a cell list. MSC-S shall validate whether the UE is controlled by the same RNC as any other cell in the cell list. If yes, the MDT activation shall be sent to the serving RNC. If the RNC receives a Signalling Based MDT activation request when the UE is served by a cell that is in the RNC but not in the MDT area scope then the RNC shall store the MDT configuration and configure the UE when the UE moves to a cell in the RNC (intra RNC handover) that satisfies the area scope in the request

4.1.3 Management deactivation

4.1.3.1 UTRAN deactivation mechanisms

When last Trace session is requested to be ended for an IMEI(SV) or a list of IMEI(SV), the RNC shall send the requested IMEI(SV)/list of IMEI(SV)s in 'Uplink Information Exchange Request' to the interacting MSC Server(s) and SGSN(s). The MSC Servers and SGSNs shall remove the requested IMEI(SV)s for the RNC in question.

4.1.3.2 PS Domain deactivation mechanisms

When a SGSN, GGSN or BM-SC receives a Trace Session Deactivation from its EM, the Trace Session identified by the Trace Reference, shall be deactivated in SGSN/GGSN/BM-SC.

If a Trace Recording Session is active at the time of receiving a Trace Session deactivation from the EM, the SGSN/GGSN/BM-SC may choose to continue the Trace Recording Session till it ends gracefully or may stop it immediately. In all cases, the SGSN/GGSN/BM-SC shall deactivate the requested Trace Session immediately at the end of the Trace Recording Session.

4.1.3.3 CS Domain deactivation mechanisms

When a MSC Server receives a Trace Session Deactivation from its EM, the Trace Session identified by the Trace Reference, shall be deactivated in MSC Server.

If a Trace Recording Session is active at the time of receiving a Trace Session deactivation from the EM, the MSC Server may choose to continue the Trace Recording Session till it ends gracefully or may stop it immediately. In all cases, the MSC Server shall deactivate the requested Trace Session immediately at the end of the Trace Recording Session.

4.1.3.4 IP Multimedia Subsystem deactivation mechanisms

When a S-CSCF/P-CSCF receives a Trace Session deactivation from the EM, the Trace Session identified by the Trace Reference, shall be deactivated.

If a Trace Recording Session is active at the time of receiving a Trace Session deactivation from the EM, the S-CSCF/P-CSCF may choose to continue the Trace Recording Session till it ends gracefully or may stop it immediately. In all cases, the S-CSCF/P-CSCF shall deactivate the requested Trace Session immediately at the end of the Trace Recording Session.

The following figure illustrates how the Trace Session is deactivated when a Trace Recording Session is going on (e.g. a SIP INVITE method is being traced in S-CSCF).

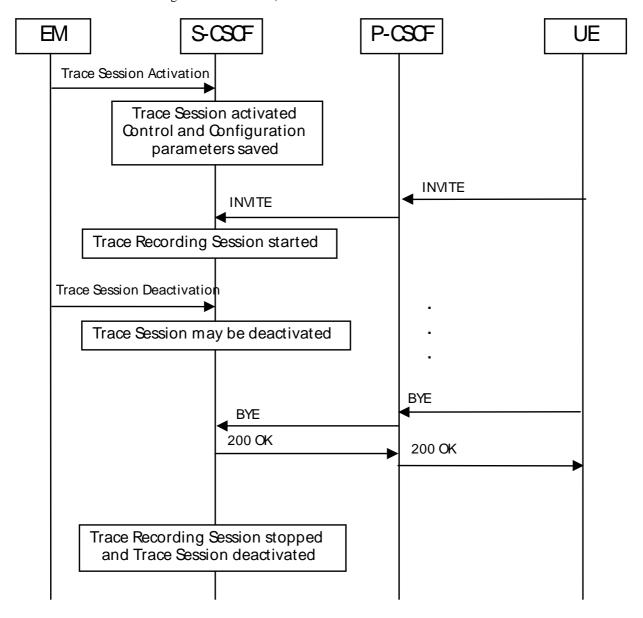


Figure 4.1.3.4.1: Trace session deactivation in IMS

4.1.3.5 E-UTRAN deactivation mechanisms

In E-UTRAN the Cell Traffic trace functionality can be deactivated when the eNodeB receives the Trace Session Deactivation message from the EM. At this time the eNodeB shall deactivate the Trace Session for those E-UTRAN Cells that have been indicated in the Trace Session Deactivation message received from the EM.

4.1.3.6 EPC Domain deactivation mechanisms

When a MME, SGW or PGW receives a Trace Session Deactivation from its EM, the Trace Session identified by the Trace Reference, shall be deactivated in the MME, SGW or PGW.

If a Trace Recording Session is active at the time of receiving a Trace Session deactivation from the EM, the MME may choose to continue the Trace Session and the Trace Recording Session till it ends gracefully or may stop it immediately. In all cases, the MME shall deactivate the requested Trace Session immediately at the end of the Trace Recording Session.

4.1.3.7 E-UTRAN deactivation mechanisms for MDT

When the eNodeB receives the indication from EM for MDT trace session deactivation, it shall deactivate the trace session for those E-UTRAN cells that have been indicated in the message. In case of immediate MDT trace session the eNodeB shall deactivate the corresponding MDT RRC measurements in the UEs that have been configured for immediate MDT as part of the given trace session.

4.1.3.8 Deactivation mechanisms at UE for MDT

The UE shall silently discard a logged MDT trace session when logging duration expires and shall indicate the availability of logged measurement results to the network next time it enters connected mode.

4.1.4 Signalling deactivation

4.1.4.1 General

In Signalling deactivation, the Trace Deactivation shall always be carried out from the Core Network EM only [EM (PS), EM (CS), EM(EPC) and EM (HSS) are generally considered to be in the Core Network. A Core Network EM can be any of these or their combinations]. In case of home subscriber trace (i.e. in the HPLMN) the Trace Session deactivation shall go to the HSS, MSC Server/VLR, SGSN or MME. In case of foreign subscriber trace (i.e. the HPLMN operator wishes to deactivate tracing on foreign subscribers roaming in his PLMN) the Trace Session deactivation shall go the MSC Server/VLR SGSN or MME. The Management System shall deactivate the Trace Session in the same NE where it activated the Trace Session.

When an HSS receives a Trace Session deactivation from its Management system, it shall deactivate the active Trace Session corresponding to the Trace Reference received in the deactivation message. The HSS shall delete all trace control and configuration parameters associated with this Trace Session. If a Trace Recording Session is active at the time of receiving a Trace Session deactivation message from the EM, the HSS may choose to continue the Trace Recording Session till it ends gracefully or may stop it immediately. In all cases, the HSS shall deactivate the requested Trace Session immediately at the end of the Trace Recording Session.

4.1.4.2 UTRAN deactivation mechanisms

When RNC receives the CN_DEACTIVATE_TRACE message it shall deactivate the Trace Session for the indicated Trace Reference in the CN_DEACTIVATE_TRACE message. In case of simultaneous CS/PS connections, the trace session for the indicated trace reference shall be closed upon reception of the CN DEACTIVATE TRACE message from any of the CN domain, whether it was the one which initiated trace session activation or not.

The Trace Session is also deactivated in the RNC when the Iu connection to the Core Network is released.

If CN_INVOKE_TRACE message is received for only one Iu connection (either CS or PS) the Trace Session shall be deactivated in the RNC when the IU_RELEASE_COMMAND message is received from the Core Network for that Iu connection where the CN_INVOKE_TRACE message is sent.

The following figure shows this behaviour:

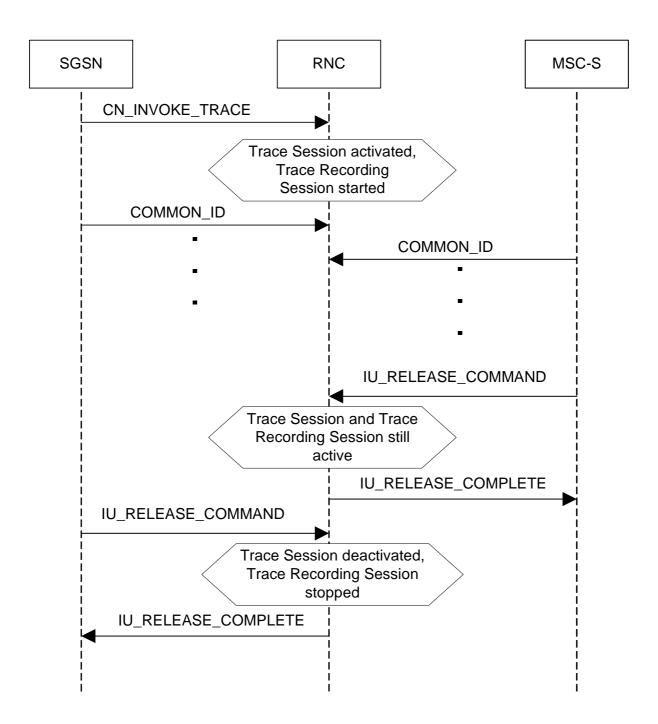


Figure 4.1.4.2.1: Trace session deactivation (Signalling) in UTRAN 1

If CN_INVOKE_TRACE message is received by the RNC for both Iu-CS and Iu-PS connection with the same Trace Reference number than the Trace Session shall not be deactivated in the RNC when any of the Iu connection is released (when the first IU_RELEASE_COMMAND message is received). The Trace Session shall be deactivated when the second Iu connection is released (the second IU_RELEASE_COMMAND message is received). The following figure shows the situation.

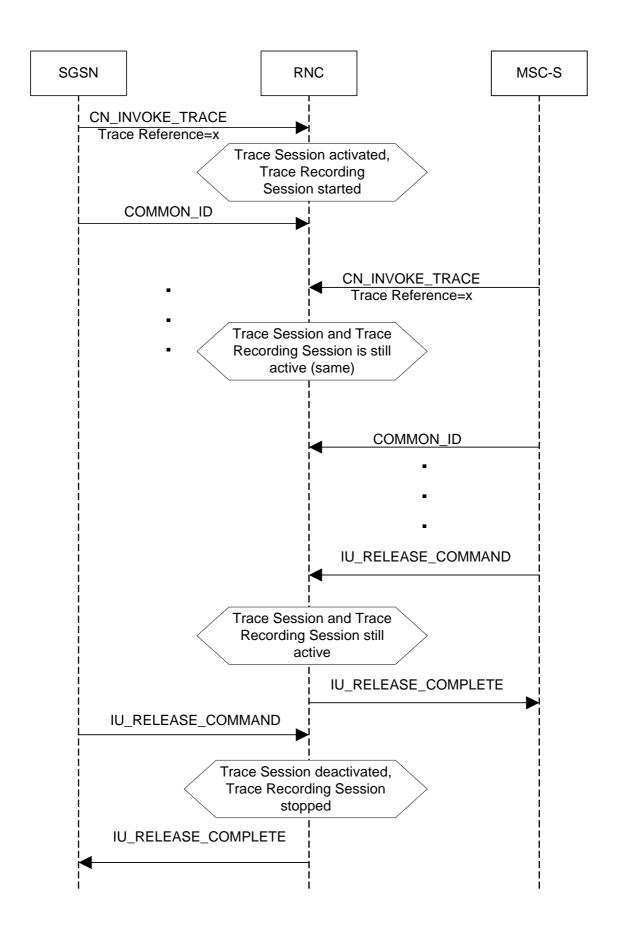


Figure 4.1.4.2.2: Trace session deactivation (Signalling) in UTRAN 2

Interaction with Soft-handover

The Trace Session should be deactivated in a Drift RNC when the DRNC receives the IUR_DEACTIVATE_TRACE message or the Iur connection is released.

When an RNC deactivates a Trace Session the Trace Recording Session shall also be stopped at the same time.

NOTE: In RNC the Trace Session and the Trace Recording Session always the same.

4.1.4.3 PS Domain deactivation mechanisms

When an HSS receives a Trace Session deactivation from the Management System it shall send a MAP_DEACTIVATE_TRACE_MODE message to the SGSN.

When the SGSN receives a MAP_DEACTIVATE_TRACE_MODE message it shall deactivate the Trace Session identified by the Trace reference received in the MAP_DEACTIVATE_TRACE_MODE message.

If a Trace Recording Session is active at the time of receiving a deactivation message (in SGSN it is the MAP-DEACTIVATE_TRACE_MODE, in GGSN it is the GTP Update PDP Context Request or the Update MBMS Context Request, in BM-SC it is the Diameter Gmb STR message), the SGSN and/or the GGSN and/or the BM-SC may choose to continue the Trace Recording Session till it ends gracefully or may stop it immediately. In all cases, the SGSN/GGSN/BM-SC shall deactivate the requested Trace Session immediately at the end of the Trace Recording Session. When the SGSN deactivates the Trace Session, it shall delete all trace control and configuration parameters associated with the corresponding Trace Session.

If SGSN deactivates the Trace Session during the Trace Recording Session, the SGSN should deactivate the trace to the RNC by using the CN_DEACTIVATE_TRACE RANAP message and should deactivate the trace to the GGSN by sending the GTP Update PDP Context Request or the Update MBMS Context Request message with Trace Activity Control set to Trace Deactivation.

If the GGSN deactivates the Trace Session during the Trace Recording Session, the GGSN should deactivate the trace to the BM-SC (by sending a Diameter Gmb STR message).

4.1.4.4 CS Domain deactivation mechanisms

When an HSS receives Trace Session deactivation from the Management System it shall send a MAP DEACTIVATE TRACE MODE message to the MSC Server.

When the MSC Server receives a MAP_DEACTIVATE_TRACE_MODE message it shall deactivate the Trace Session identified by the Trace reference received in the MAP_DEACTIVATE_TRACE_MODE message.

If a Trace Recording Session is active at the time of receiving a MAP_DEACTIVATE_TRACE_MODE message from the HSS, the MSC Server may choose to continue the Trace Recording Session till it ends gracefully or may stop it immediately. In all cases, the MSC Server shall deactivate the requested Trace Session immediately at the end of the Trace Recording Session. When the MSC Server deactivates the Trace Session it shall delete all trace control and configuration parameters associated with the corresponding Trace Session.

If MSC Server deactivates the Trace Session during a Trace Recording Session, it should deactivate the trace to the RNC by sending the CN_DEACTIVATE_TRACE RANAP message and should deactivate the trace to the MGW.

4.1.4.5	Void		
4.1.4.6	void		
4.1.4.6.1	void		
4.1.4.6.2	void		
4.1.4.6.2.1	void		
4.1.4.6.2.2	void		
4.1.4.6.2.3	void		
4.1.4.6.3	Void		

4.1.4.7 EPC deactivation mechanisms

When an HSS receives a Trace Session Deactivation from the Management System it shall send an S6a-Delete Subscriber Data Request message to the MME at which the UE is currently registered if MME is included in the NE types for Tracing, via the S6a interface to remove the "trace data" from subscription data (see 3GPP TS 29.272[26]). The HSS shall deactivate trace if trace is active at the HSS.

When the MME receives the S6a-Delete Subscriber Data Request message to remove the "trace data" from subscription data (see 3GPP TS 29.272 [26]) or the Trace Session is deactivated directly from the EM it shall deactivate the Trace Session identified by the Trace Reference.

If the UE was registered to the HSS by an MME via the S6a interface, (i.e. the user is attached to a 3GPP access network), the Trace Session shall be deactivated to the MME via the S6a interface.

If the user was registered by a AAA server via the SWx interface (i.e. the user is attached to a non-3GPP network) the HSS shall send the Trace Session deactivation request with a push profile request.

The AAA server shall examine the received user profile and if it detects that the Trace Session shall be deactivated, it shall initiate a re-authorization procedure towards the PDN GW. The Trace Session is deactivated in the PDN GW by using this re-authorization procedure.

When the PDN GW receives the updated authorization data with trace information that represents Trace Session deactivation request, it shall deactivate the Trace Session identified by the Trace Reference.

The following figure illustrates the Trace Session deactivation when the user is attached to a non-3GPP access network for DSMIPv6 on S2c or PMIP on S2a/S2b.

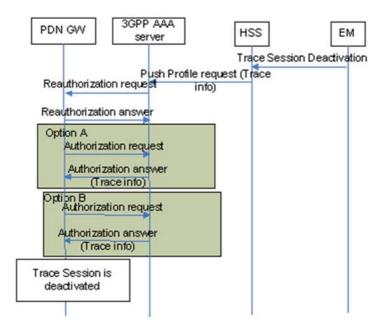


Figure 4.1.4.7.1: Trace Session deactivation in case UE attached from non-3GPP access network for DSMIPv6 on S2c or PMIP on S2a/S2b

If the user was registered by a AAA server via the SWx interface (i.e. the user is attached to a non-3GPP network) the HSS shall send the Trace Session deactivation request with a push profile request.

The AAA server shall examine the received user profile and if it detects that the Trace Session shall be deactivated, it shall initiate a re-authorization procedure towards the ePDG.

The ePDG shall examine the received information from the AAA and if it detects that the Trace Session shall be deactivated (see 3GPP TS 29.273 [22]), it shall initiate a trace deactivation procedure towards the PDN GW (see 3GPP TS 29.274 [34]).

When the PDN GW receives the data with trace information that represents Trace Session deactivation request, it shall deactivate the Trace Session identified by the Trace Reference.

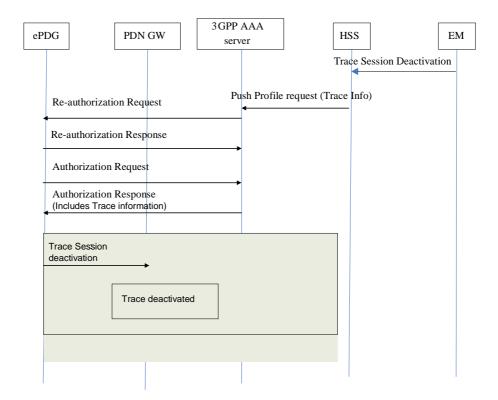


Figure 4.1.4.7.2: Trace Session deactivation in case UE attached from non-3GPP access network for GTP based S2b interface

When the MME receives the S6a-Delete Subscriber Data Request message to remove the "trace data" from subscription data (see 3GPP TS 29.272 [26]) or the Trace Session is deactivated directly from the EM it shall deactivate the Trace Session identified by the Trace Reference.

If a Trace Recording Session is active at the time of receiving a deactivation message, the MME may choose to continue the Trace Recording Session until it ends gracefully or may stop it immediately. In all cases, the MME shall deactivate the requested Trace Session immediately at the end of the Trace Recording Session. When the MME deactivates the Trace Session, it shall delete all trace control and configuration parameters associated with the corresponding Trace Session.

If MME deactivates the Trace Session during the Trace Recording Session, the MME should deactivate the trace at the eNB by sending the S1-Deactivate Trace message to the eNodeB via the S1 interface and should deactivate the trace at the SGW by sending an S11-Trace Session Deactivation message to the SGW via the S11 interface. The message sent by MME shall include the Trace Reference to identify the Trace Session that is to be deactivated.

When SGW receives an S11-Trace Session Deactivation message from the MME, the SGW may choose to continue the Trace Recording Session until it ends gracefully or may stop it immediately. In all cases, the SGW shall deactivate the requested Trace Session immediately at the end of the Trace Recording Session. If SGW deactivates the Trace Session during the Trace Recording Session, the SGW should deactivate the trace at the PDN GW by sending the S5-Trace Session Deactivation message to the PGW via the GTP based S5 interface. In case of PMIP based S5 interface the SGW should deactivate the trace to the PDN GW using PCC signalling, i.e. by sending a Trace Deactivation message to the PCRF and PCRF forwards the trace deactivation message to the PDN GW [29]. When the SGW deactivates the Trace Session, it shall delete all trace control and configuration parameters associated with the corresponding Trace Session.

When PGW receives an S5-Trace Session Deactivation message from the SGW, or S2b-Trace Session Deactivation message from the ePDG, or it receives the Trace Session Deactivation message from PCRF in case of PMIP based S5, the PDN GW may choose to continue the Trace Recording Session until it ends gracefully or may stop it immediately. In all cases, the PDN GW shall deactivate the requested Trace Session immediately at the end of the Trace Recording Session. When the PDN GW deactivates the Trace Session, it shall delete all trace control and configuration parameters associated with the corresponding Trace Session.

When a Trace Session Deactivation message is sent on any interface the Trace Reference that identifies the Trace Session shall be included to the Trace Session Deactivation message.

4.1.4.8 E-UTRAN deactivation mechanisms

There are two different events that deactivate a Trace Session:

- 1. When eNB receives the S1- Deactivate Trace message it shall deactivate the Trace Session for the indicated Trace Reference.
- 2. When the eNB releases the UE context the Trace Recording Session shall be stopped and the Trace Session is deactivated at the eNB.

4.1.4.9 EPC deactivation mechanisms for MDT

When the MME receives a Trace Session Deactivation request for an MDT Trace Session of a UE, it shall act according to the following.

In case of an immediate MDT trace session and the UE being in connected mode, the MME shall send trace session deactivation toward the eNodeB. The eNodeB shall deactivate the corresponding MDT RRC measurements in the UE and shall discard the given trace session context.

In case of an immediate MDT trace session and the UE being in idle mode, the MME shall silently discard the stored trace session context.

NOTE: Signaling based deactivation does not apply for logged MDT trace sessions, the logged MDT trace session terminates when logging duration expires.

4.1.4.10 Deactivation mechanisms at UE for MDT

The UE shall discard a logged MDT trace session when logging duration expires and shall indicate the availability of logged measurement results to the network next time it enters connected mode.

4.1.5 MDT Trace selection conditions

In Immediate MDT, both in case of signalling based and management based MDT trace activation, it is always the network that evaluates all selection conditions for activating the MDT measurements and deactivating the MDT measurements (this evaluation is done continuously during the selected call session). The network activates and deactivates the MDT measurements toward the UE accordingly via RRC.

In Logged MDT, the network configures UEs for MDT tracing that are eligible based on the specified selection criteria. If area based condition is specified in the trace configuration, it is sent to the UE at configuration time and the UE will evaluate the area condition as it moves in the network in idle mode.

Immediate and Logged MDT measurements shall always be configured as separate trace sessions.

In cases of overlapping MDT configuration request the signaling based request shall override the management based request. For logged MDT, prior to re configuring, the eNB shall retrieve the MDT logs from the UE.

4.2 Trace Recording Session Start / Stop triggering for Trace and MDT

4.2.1 General

The Trace Session activation contains the triggering events parameter. The actual start/stop triggering events corresponding to the values of the triggering events parameter are defined in triggering events tables in sub-clause 5.1 in the present document.

If the NE failed to start the Trace Recording Session, a Trace failure notification shall be sent to the TCE, and the Trace failure notification has the the same parameters as the notification notifyTraceRecordingSessionFailure defined in 3GPP TS 32.442 [24], the Trace failure notification file XML schema is defined in Annex A.

4.2.2 Starting a trace recording session - management based

4.2.2.1 UTRAN starting mechanisms

In an RNC, a Trace Recording Session should start after the reception of the CN_INVOKE_TRACE message from the CN and if some activities have been started on the interfaces that have been requested to be traced. The RNC shall record those signalling messages in the interfaces that are defined in the *list of interfaces* parameter. Trace depth defines whether entire signalling messages or just some IEs needs to be recorded.

The RNC may not start a Trace Recording Session if there are insufficient resources available for the recording.

When RNC starts a Trace Recording Session it shall assign a Trace Recording Session Reference for the Trace Recording Session.

When several PLMNs are supported in the RAN, for starting Trace and management based MDT the RNC shall only select UEs where the pLMNTarget = PLMN identity that the UE includes in Initial Direct Transfer message 3GPP TS 25.331 [31].

4.2.2.2 PS Domain starting mechanisms

In a SGSN/GGSN/BM-SC, a Trace Recording Session should start after the reception of a Trace Session Activation from EM and if any of the defined *start triggering events* occur. During the Trace Recording Session, the SGSN/GGSN/BM-SC shall record those signalling messages in the interfaces that are defined in the *list of interfaces* parameter. The *Trace Depth* parameter defines whether entire signalling messages or just some IEs need to be recorded.

The IMSI and IMEISV shall be available in the SGSN, in the GGSN and in the BM-SC for at least those connections which shall be traced.

The SGSN/GGSN/BM-SC may not start a Trace Recording Session if there are insufficient resources available for the recording.

If the SGSN/GGSN/BM-SC receives the Trace Session Activation during an established session (e.g. during an active PDP context or an active MBMS context), it *may* start the Trace Recording Session immediately. However, if any of the start triggering events occur in the SGSN/GGSN/BM-SC after receiving the Trace Session Activation, it shall start the Trace Recording Session.

When a Trace Recording Session is started, the SGSN/GGSN/BM-SC shall assign a Trace Recording Session Reference for the Trace Recording Session.

4.2.2.3 CS Domain starting mechanisms

In a MSC Server, a Trace Recording Session shall start after the reception of a Trace Session Activation from EM and if any of the defined *start triggering events* occur. During the Trace Recording Session, the MSC Server shall record those signalling messages in the interfaces that are defined in the *list of interfaces* parameter. The *Trace Depth* parameter defines whether entire signalling messages or just some IEs needs to be recorded.

The IMSI and the IMEISV shall be available in the MSC Server for at least those connections which shall be traced.

The MSC Server may not start a Trace Recording Session if there are insufficient resources available for the recording.

If the MSC Server receives the Trace Session Activation during an established call, it *may* start the Trace Recording Session immediately. However, if any of the start triggering events occurs in MSC Server after receiving the Trace Session Activation, it shall start the Trace Recording Session.

When a Trace Recording Session is started, the MSC Server shall assign a Trace Recording Session Reference for the Trace Recording Session.

4.2.2.4 Void

4.2.2.5 E-UTRAN starting mechanism

In E-UTRAN, after the Cell Traffic Trace has been activated in the monitored cell(s), the eNodeB shall start a Trace Recording Session for new call(s)/session(s) and for already existing call(s)/session(s) (events for existing call(s)/session(s) are not required to be recorded prior to the activation of the cell traffic trace). When the eNodeB starts a Trace Recording Session it shall allocate a Trace Recording Session Reference for the given call or session. The eNodeB shall send the allocated Trace Recording Session Reference, and the Trace Reference and the Trace Collection Entity address in the CELL TRAFFIC TRACE message to the MME via the S1 connection.

When MME receives this new S1 signalling message containing the Trace Recording Session Reference and Trace Reference, the MME shall look up the IMSI/IMEI(SV) of the given call from its database and shall send the IMSI/IMEI(SV) numbers together with the Trace Recording Session Reference and Trace Reference to the Trace Collection Entity.

When several PLMNs are supported in the RAN, for starting Trace the eNB shall only select UEs where the pLMNTarget = selectedPLMN-Identity that the UE includes in RRCConnectionSetup message 3GPP TS 36.331 [32].

The format of the file sent to the TCE from the MME is defined in 3GPP TS 32.423, clause A.2.2.

The figure 4.2.2.5.1 illustrates the procedure.

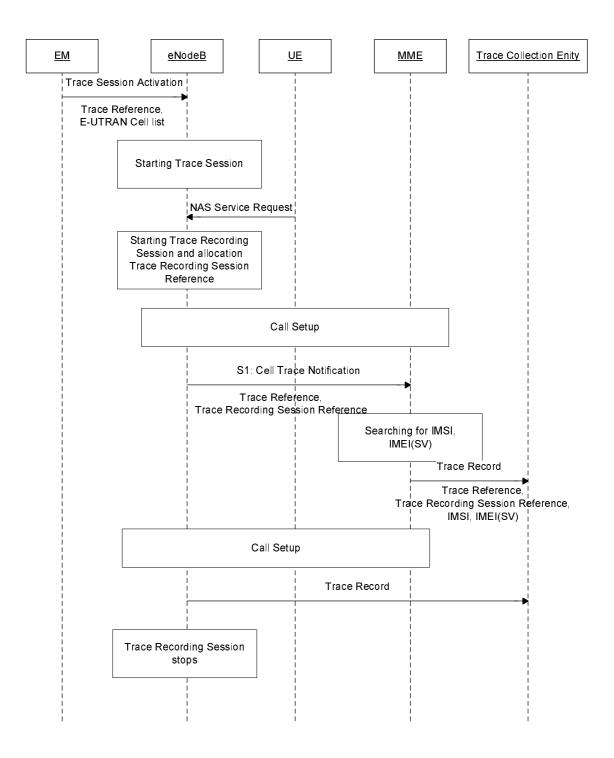


Figure 4.2.2.5.1

4.2.2.6 EPC Domain starting mechanisms

In a MME, SGW or PGW, a Trace Recording Session should start after the reception of a Trace Session Activation from EM and if any of the defined *start triggering events* occur. During the Trace Recording Session, the MME, SGW or PGW shall record those signalling messages in the interfaces that are defined in the *list of interfaces* parameter. The *Trace Depth* parameter defines whether entire signalling messages or just some IEs need to be recorded.

The IMSI and IMEISV shall be available in the MME and in the SGW for at least those connections which shall be traced.

The MME, SGW or PGW may not start a Trace Recording Session if there are insufficient resources available for the recording.

If the MME, SGW or PGW receives the Trace Session Activation during an established session (e.g. during an active PDP context), it may start the Trace Recording Session immediately. However, if any of the start triggering events occur in the MME, SGW or PGW after receiving the Trace Session Activation, it shall start the Trace Recording Session.

When a Trace Recording Session is started, the MME, SGW or PGW shall assign a Trace Recording Session Reference for the Trace Recording Session.

4.2.2.7 E-UTRAN starting mechanisms for MDT

A trace recording session of immediate MDT or logged MDT shall be started in the eNodeB for each selected UE that satisfy the MDT UE selection criteria (i.e. capability condition), provided that a cell trace session for immediate MDT or logged MDT has been activated in the eNodeB from EM for the given cell(s) before.

The eNodeB shall configure the corresponding MDT RRC measurements at the selected UE.

When several PLMNs are supported in the RAN for management based MDT, possibly combined with Trace, the eNB shall only select UEs where the pLMNTarget = selectedPLMN-Identity that the UE includes in RRCConnectionSetup message 3GPP TS 36.331 [32].

4.2.2.8 Starting mechanisms at UE for MDT

There is no starting mechanism at the UE for MDT trace recording sessions. The UE shall execute the received MDT measurement configuration. In case of logged MDT, the UE shall store the trace recording session parameters as received from the eNodeB.

When several PLMNs are supported in the RAN, for starting logged MDT the UE shall only perform logging for the cells recived in the MDT measurement configuration, if they are allowed as selected PLMNs.

4.2.3 Starting a trace recording session - signalling based

4.2.3.1 UTRAN starting mechanisms

In an RNC the Trace Recording Session will always be the same as the Trace Session as no triggering events are defined in UTRAN. Therefore a Trace Recording Session should be started in an SRNC when the SRNC receives the CN_INVOKE_TRACE message from the Core Network and if some activities have been started on the interfaces that have been requested to be traced.

The CN_INVOKE_TRACE message that is received from the Core Network (MSC Server or SGSN) contains the following information:

- Trace Reference
- UE identity (IMSI or IMEI(SV)
- Trace Recording Session Reference
- Trace Depth
- List of interfaces for RNC
- Job type
- Area scope
- List of measurements
- Reporting Trigger
- Report Interval
- Report Amount
- Event Threshold
- Logging Interval
- Logging Duration
- IP address of Trace Collection Entity
- MDT PLMN List

Note that at the same time not all of the parameters can be present. The conditions which parameters shall be present is described in clause 5 of the present document.

If the Job type parameter indicates MDT (e.g. Immediate or logged MDT is required) in the CN_INVOKE_TRACE message the RNC shall also configure MDT to the UE. The detailed mechanism of the MDT configuration to the UE is defined in TS 37.320 [30] and TS 25.331 [31].

The RNC shall send the following parameters to the UE in case of Logged MDT:

- Trace Reference
- Trace Recording Session Reference
- Area scope
- TCE Id (The value signalled as IP address of TCE is mapped to a TCE Id, using a configured mapping in the RNC).
- Logging Interval
- Logging Duration
- MDT PLMN List

In case of Immediate MDT the RNC shall send the following parameters to the UE:

- List of measurements
- Reporting Trigger
- Report Interval
- Report Amount
- Event Threshold

Note that at the same time not all of the parameters can be present. The conditions which parameters shall be present is described in clause 5 of the present document.

If the SRNC does not have enough resources it may not start a Trace Recording Session.

The Trace Recording Session Reference shall be the same as received in the CN_INVOKE_TRACE message.

In a DRNC the Trace Recording Session should be started when the DRNC receives the IUR_INVOKE_TRACE message. If the DRNC does not have enough resources it may not start a Trace Recording Session.

The Trace Session is activated to the RNC by sending a CN_INVOKE_TRACE message from the CN (MSC Server or SGSN). When RNC receives the CN_INVOKE_TRACE message it should immediately start a Trace Session and a Trace Recording Session according to the trace control and configuration parameters received in the CN_INVOKE_TRACE message.

If there are not enough resources in RNC to start a Trace Recording Session, the RNC may reject to start a Trace Recording Session. However the RNC shall start the Trace Session. Session and if MDT activation is requested shall activate the MDT to the UE.

When SRNC/DRNC receives the trace control and configuration parameters:

- If the Trace Reference is the same as an existing Trace Session for the same subscriber or equipment in SRNC/DRNC, the SRNC/DRNC shall not activate a new Trace Session and the existing Trace Session will not be impacted;
- If the Trace Recording Session Reference is the same as an existing Trace Recording Session in the existing Trace Session having the same Trace Reference, the SRNC/DRNC shall not start a new Trace Recording Session;
- If the trace control and configuration parameters are received from the same CN domain (CS/PS) as the existing Trace Recording Session(s) if any, and the Trace Recording Session Reference is not the same as any existing Trace Recording Session(s) in the existing Trace Session having the same Trace Reference, the SRNC/DRNC shall start a new Trace Recording Session;
- If the trace control and configuration parameters are received from different CN domain (CS/PS) as the existing Trace Recording Session(s) if any (i.e. the RNC has simultaneoud CS and PS connection and CN_INVOKE_TRACE is received from both connection), regardless of the Trace Recording Session Reference is the same or not as any existing Trace Recording Session(s) in the existing Trace Session having the same Trace Reference, the SRNC shall not start a new Trace Recording Session;
- If the Trace Reference is the same as an existing Trace Session for different subscriber(s) or equipment(s) in SRNC/DRNC, the SRNC /DRNC shall not activate a new Trace Session, and the SRNC/DRNC shall not start a new Trace Recording Session.

The following figure shows an example for a CS call how the Trace Session is activated to RNC. In the example it is assumed that there is no PS connection at all during the CS call.

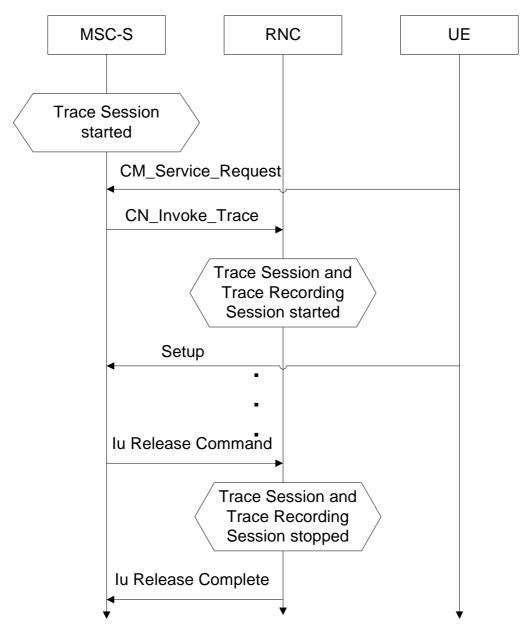


Figure 4.2.3.1.1: Starting a Trace Recording Session (Signalling) in UTRAN

Interaction with soft-handovers

If the subscriber or equipment, which is traced, makes a soft handover the SRNC should propagate the trace control and configuration parameters (including MDT specific parameters if they are available) further to the DRNC by using the IUR_INVOKE_TRACE message. When the DRNC receives the IUR_INVOKE_TRACE message it should immediately start a Trace Session and a Trace Recording Session according to the trace control and configuration parameters received in the IUR_INVOKE_TRACE message.

If there are insufficient resources in the DRNC, the DRNC may not start a Trace Recording Session.

The Trace Recording Session Reference sent by the SRNC to the DRNC shall be the same what SRNC has received in the CN_INVOKE_TRACE message from the CN.

Interaction with Relocation

If the tracing shall continue also after the relocation has been performed, the CN Invoke Trace procedure shall be reinitiated from the CN towards the future SRNC after the Relocation Resource Allocation procedure has been executed successfully.

4.2.3.2 PS Domain starting mechanisms

In SGSN/GGSN/BM-SC a Trace Recording Session should start after the reception of a Trace Session Activation message (in SGSN it is the MAP-ACTIVATE_TRACE_MODE, in GGSN it is the GTP-Create PDP Context request or Update PDP Context request, in BM-SC it is the Diameter Gmb AAR message) and if any of the defined *start triggering events* occur. During the Trace Recording Session, the SGSN/GGSN/BM-SC shall record the signalling messages in the interfaces that are defined in the *list of interfaces* parameter. The *Trace Depth* parameter defines whether entire signalling messages or just some IEs need to be recorded.

The SGSN/GGSN/BM-SC may not start a Trace Recording Session if there are insufficient resources available for the recording.

In case of an established session, the SGSN may start the Trace Recording Session immediately after the reception of the Trace Session Activation message. However, if any of the start triggering events occurs in SGSN after receiving the Trace Session activation message, it shall start the Trace Recording.

When a Trace Recording Session is started in SGSN, it shall assign a Trace Recording Session Reference for the Trace Recording Session. When the SGSN propagates the Trace control and configuration parameters to GGSN or to UTRAN (I.e. activates a Trace Session in GGSN/UTRAN), it shall include the assigned Trace Recording Session Reference in the Trace Session Activation message. When an SGSN starts a Trace Recording Session and the list of NE types parameter requires GGSN tracing, it shall send the GTP- Update PDP Context Request or Create PDP Context Request message for activating the Trace Session to GGSN. When a GGSN starts a Trace Recording Session and the list of NE types parameter requires BM-SC tracing, it shall send a Diameter Gmb AAR message to the BM-SC in order to activate a Trace Session in the BM-SC. Also, when an SGSN starts a Trace Recording Session and the list of NE types parameter requires RNC tracing, it shall send the CN_INVOKE_TRACE message to the RNC in order to activate a Trace Session in RNC. In both cases the Trace Session and the Trace Recording Session in the receiving NE should start at the same time.

In case of SRNS relocation the SGSN shall send the CN_INVOKE_TRACE message to the new SRNC after the successful Relocation Resource Allocation procedure.

SGSN has to find the identity of the mobile before it activates a Trace Session towards other NE. The IMEI(SV) can be got from the Mobile by using the Identification procedure on the Iu interface.

When the SGSN sends the Trace Session activation (CN_INVOKE_TRACE) message to RNC it shall include the following parameters to the message:

- IMSI or IMEI (SV) (M).
- Trace reference (M).
- Trace Recording Session Reference (M).
- Trace Depth (M).
- List of interfaces (O).
- IP address of Trace Collection Entity (O).

4.2.3.3 CS Domain starting mechanisms

In MSC Server/MGW a Trace Recording Session should start after the reception of a Trace Session Activation message (MAP-ACTIVATE TRACE MODE in MSC Server and ADD/MOD command with Trace package in MGW) and if any of the defined *start triggering events* occur. During the Trace Recording Session the MSC Server/MGW shall record the signalling messages in the interfaces that are defined in the *list of interfaces* parameter. The *Trace Depth* parameter defines whether entire signalling messages or just some IEs need to be recorded.

The MSC Server may not start a Trace Recording Session if there are insufficient resources available for the recording.

In case of an established call, the MSC Server may start the Trace Recording Session immediately after the reception of the MAP-ACTIVATE_TRACE_MODE message. However, if any of the start triggering events occur in the MSC Server after receiving the Trace Session activation message, it shall start the Trace Recording Session.

When a Trace Recording Session is started in MSC Server, it shall assign a Trace Recording Session Reference for the Trace Recording Session. When the MSC Server propagates the Trace control and configuration parameters to MGW or to UTRAN (I.e. activates a Trace Session in MGW/UTRAN) it shall include the assigned Trace Recording Session Reference in the Trace Session Activation message.

When an MSC Server starts a Trace Recording Session and the list of NE types parameter requires MGW tracing, it shall send the ADD/MOD command with trace package to MGW in order to activate the trace in MGW. Also, when an MSC Server starts a Trace Recording Session and the list of NE types parameter requires RNC tracing, it shall send the CN_INVOKE_TRACE message to the RNC. In both cases the Trace Session and the Trace Recording Session in the receiving NE should start at the same time.

MSC Server has to find the identity of the mobile before it activates a Trace Session towards other NE. The IMEI(SV) can be got from the Mobile by using the Identification procedure on the Iu interface.

In case of SRNS relocation the MSC Server shall send the CN_INVOKE_TRACE message to the new SRNC after the successful Relocation Resource Allocation procedure. The following figure shows an example how the Trace Session is activated with CN_INVOKE_TRACE message in case of relocation.

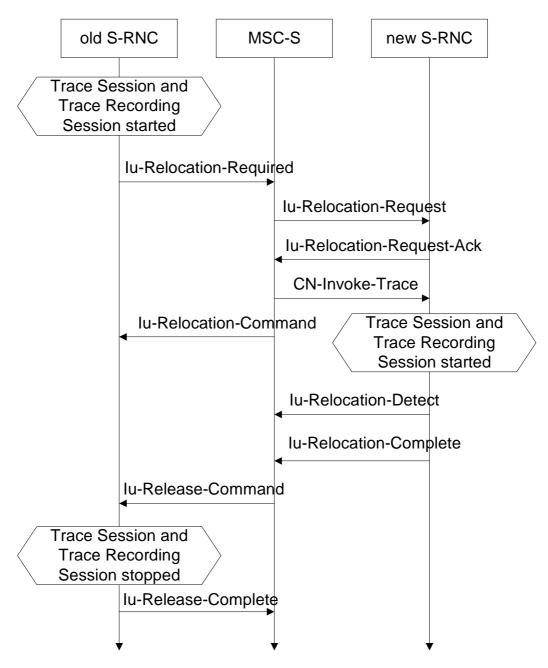


Figure 4.2.3.3.1: Starting a Trace Recording Session (Signalling) in CS Domain

When the new SRNC receives the CN_INVOKE_TRACE message it should start immediately a Trace Session and a Trace Recording session according to the trace control and configuration parameters received in the CN_INVOKE_TRACE message. The Trace Session shall automatically be deactivated in the old RNC when the Iu connection is released.

When the MSC Server sends the Trace Session activation (CN_INVOKE_TRACE) message to RNC it shall include the following parameters to the message:

- IMSI or IMEI (SV) (M).
- Trace reference (M).
- Trace Recording Session Reference (M).
- Trace Depth (M).
- List of interfaces to trace (O).

• IP address of Trace Collection Entity (O).

4.2.3.4	Void
4.2.3.5	void
4.2.3.5.1	void
4.2.3.5.2	void
4.2.3.5.3	void
4.2.3.5.4	void

4.2.3.6 E-UTRAN starting mechanism

In an eNB the Trace Recording Session will always be the same as the Trace Session as no triggering events are defined in eNB.

Tracing starts immediately at eNodeB upon reception of the trace control and configuration parameters. The eNodeB may not start a Trace Recording Session if there are insufficient resources available for the recording, however, the eNodeB shall store the trace control and configuration parameters, and forward these parameters when the UE handovers to other eNBs over X2.

The Trace Recording Session shall be started at the eNB when it receives trace control and configuration parameters via one of the following messages:

- 1. via an S1-Initial Context Setup Request message from the MME in response to an S1-Initial UE Message
- 2. via an S1-Trace Start message from the MME in response to an S1-Initial UE Message or when an established S1AP connection exists
- 3. via an S1-Handover Request message from the target MME as part of intra/inter-MME handover procedures via S1
- via an X2-Handover Request message from a source eNodeB as part of inter-eNodeB handover procedures via X2

There can only be one Trace Recording Session Reference per Trace Reference at one given time for a UE trace session. So there shall be only one TR/TRSR to be propagated during S1 and X2 handover.

If the Trace Reference is the same as an existing Trace Session for the same subscriber or equipment, and the Trace Recording Session Reference is the same as the existing Trace Recording Session in the existing Trace Session having the same Trace Reference, the eNB shall not start a new Trace Recording Session and shall continue with the existing trace session and ignore the second request.

If the Trace Reference is the same as an existing Trace Session for the same subscriber or equipment, and the Trace Recording Session Reference is not the same as the existing Trace Recording Session in the existing Trace Session having the same Trace Reference, the eNB shall continue with the existing trace session and ignore the second request.

4.2.3.7 EPC starting mechanisms

In MME/SGW/PGW a Trace Recording Session should start after the reception of a Trace Session Activation message and if any of the defined *start triggering events* occur. During the Trace Recording Session, the MME/SGW/PGW shall record the signalling messages in the interfaces that are defined in the *list of interfaces* parameter. The *Trace Depth* parameter defines whether entire signalling messages or just some IEs need to be recorded.

The MME/SGW/PGW may not start a Trace Recording Session if there are insufficient resources available for the recording.

In case of an established session, the MME/SGW/PGW may start the Trace Recording Session immediately after the reception of the trace control and configuration parameters. However, if any of the start triggering events occurs in MME/SGW/PGW after receiving the trace control and configuration parameters, it shall start the Trace Recording Session.

In the case of the *triggering events* come into collision on the same traced UE as defined in 3GPP TS 24.301[33], the MME shall not start a new Trace Recording Session for the later event(s), and shall use the existing Trace Recording Session and Trace Recording Session Reference to continuing the trace recording for these events until one stop triggerring event occurs.

MME shall start a Trace Recording Session for a certain Trace Session only if there is no ongoing Trace Recording Session for this Trace Session. i.e. at any given time, there can be a maximum of one Trace Recording Session for a certain Trace Session.

When a Trace Recording Session is started in MME, it shall assign a Trace Recording Session Reference for the Trace Recording Session. When the MME propagates the Trace control and configuration parameters to E-UTRAN (i.e. activates a Trace Session in eNB), it shall include the assigned Trace Recording Session Reference in the Trace Session Activation message.

Also, when an MME starts a Trace Recording Session and the list of NE types parameter requires eNB tracing, it shall propagate the trace control and configuration parameters including the Trace Recording Session Reference via the S1 interface to the eNodeB per one of the following messages:

- 1. if an S1 connection exists, via the S1-Trace Start message
- 2. if the S1 connection does not exist, via the S1-Trace Start message prior to S1 connection setup, or via the S1-Initial Context Setup Request message during S1 connection setup
- 3. during intra/inter-MME handover over S1, via the S1-Handover Request message

In above cases the Trace Session and the Trace Recording Session in the receiving NE should start at the same time

If all events are set in the triggering event parameter at the MME, MME shall send Trace Session Activation message to eNB not only when the MME starts the Trace Recording Session, but also when an Intra-MME handover happens. In this case the MME shall send Trace Session activation to the target eNB via the S1-Handover Request message..

NOTE: In case of "UE-Initiated Detach Procedure with UE camping on GERAN/UTRAN and ISR activated / SGSN-Initiated Detach Procedure with ISR activated",

Trace is not activated in eNB.

4.2.3.8 EPC starting mechanisms for MDT

In the MME, no trace recording sessions are started for MDT trace sessions. The MME sends the trace session activation to the eNodeB with parameters as specified in 4.1.2.12.

4.2.3.9 E-UTRAN starting mechanisms for MDT

A trace recording session of either immediate or logged MDT shall be started in the eNodeB for a given UE when a trace session activation request is received from the MME for the UE and the MDT UE selection conditions are satisfied for the UE. The eNodeB shall configure the corresponding MDT RRC measurements at the UE. If selection conditions are not satisfied, the eNodeB shall store the trace control and configuration parameters, and forward these parameters when the UE handovers to other eNBs over X2 or S1.

If the eNodeB receives a Signalling Based MDT activation request when the UE is served by a cell that is in the eNodeB but not in the MDT area scope then the eNodeB shall store the MDT configuration and configure the UE when the UE moves to a cell in the eNodeB (intra eNodeB handover) that satisfies the area scope in the request.

4.2.3.10 Starting mechanisms at UE for MDT

There is no starting mechanism at the UE for MDT trace recording sessions. The UE shall execute the received MDT measurement configuration. In case of logged MDT, the UE shall store the trace recording session parameters as received from the eNodeB.

4.2.4 Stopping a trace recording session - management based

4.2.4.1 UTRAN stopping mechanisms

The Trace Recording Session in the RNC shall be stopped when the last connection, which belongs to the traced subscriber/mobile, is released.

4.2.4.2 PS Domain stopping mechanisms

In SGSN, GGSN and BM-SC a Trace Recording Session shall be stopped when any of the defined stop triggering events occur. If Trace Session deactivation is received during the Trace Recording Session, the SGSN is allowed to finish tracing of the on-going procedures (e.g. session). In this case the Trace Recording Session shall be stopped between the reception of the Trace Session deactivation and the appropriate stop-triggering event.

The following figure illustrates the successful case in tracing a PDP context when a Trace Recording Session is stopped.

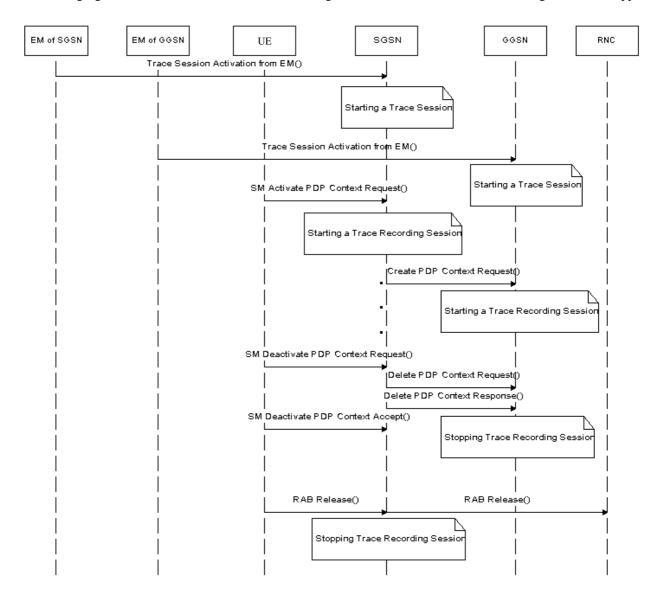


Figure 4.2.4.2.1: Stopping a Trace Recording Session for a PDP Context (Management Based) - PS domain

The following figure illustrates the successful case in tracing a MBMS context when a Trace Recording Session is stopped.

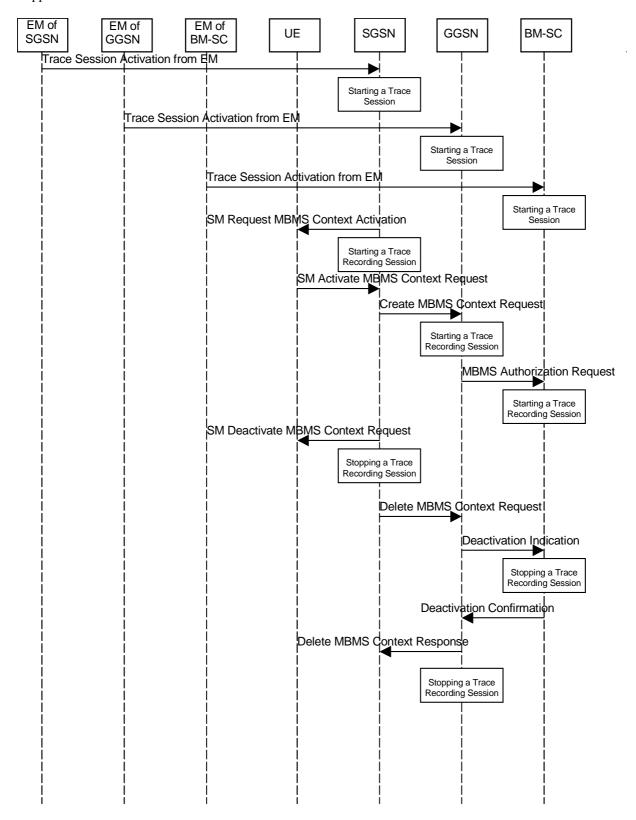


Figure 4.2.4.2.2: Stopping a Trace Recording Session for a MBMS Context (Management Based) - PS domain

4.2.4.3 CS Domain stopping mechanisms

In MSC Server a Trace Recording Session shall be stopped when any of the defined stop triggering events occur. If Trace Session deactivation is received during the Trace Recording Session, the MSC Server is allowed to finish tracing of the on-going procedures (e.g. calls). In this case the Trace Recording Session shall be stopped in MSC Server between the reception of the Trace Session deactivation and the appropriate stop-triggering event.

The following figure illustrates the successful case in tracing a call and the time of stopping a Trace Recording Session.

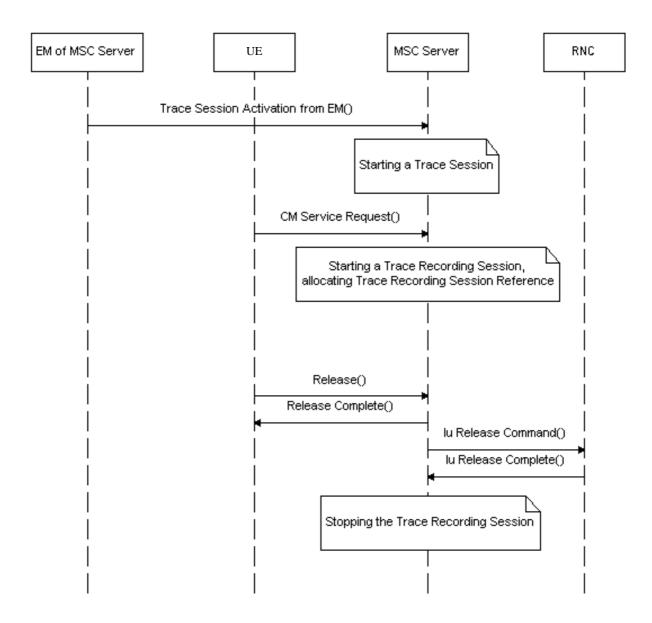


Figure 4.2.4.3.1: Stopping a Trace Recording Session (Management Based) - CS domain

4.2.4.4 Void

4.2.4.5 E-UTRAN stopping mechanisms

The Trace Recording Session in the eNodeB shall be stopped when the call/session is ended in the cell under trace or the call/session is handed over to another cell. If the Trace Session is deactivated at a time when there are ongoing sessions the trace recording session may be stopped immediately or gracefully when the session ends.

4.2.4.6 EPC Domain stopping mechanisms

In MME, SGW and PGW a Trace Recording Session shall be stopped when any of the defined stop triggering events occur. If Trace Session deactivation is received from its EM during the Trace Recording Session, the MME, SGW and PGW are allowed to finish tracing of the on-going procedures (e.g. session). In this case the Trace Recording Session shall be stopped between the reception of the Trace Session deactivation and the appropriate stop-triggering event.

4.2.4.7 E-UTRAN stopping mechanisms for MDT

In case of immediate MDT, the eNodeB shall stop a trace recording session for a given UE when the UE changes cell or goes to idle mode or when the cell trace session is deactivated at the eNodeB from its EM. The eNodeB shall deactivate the corresponding MDT RRC measurements in the UE.

In case of logged MDT, there is no stopping mechanism in the eNodeB. The eNodeB does not need to maintain a logged MDT trace recording session once it has been configured in the UE.

4.2.4.8 Stopping mechanisms at UE for MDT

In case of logged MDT, the UE shall stop an ongoing trace recording session when logging duration expires and it shall indicate the availability of logged measurement results to the network next time it enters connected mode.

The UE shall discard an ongoing logged MDT trace recording session when it receives a new logged MDT trace recording session configuration from the network.

4.2.5 Stopping a trace recording session - signalling based

4.2.5.1 UTRAN stopping mechanisms

In an RNC the Trace Recording Session will always be the same as the Trace Session as no triggering events are defined in UTRAN. Therefore a Trace Recording Session shall always be stopped in an RNC when the RNC deactivates the Trace Session. For more information on Trace Session deactivation in UTRAN see subclause 4.1.4.2.

4.2.5.2 PS Domain stopping mechanisms

A Trace Recording Session shall be stopped when the SGSN/GGSN/BM-SC detect any of the stop triggering events.

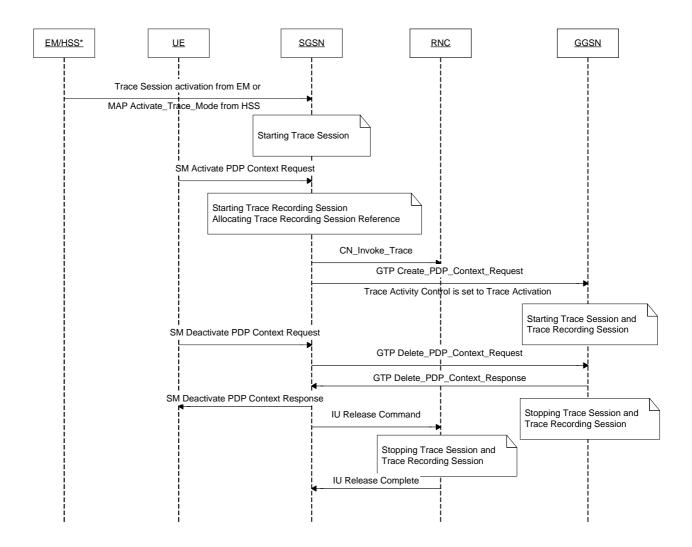
However, if a SGSN receives a Trace Session deactivation either from its EM (in case of tracing roaming subscribers) or from HSS (in case of tracing home subscribers) during an ongoing Trace Recording Session, it may stop it immediately or at any time until the occurrence of an appropriate stop-triggering event.

A GGSN shall stop a Trace Recording Session when it receives a Trace Session deactivation message (GTP- Update PDP Context Request and Trace Activity Control is set to Trace Deactivation)from the SGSN or at any time until the occurrence of an appropriate stop-triggering event.

A BM-SC shall stop a Trace Recording Session when it receives a Diameter Gmb STR message from the GGSN or at any time until the occurrence of an appropriate stop-triggering event.

When a Trace Recording Session is stopped in a SGSN, the SGSN shall send a Trace Session deactivation message to the NEs where tracing was required, as defined in the "List of NE types" configuration parameter, received in the Trace Session activation message. The Trace Reference, used for the deactivation procedure, shall be the same as used in the SGSN for the activation of the Trace Session.

The following figure illustrates a successful case in tracing a PDP context, when a Trace Recording Session is stopped. (Reference 3GPP TS 23.060 [6].)



NOTE: The activation to SGSN can come from EM-SGSN (in the figure just EM) or from the HSS.

Figure 4.2.5.2.1: Stopping a Trace Recording Session for a PDP Context (Signalling based) - PS domain

The following figure illustrates a successful case in tracing a MBMS context, when a Trace Recording Session is stopped. (Reference 3GPP TS 23.246 [9].)

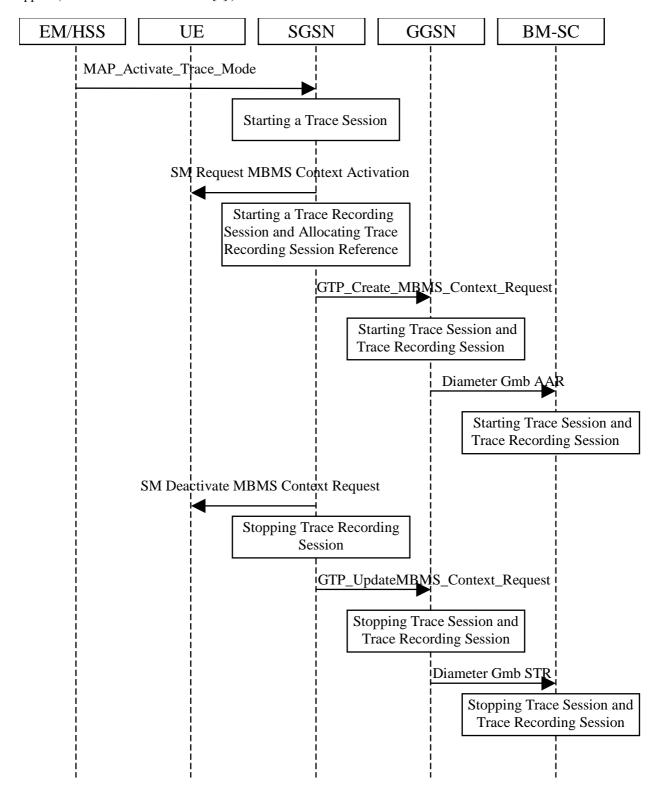


Figure 4.2.5.2.2: Stopping a Trace Recording Session for a MBMS Context (Signalling based) - PS domain

4.2.5.3 CS Domain stopping mechanisms

A Trace Recording Session shall be stopped when the MSC Server and MGW detect any of the stop triggering events.

However, if a MSC Server receives a Trace Session deactivation either from its EM (in case of tracing roaming subscribers) or from HSS (in case of tracing home subscribers) during an ongoing Trace Recording Session, it may stop it immediately or at any time until the occurrence of an appropriate stop-triggering event.

A MGW shall stop a Trace Recording Session when it receives a MOD command with trace package (indicating Trace Deactivation) from the MSC Server or at any time until the occurrence of an appropriate stop-triggering event.

When a Trace Recording Session is stopped in a MSC Server, the MSC Server shall send a Trace Session deactivation message to the NEs where tracing was required, as defined in the "List of NE types" configuration parameter, received in the Trace Session activation message. The Trace Reference, used for the deactivation procedure, shall be the same as used in the MSC Server for the activation of the Trace Session.

The following figure illustrates a successful case in tracing a call, when a Trace Recording Session is stopped. (Reference 3GPP TS 23.205 [7] and 3GPP TS 23.108 [8].)

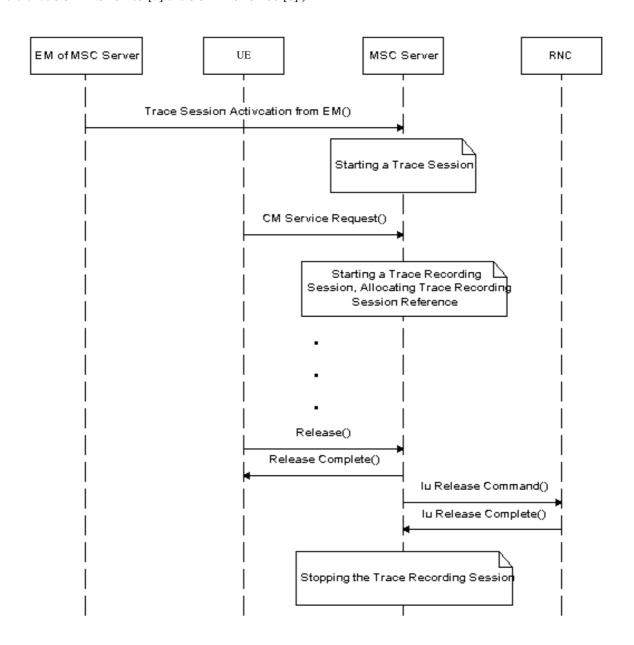


Figure 4.2.5.3.1: Stopping a Trace Recording Session (Signalling based) - CS domain

void

4.2.5.4	Void
4.2.5.5	void
4.2.5.5.1	void
4.2.5.5.2	void

4.2.5.6 void

4.2.5.5.3

4.2.5.7 E-UTRAN stopping mechanisms

In an eNB the Trace Recording Session will always be the same as the Trace Session as no triggering events are defined in E-UTRAN. Therefore a Trace Recording Session shall always be stopped in an eNB when the eNB deactivates the Trace Session since there can be only 1 trace reference/trace recoding session reference combination per Trace Session at any given time. For more information on Trace Session deactivation in E-UTRAN, see subclause 4.1.4.8.

4.2.5.8 EPC Domain stopping mechanisms

A Trace Recording Session may be stopped when the MME/SGW/PGW detect any of the stop triggering events. Detection of a stop trigger event results in MME/SGW/PGW immediately stopping the trace recording session.

However, if an MME receives a Trace Session deactivation either from its EM (in case of tracing roaming subscribers) or from HSS (in case of tracing home subscribers) during an ongoing Trace Recording Session, it may stop it immediately or at any time until the occurrence of an appropriate stop-triggering event.

When a Trace Recording Session is stopped in an MME, the MME may send a S1-Deactivate Trace message to the eNB where tracing was required, as defined in the "List of NE types" configuration parameter, received in the Trace Session activation message. If the triggering event parameter indicates that all events shall be traced, the MME shall not send the S1-Deactivate Trace message to the eNB. If the Trace Recording Session is not terminated in the MME, then it shall not be deactivated in the eNB. The Trace Reference, used for the deactivation procedure, shall be the same as used in the MME for the activation of the Trace Session. This only applies to the eNB as the PGW and SGW have their own triggering criteria.

4.2.5.9 EPC stopping mechanisms for MDT

There is no stopping mechanism in the EPC for MDT trace recording sessions, as there are no starting mechanisms either (see also clause 4.2.3.8).

4.2.5.10 E-UTRAN stopping mechanisms for MDT

In case of immediate MDT, the eNodeB shall stop an ongoing trace recording session for a given UE when a trace session deactivation is received from the MME. The eNodeB shall deactivate the corresponding MDT measurements in the UE.

If the configured area scope is not satisfissed in the target cell after a handover, the eNB may deactivate the Immediate MDT configured to the UE like explained in clause 4. 4.

In case of logged MDT, there is no stopping mechanism in the eNodeB. The eNodeB does not need to maintain a logged MDT trace recording session once it has been configured in the UE.

4.2.5.11 Stopping mechanisms at UE for MDT

In case of logged MDT, the UE shall stop an ongoing trace recording session when logging duration expires and it shall indicate the availability of logged measurement results to the network next time it enters connected mode.

The UE shall discard an ongoing logged MDT trace recording session when it receives a new logged MDT trace recording session configuration from the network.

- 4.2.6 Void
- 4.2.7 Void
- 4.2.8 Void
- 4.2.8.1 Void
- 4.2.8.2 Void
- 4.2.9 Void

4.3 RLF reporting

4.3.1 Trace session activation for RLF reporting

RLF reporting is activated to the eNB as a special Trace Session where the job type indicates RLF reporting only. The detailed procedure is shown in figure 4.3.1 where one UE experiences an RLF event and the reestablishment is successful to the source eNB.

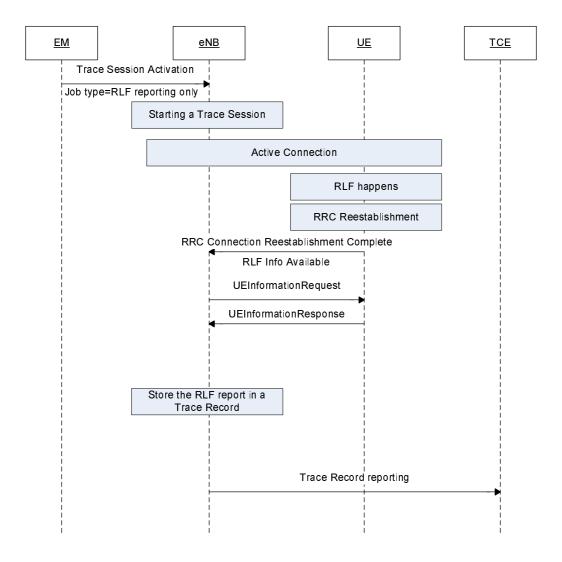


Figure 4.3.1.1 Example scenario for RLF reporting when UE reestablishment is successful at source eNB.

When the eNB receives the Trace Session activation indicating RLF reporting only, the eNB shall start a Trace Session. This Trace Session shall collect only RLF reports received from the UE. The Trace Session activation message received from the EMS shall contain the following information:

- Trace Reference
- Job type=RLF reporting only
- IP address of the TCE

Figure 4.3.2 shows another example where the UE reestablishment is failed in the source eNB, but successful at a target eNB.

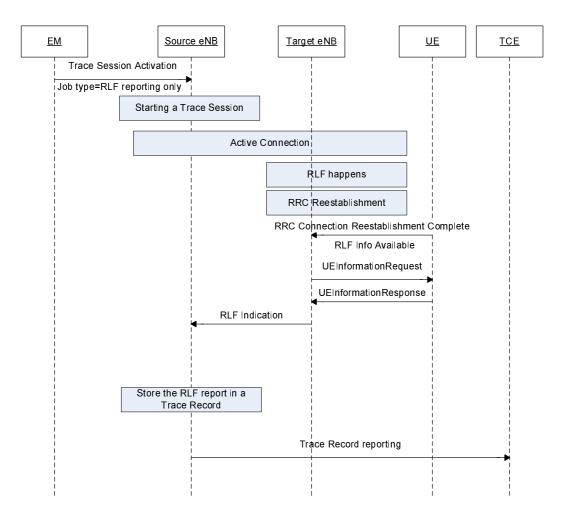


Figure 4.31.2 Example scenario for RLF reporting when the UE reestablishment is successful at target eNB

If the UE re-establishes the RRC connection successfully at the target eNB the RLF reports are fetched by the target eNB. The target eNB forwards the RLF report in the X2 RLF Indication message. The procedures to be used at eNB to forward the RLF reports towards the management system is the same as the reporting will be done by the source eNB in this case.

If a UE detects a Radio Link Failure event, it collects certain information as described in TS 36.300[37] and TS 36.331 [32]. Once the eNB retrieved the RLF report from the UE or received it from the target eNB via X2, as defined in TS 36.300[37], it shall save to the Trace Record. The Trace Record containing the RLF reports can be transferred to the TCE in the same mechanism as for normal subscriber and equipment trace or for MDT.

4.3.2 Trace session deactivation for RLF reporting

When the eNB receives the indication from the EM for trace session deactivation with the job type "RLF reporting only", it shall deactivate the trace session for the indicated trace reference of RLF reporting and stop RLF reporting to the TCE.

4.4 Handling of MDT Trace sessions at handover for Immediate MDT

The eNB/RNC shall activate the Immediate MDT in the UE if the area based selection conditions are satisfied or not in the target cell after a handover that is made over X2 or S1 (or over Iur or Iu in case of UMTS). If the area based

selection conditions are not satisfied in the handover target cell, the eNB/ RNC may deactivate the Immediate MDT in the UE. The trace sessions and trace recording sessions are not visible for the UE.

In case of signalling based trace activation (subscription based MDT), the eNB/RNC shall propagate the Trace Session parameters together with the MDT specific parameters to the target cell regardless of whether the source or target cell is part of the configured area scope in case of an Intra-PLMN handover over X2 or S1 (or Iur or Iu in case of UMTS).

In case of UTRAN the RNC shall propagate the Trace Session of the UE to the target cell in case of a handover over Iur or Iu. Any trace recording session shall be maintained, stopped or started in the target cell according to the evaluation of the selection criteria.

For LTE, the MDT configuration received by signalling based trace messages for a specific UE will propagate during intra-PLMN handover, and may propagate during inter-PLMN handover if the Signalling Based MDT PLMN List is available and includes the target PLMN. This behaviour applies also for MDT configuration that includes area scope, regardless of whether the source or target cell is part of the configured area scope.

For UMTS, the MDT configuration received by signalling based trace messages for a specific UE will continue during intra-PLMN handover, and may continue during inter-PLMN handover if the Signalling Based MDT PLMN List is available and includes the target PLMN, except for the case of SRNS relocation. In the case of SRNS relocation, MDT may be reactivated by the Core Network following a successful relocation.

For signalling based MDT configuration (i.e. subscription based MDT), when a UE that has been configured with MDT hands over to another eNB (i.e., in connected mode) and the Signalling Based MDT PLMN List conditions mentioned above are satisfied:

- with an X2 handover: the MDT configuration shall be passed to the eNB in the X2 handover request for continuity of MDT data collection. The new eNB shall stop the MDT collection if the new conditions are not within the criteria for MDT data collection.
- with an S1 handover and with no MME relocation: with S1 handover the MME shall ensure the MDT configuration is sent to the new eNB.
- with an S1 handover and with MME relocation: MDT configuration shall be passed on to the new MME on MME relocation. During inter-MME handover, the MME shall propagate the MDT configuration parameters to the target MME within an S10- Forward Relocation Request message as part of inter-MME handover procedures. The new MME shall save the information as part of the UE context and forward the MDT configuration to the new eNB.

The following MDT configuration shall be passed during handovers (Either intra-eNB, inter-eNB or inter-MME HO):

- Trace Session Reference
- Trace Recording Session Reference
- Area scope
- List of measurements
- Report Amount
- Reporting Trigger
- Event Threshold
- Report Interval
- IP address of TCE
- Job type
- Measurement period LTE (if either of the measurements M4, M5 is requested)
- Positioning method
- Collection period for RRM measurements LTE (present only if any of M2 or M3 measurements are requested)
- MDT PLMN List

Note that at the same time not all the parameters can be present. The conditions are described in clause 5.10 of the present document.

4.5 Handling of MDT Trace sessions at handover for Logged MDT

In logged MDT mode, no propagation of the MDT configuration is performed.

4.6 User consent handling in MDT

4.6.1 Signalling based MDT

In case of signalling based MDT getting user consent before activating the MDT functionality is required because of privacy and legal obligations. It is the Operator responsibility to collect user consent before initiating an MDT for a specific IMSI or IMEI number.

Collecting the user consent shall be done via customer care process. The user consent information availability should be considered as part of the subscription data and as such this shall be provisioned to the HSS database.

The following figure summarizes the functionality.

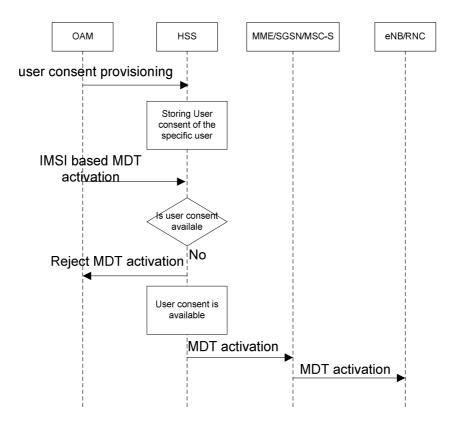


Figure 4.5.1.1

When the IMSI based MDT is activated it is targeted the HSS. Once the user consent availability information is stored in the HSS database, the HSS can check the user consent availability before starting a Trace Session for the given subscriber. If there is no user consent given by the specific user to network where TCE resides, the HSS should not start a Trace Session for the given subscriber.

As the user consent availability information is stored as part of the subscription data it should also be transferred to the MME/SGSN/MSC-S during update location procedure. This is required if the subscription based MDT is started from MME/SGSN/MSC-S. In that case similar checking is required as in the HSS case.

It should also be possible to handle user consent revocation. The process of user consent revocation shall be done also via customer care process and the user consent availability information should be updated in the HSS DB when a user consent revocation happens.

If the user consent revocation happens during an ongoing Trace Session with MDT, it is not required to stop and deactivate the Trace Recording Session, Trace Session respectively immediately i.e. to stop an ongoing Trace Recording Session in case of Immediate MDT. A notification to the management system should be sent and the management system should deactivate the Trace Session.

4.6.2 Area based MDT

In case of area based MDT getting user consent is required before activating the MDT functionality because of privacy and legal obligations. The same user consent information can be used for area based MDT and for signalling based MDT (i.e. there is no need to differentiate the user consent per MDT type).

Collecting the user consent shall be done via customer care process. The user consent information availability shall be considered as part of the subscription data and as such this shall be provisioned to the HSS database.

The following figure shows an example scenario summarizing the functionality.

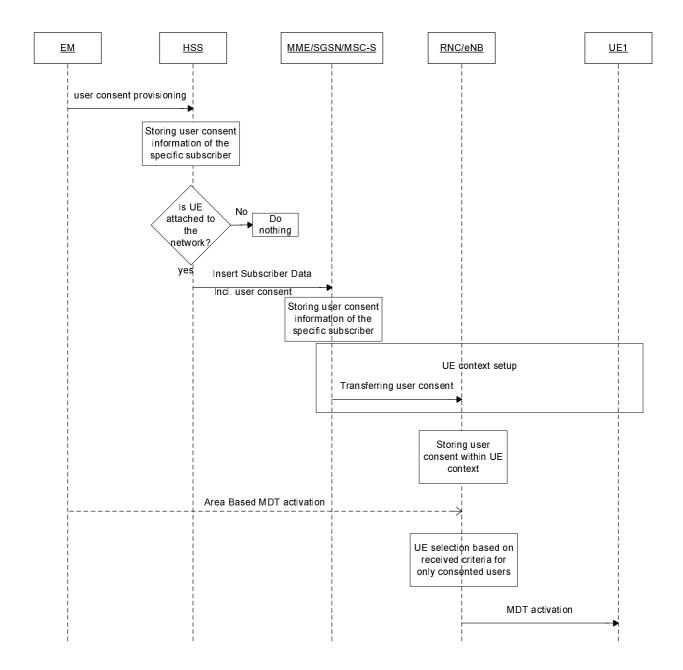


Figure 4.6.2.1: Example for delivering user consent information in area based MDT

When UE attaches to the network, the HSS shall forward the user consent information, stored in the HSS database, to the corresponding MME/SGSN/MSC-S. When the MME/SGSN/MSC-S receive the user consent information it shall store it in its subscriber database.

The MME/SGSN/MSC-S shall also check the roaming status of the user. If the user is within his home operator's PLMNs and the user has given his consent, the MME/SGSN/MSC-S shall send the Management Based MDT Allowed IEto the eNB/RNC during the UE context setup procedure. Otherwise the MME/SGSN/MSC-S shall not send the Management Based MDT Allowed IE to the eNB/RNC.

If the result of the roaming status check indicates a home subscriber, MME/SGSN/MSC-S shall forward the already stored user consent information to the corresponding eNodeB/RNC as part of Management Based MDT Allowed IE.

When the area based MDT activation is sent to eNodeB/RNC, eNodeB/RNC shall check the availability of the Management Based MDT Allowed IE before making the UE selection. In case the Management Based MDT Allowed IE is not available, the eNodeB/RNC shall not select the UE. In case the Management Based MDT Allowed IE is available, the eNodeB/RNC shall verify if the UE's RPLMN matches the PLMN where TCE resides – Trace Reference PLMN (PLMN portion of the Trace Reference). In case of a mismatch, the eNodeB/RNC shall not select the UE. The eNB/RNC shall forward the received Management Based MDT Allowed IE during X2/Iur based handovers to the target node. The Management Based MDT Allowed IE is stored in the eNB/RNC as part of the UE context. If the user consent information is updated while a UE context is already set up in the eNB, the changed user consent should be taken into account in the next call/session setup.

4.7 Anonymization of MDT data for area based MDT

If the job type is either Immediate MDT or Logged MDT or combined Immediate MDT and trace, the anonymization requirements are applicable as described in this clause.

In case of UTRAN/E-UTRAN the anonymization of MDT data depends on the configuration parameter received at the MDT configuration. There are two levels of anonymization:

- Using IMEI-TAC.
- Not sending any identity to the TCE.

If the anonymization indicates that no identity should be sent to the TCE:

- For E-UTRAN the eNB should not send the CELL TRAFFIC TRACE message to the MME.
- For UTRAN the RNC should not send the UPLINK INFORMATION EXCHANGE REQUEST message to the SGSN/MSC Server.

If the anonymization indicates that thIMEI-TACe is required:

- For E-UTRAN eNB should send the CELL TRAFFIC TRACE message to the MME and shall put immediate MDT or logged MDT in the privacy indicator IE according to the job type parameter.. MME shall look up of the IMEI-TAC and send to the TCE if the privacy indicator indicates logged MDT or Immediate MDT
- For UTRAN the RNC shall send the UPLINK INFORMATION EXCHANGE REQUEST message to the SGSN/MSC Server with IMSI information. SGSN/MSC Server shall find the corresponding IMEI and send the IMEI-TAC to the TCE..

4.8 RCEF reporting

4.8.1 Trace session activation for RCEF reporting

RCEF reporting is activated to the eNB as a special Trace Session where the job type indicates RCEF reporting only. The detailed procedure is shown in figure 4.8.1.1 where a UE experiences an RCEF event and the RRC establishment is successful to the same eNB.

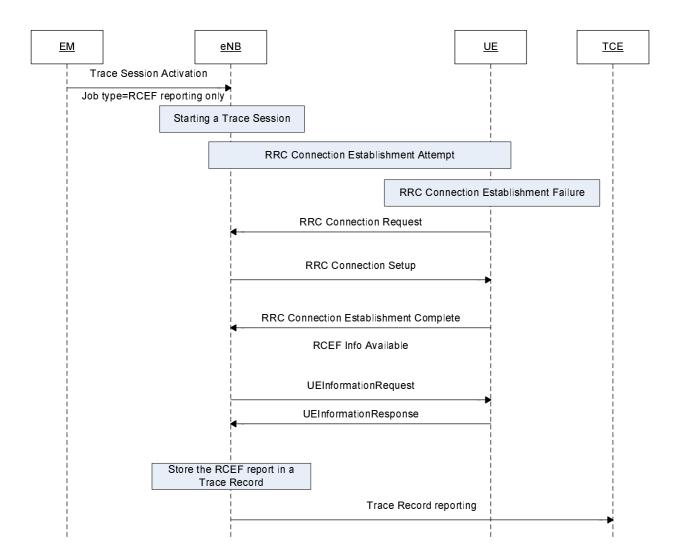


Figure 4.8.1.1 Example scenario for RCEF reporting when UE RRC establishment is successful to the same eNB.

When the eNB receives the Trace Session activation indicating RCEF reporting only, the eNB shall start a Trace Session. This Trace Session shall collect only RCEF reports received from the UE. The Trace Session activation message received from the EMS shall contain the following information:

- Trace Reference
- Job type=RCEF reporting only
- IP address of the TCE

Figure 4.8.1.2 shows another example where the UE RRC Establishment is failed to one eNB, but successful to another eNB.

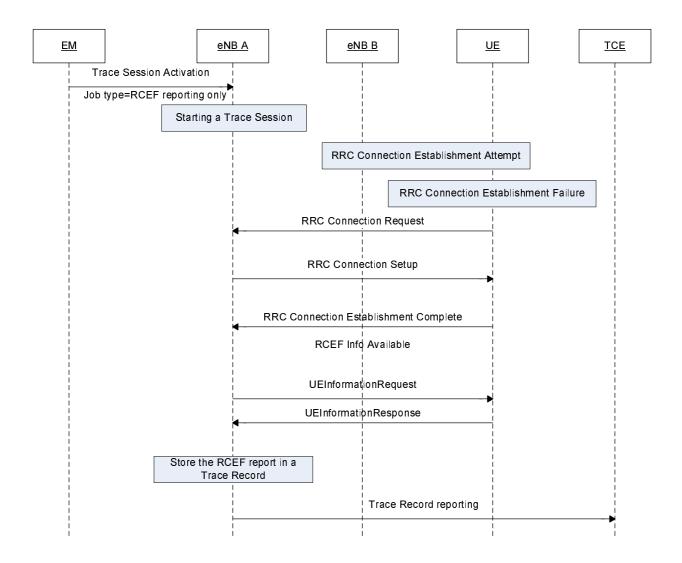


Figure 4.8.1.2 Example scenario for RCEF reporting when the UE RRC establishment is successful to a different eNB

If the UE establishes the RRC connection successfully the RCEF reports are fetched by the eNB. The procedures to be used at eNB to forward the RCEF reports towards the management system are the same regardless of whether RCEF occurred at this eNB or a different eNB.

If a UE detects a RRC Connection Establishment Failure event, it collects certain information as described in TS 37.320[30]. Once the eNB retrieved the RCEF report from the UE, as defined in TS 37.320[30], it shall save it to the Trace Record. The Trace Record containing the RCEF reports can be transferred to the TCE in the same mechanism as for normal subscriber and equipment trace or for MDT.

4.8.2 Trace session deactivation for RCEF reporting

When the eNB receives the indication from the EM for trace session deactivation with the job type "RCEF reporting only", it shall deactivate the trace session for the indicated trace reference of RCEF reporting and stop RCEF reporting to the TCE.

5 Trace/UE measurement control and configuration parameters

5.1 Triggering events (M)

This mandatory parameter defines when to start a Trace Recording Session and which message shall be recorded first, when to stop a Trace Recording Session and which message shall be recorded last respectively. The messages in the start triggering event tables indicate the transaction to be recorded first and the starting time of the Trace Recording Session within a Trace Session for the traced MS/subscriber in the given NE.

The messages in the stop triggering event tables indicate the transaction to be recorded last and the stopping time of the Trace Recording Session.

MSC Server	Start triggering events	Stop triggering events
Mobile Originated Call	Receipt of the CM SERVICE-REQUEST message with service type set to originating call establishment	Reception of CC-RELEASE COMPLETE or CM-SERVICE ABORT message
Mobile Terminated Call	Sending of PAGING REQUEST message	Reception of CC-RELEASE COMPLETE or CM-SERVICE ABORT message
Mobile Originated SMS	Receipt of the CM SERVICE-REQUEST message with service type set to Short Message service	Transmission of RP-ACK/RP-NACK message
Mobile Terminated SMS	Sending of PAGING REQUEST message	Reception of RP-ACK/RP-NACK message
IMSI Attach	Receipt of the MM-LOCATION UPDATING REQUEST message	Sending of MM-LOCATION-UPDATING ACCEPT or MM-LOCATION-UPDATING-REJECT message
Location Update	Receipt of the MM-LOCATION UPDATING REQUEST message	Sending of MM-LOCATION-UPDATING ACCEPT or MM-LOCATION-UPDATING-REJECT message
IMSI Detach	Receipt of the MM-IMSI DETACH INDICATION message	Reception of MM-IMSI DETACH INDICATION message
Handover	Receipt of the BSSMAP-HANDOVER-REQUIRED message in case of GSM or RANAP-RELOCATION-REQUIRED message in case of UMTS	Reception of BSSMAP-CLEAR COMPLETE message in case of GSM or RANAP-IU RELEASE COMPLETE message in case of UMTS or BSSMAP-HANDOVER FAILURE in case of GSM or RANAP-RELOCATION FAILURE in case of UMTS.
Supplementary Service	TBD	TBD

MGW	Start triggering events	Stop triggering events
Context	Reception of H.248-ADD command, or reception of H.248 MODIFY command	Sending of H.248- SUBTRACT reply

SGSN	Start triggering events	Stop triggering events
PDP Context	Reception of SM-ACTIVATE PDP CONTEXT REQUEST or sending SM-REQUEST	Reception or sending of SM- DEACTIVATE PDP CONTEXT
	PDP CONTEXT ACTIVATION or reception of SM- MODIFY PDP CONTEXT	REQUEST or sending SM-ACTIVATE PDP CONTEXT
	REQUEST	REJECT
Mobile Originated SMS	Receipt of RP-DATA message	Transmission of RP-ACK/RP-NACK message
Mobile Terminated SMS	Transmission of RP-DATA message	Reception of RP-ACK/RP-NACK message
GPRS Attach	Reception of MM-ATTACH-REQUEST	Sending MM-ATTACH-ACCEPT or MM-ATTACH-REJECT
Routing Area Update	Reception of MM-ROUTING AREA UPDATE REQUEST	Sending MM-ROUTING AREA UPDATE ACCEPT or MM-
		ROUTING AREA UPDATE REJECT
GPRS Detach	Reception MM-DETACH REQUEST	Reception of MM-DETACH ACCEPT
MBMS Context	Sending SM-Request MBMS Context Activation or reception of SM-Update MBMS	Sending of SM-Deactivate MBMS Context Request or
	Context Request	sending of SM-Activate MBMS Context Reject

GGSN	Start triggering events	Stop triggering events
PDP Context	Reception of GTP Create PDP context request or reception of GTP Update PDP context request	Sending of GTP Delete PDP context response
MBMS Context	Reception of GTP Create MBMS Context Request or reception of GTP Update MBMS Context Request	Sending of GTP Delete MBMS Context Response

IMS Network Element	Start triggering events	Stop triggering events
SIP session or	Reception of an initial SIP request that	Sending of a SIP final response to a SIP BYE or other request (originating or terminating), timer expiry
standalone transaction	matches the start trigger event configured by	or other event that matches the stop trigger event configured by the Management System via the
	the Management System via the Trace IRP	Trace IRP TS 32.442 [24].
	TS 32.442 [24]	

BM-SC	Start triggering events	Stop triggering events
MBMS Multicast service	Reception of MBMS Authorization	Reception of Deactivation Indication for user deactivation or sending of Session Stop Request for
activation	Request	service deactivation

MME	Start triggering events	Stop triggering events
Service request	Reception of NAS: Service Request message or S11: Downlink Data Notification	Reception of S11: Modify Bearer Response or sending of NAS: SERVICE REJECT
	Note: The Service Request message shall not start a new Trace Recording	Note: Modify Bearer Response shall stop the Trace
	Session when received after a Downlink Data Notification for the same service	Recording Session only if it has been sent as part of the
	request instance.	Service Request procedure
UE initiated PDN connectivity	Reception of NAS: PDN connectivity Request message	Reception of NAS PDN Connectivity Complete
Initial Attach, Tracking area update,	Initial Attach: Reception of the NAS: ATTACH REQUEST or of S6a Update	Initial Attach: Reception of the NAS: ATTACH
Detach	Location Answer	COMPLETE or sending of the NAS: ATTACH REJECT
	Tracking Area Update: Reception of the NAS: TRACKING AREA UPDATE REQUEST	Tracking Area Update: Sending of the NAS: TRACKING AREA UPDATE ACCEPT or sending of NAS: TRACKING
	Detach: Reception of the NAS: DETACH REQUEST or S3 Detach Notification	AREA UPDATE REJECT
	or S6a Cancel Location Request or sending of S11 Delete Session Request.	Detach: Sending of NAS: DETACH ACCEPT or S3 Detach Acknowledgement message or S6a Cancel
	Note: Cancel location location shall not trigger new Trace Recording Session if	Location Answer message or reception S11 Delete
	it is sent as part of the tracking area update procedure.	Session Response
	Note: The Delete Session Request message shall trigger a new Trace	
	Recording Session only if sent as part of a Detach procedure and only if a	Note: Cancel Location Answer shall not stop a Trace
	Detach Request has not been received for the same instance of the	Recording Session if it is sent as part of the TAU
	procedure.	procedure.
	Note: Update Location Answer shall be a start trigger for a Trace Recording	
	Session only if sent as part of Attach procedure and if containing Trace Data.	Note: The Delete Session Response message shall stop
		a Trace Recording Session only if sent as part of a
		Detach procedure and only if a Detach Request has not
		been received for the same instance of the procedure.
UE initiated PDN disconnection	Sending of the S11: Delete Session Request	Reception of NAS Deactivate EPS Bearer Context Accept
	Note: The S11 Delete Session Request message shall trigger a new Trace	
	Recording Session only if it is sent as part of the UE initiated PDN	
	disconnection procedure.	
Bearer	Bearer Activation: Reception of S11: Create Bearer Request	Bearer Activation: Sending of S11: Create Bearer
Activation/Modification/Deactivation	Bearer Modification: Reception of S11: Update Bearer Request	Response
	Bearer Deactivation: Reception of S11 Delete Bearer Request	Bearer Modification: Sending of S11: Update Bearer
	Note: Create Bearer Request shall not trigger a new trace recording session if	Response
	it is sent due to Dedicated bearer activation in combination with the default	
	bearer activation at Attach and UE requested PDN connectivity procedures	Bearer Deactivation: Sending of S11: Delete Bearer
		Response

Handover	Inter-eNB/Intra-MME: Reception of S1AP: Path Switch Request or S1AP Handover Required	Inter-eNB/Intra-MME: Sending of S1AP: Path Switch Request Acknowledge or S1AP: Path Switch Request
	Required	Failure, or S1AP: Handover Preparation Failure or S1AP: Handover Cancel Acknowledge or receiving Handover Notify Inter eNB - Inter MME / Inter RAT (source MME): Reception of S10/S3 Forward Relocation Complete Notification or sending of S1AP Handover Cancel Acknowledge or S1AP Handover Preparation Failure
		Inter eNB - Inter MME /Inter RAT (target MME): Sending of S10/S3 Forward Relocation Complete Notification or of S10/S3 Relocation Cancel Response or of S10/S3 Forward Relocation Response with reject cause value

SGW	Start triggering events	Stop triggering events
PDN connection creation	Reception of the S11: Create Session Request	Sending of the S11: Create Session Response
PDN connection termination	Reception of the S11: Delete Session Request	Sending of the S11: Delete Session Response
Bearer	Bearer Activation: Reception of the S5: Create Bearer Request or S11: Bearer	Bearer Activation: Sending of the S5: Create Bearer
Activation/Modification/Deactivation	Resource Command	Response
	Bearer Modification: Reception of the S11: Modify Bearer Request or S5:	Bearer Modification: Sending of the S11: Modify Bearer
	Update Bearer Request	Response or S5: Update Bearer Response
	Bearer Deletion: Reception of the S11: Deactivate Bearer Command or S5:	Bearer Deletion: Sending of S5: Delete Bearer Response
	Delete Bearer Request	

PGW	Start triggering events	Stop triggering events
PDN connection creation	Reception of S5: Create Session Request (GTP) or Proxy Binding Update (PMIP)	Sending of S5: Create Session Response (GTP) or Proxy Binding Update Ack (PMIP)
	Reception of S2b: Create Session Request (GTP)	Sending of S2b: Create Session Response (GTP)
PDN connection termination	Reception of the S5: Delete Session Request or Proxy Binding Update	Sending of the S5: Delete Session Response (GTP) or Proxy Binding Update ACK (PMIP)
	Reception of the S2b: Delete Session Request	(0.75)
		Sending of the S2b: Delete Session Response (GTP)
Bearer Activation/Modification/Deactivation	Bearer Activation: Sending of the S5/S2b: Create Bearer Request Bearer Modification: Reception of the S5: Modify Bearer Request or sending of	Bearer Activation: Reception of the S5/S2b: Create Bearer Response
	the S5/S2b: Update Bearer Request	Bearer Modification: Sending of the S5: Modify Bearer
based S5 interface.		Response or reception of the S5/S2b: Update Bearer
	S5/S2b: Delete Bearer Request	Response
		Bearer Deletion: Reception of the S5/S2b: Delete Bearer
		Response

Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1					
	MSC Server											
	MGW											
	SGSN											
			GG	SN								
	BM-SC											
	MME											
	PGW SGW											

MSC Server										
Bit 8	Bit 8 Bit 7 Bit 6 Bit 5 Bit 4 Bit 3 Bit 2 Bit 1									
spa	spare spare SS Handovers		Handovers	LU, IMSI attach, IMSI detach	MO and MT SMS	MO and MT calls				
	spare									

MGW								
Bit 8	Bit 8							
spare						spare	Context	

	SGSN										
Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1				
	spare MBMS Context			MBMS Context	RAU, GPRS attach, GPRS detach	MO and MT SMS	PDP context				
	Reserved										

	GGSN									
Bit 8	Bit 8									
spare					MBMS Context	PDP Context				

		MME											
Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1						
spare	Spare	Handover	Bearer Activation Modification Deletion	UE initiated PDN disconnection	Initial Attach, Tracking area update, Detach	Service requests	UE initiated PDN connectivity request						

PGW				SGW				
Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	
spare	Bearer	PDN	PDN	Spare	Bearer	PDN	PDN	
-	Activation	connection	connection		Activation	connection	Connection	
	Modification	termination	creation		Modification	termination	creation	
	Deletion				Deletion			

If a bit is set to 1 the given event shall be traced, i.e. a Trace Recording Session shall be started for that event.

If a bit is set to 0 the given event should not be traced, i.e. Trace Recording Session should not be started.

5.2 void

5.3 Trace Depth (M)

This mandatory parameter defines how detailed information should be recorded in the Network Element. The Trace Depth is a paremeter for Trace Session level, i.e., the Trace Depth is the same for all of the NEs to be traced in the same Trace Session.

The following table describes the values of the Trace Depth parameter.

Trace Depth	Meaning
Minimum	Recording of some IEs in the signalling messages plus any vendor specific extensions to this definition, in decoded format.
Medium	Recording of some IEs in the signalling messages together with the radio
	measurement IEs plus any vendor specific extensions to this definition, in
	decoded format.
Maximum	Recording entire signalling messages plus any vendor specific extensions
	to this definition, in encoded format.
MinimumWithoutVendorSpecificExtension	Recording of some IEs in the signalling messages in decoded format.
MediumWithoutVendorSpecificExtension	Recording of some IEs in the signalling messages together with the radio
	measurement IEs in decoded format.
MaximumWithoutVendorSpecifcExtension	Recording entire signalling messages in encoded format.

At least one of Minimum, Medium or Maximum trace Depth shall be supported depending on the NE type (see trace record description in TS 32.423 [3] for details).

Trace depth shall be an enumerated parameter with the following possible values:

- 0 -Minimum,
- 1 Medium
- 2 Maximum
- 3 MinimumWithoutVendorSpecificExtension
- 4 MediumWithoutVendorSpecificExtension
- 5 MaximumWithoutVendorSpecificExtension

5.4 List of NE types (M)

This conditional mandatory parameter defines the Network Element types where Trace Session activation is needed. The condition of this parameter is that signalling based activation mechanism is used except in IMS. This parameter determines whether the Trace Session Activation shall be propagated further to other Network Elements. In the management based activation mechanism, and in the signalling based activation mechanism for IMS, this parameter is not needed.

The following list contains the Network Element types:

- MSC Server
- MGW
- RNC
- SGSN
- GGSN
- BM-SC
- MME
- SGW
- PDN GW

- eNB

Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1
SGW	MME	BM-SC	RNC	GGSN	SGSN	MGW	MSC-S
spare							PDN GW

If a bit is set to 1, Trace Session to that Network Element shall be activated.

If a bit is set to 0, Trace Session is not needed in that Network Element.

5.5 List of interfaces (O)

This is an optional parameter, which defines the interfaces to be recorded in the Network Element.

The following list contains the list of interfaces in each Network Element:

- MSC Server: A, Iu-CS, Mc and MAP (G, B, E, F, D, C) interfaces, CAP.
- MGW: Mc, Nb-UP, Iu-UP.
- RNC: Iu-CS, Iu-PS, Iur, Iub and Uu interfaces.
- SGSN: Gb, Iu-PS, Gn, MAP (Gr, Gd, Gf), CAP (Ge), Gs, S6d, S4, S3, S13' interfaces.
- GGSN: Gn, Gi and Gmb interfaces.
- S-CSCF: Mw, Mg, Mr and Mi interfaces.
- P-CSCF: Gm and Mw interfaces.
- I-CSCF: Cx, Dx, Mg, Mw.
- MRFC: Mp, Mr.
- MGCF: Mg, Mj, Mn.
- IBCF: Ix, Mx.
- E-CSCF: Mw, Ml, Mm, Mi/Mg.
- BGCF: Mi, Mj, Mk.
- AS: Dh, Sh, ISC, Ut.
- HSS: MAP (C, D, Gc, Gr), Cx, S6d interfaces, S6a, Sh and location and subscription information.
- EIR: MAP (F), S13, S13', MAP (Gf)
- BM-SC: Gmb interface.
- MME: S1-MME, S3, S6a, S10, S11, S13
- SGW: S4, S5, S8, S11, Gxc
- PDN GW: S2a, S2b, S2c, S5, S6b, Gx, S8, SGi
- eNB: S1-MME, X2, Uu

NOTE: For IMS Network Elements other than P-CSCF and S-CSCF the interfaces included in the Trace Job for a particular type of IMS session are configured in the Management System via the Trace IRP (3GPP TS 32.442 [24]).

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1			
		MSC :	Server						
MGW									
SGSN									
		GG	SN						
		R1	VC						
		BM	-SC						
		1M	ME						
		SC	SW						
		PDN	I GW						
		el	NΒ						
HSS									
EIR									
	Bit 7	Bit 7 Bit 6	MSC MKC MKC SG GG RI BM MII SC PDN ef	MSC Server MGW SGSN GGSN RNC BM-SC MME SGW PDN GW eNB HSS	MSC Server MGW SGSN SGSN GGSN RNC BM-SC MME SGW PDN GW eNB HSS	MSC Server MGW SGSN SGSN GGSN RNC BM-SC MME SGW PDN GW eNB HSS			

	MSC Server									
Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1			
CAP	CAP MAP-F MAP-E MAP-B MAP-G Mc						Α			
	spare						MAP-D			

	SGSN										
Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1				
Ge	Gs	MAP-Gf	MAP-Gd	MAP-Gr	Gn	lu	Gb				
		spare		S13'	S3	S4	S6d				

MGW									
Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1		
		Spare	lu-UP	Nb-UP	Mc				

	GGSN									
Bit 8	Bit 8 Bit 7 Bit 6 Bit 5 Bit 4 Bit 3 Bit 2 Bit 1									
		spare			Gmb	Gi	Gn			

RNC								
Bit 8								
Spare				Uu	lub	lur	lu	

BM-SC								
Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	
	spare							

I	MME								
ĺ	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	
	Spare	е	S13	S11	S10	S6a	S3	S1-MME	

	SGW								
Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1		
Spare			Gxc	S11	S8b	S5	S4		

	PDN GW									
Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1			
SGi	S8b	Gx	S6b	S5	S2c	S2b	S2a			

	eNB									
Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1			
		Spare	Uu	X2	S1-MME					

HSS								
Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	
Sh	S6a	S6d	Сх	MAP-Gr	MAP-Gc	MAP-D	MAP-C	

	EIR									
Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1			
		Spare		MAP-Gf	S13'	S13	MAP-F			

If a bit is set to 1, the interface should be traced in the given Network Element.

If a bit is set to 0, that interface should not be traced in the given Network Element.

NOTE: The bit significance of the bitmaps defined above for the OAM interface can be different from the bit significance of the corresponding bitmaps in the signalling interface specifications.

5.6 Trace Reference (M)

The Trace Reference parameter shall be globally unique, therefore the Trace Reference shall compose as follows:

MCC+MNC+Trace ID, where the MCC and MNC are coming with the Trace activation request from the EM/NM to identify one PLMN containing the EM/NM, and Trace ID is a 3 byte Octet String.

NOTE 1: Trace ID referred here is the same as Trace reference in previous releases.

NOTE 2: The MCC+MNC being part of the Trace Reference from Rel-8 onwards (e.g. ignored by Rel-6 / Rel-7 UTRAN Network Elements), the uniqueness of the Trace Reference may not be guaranteed with Rel-6 / Rel-7 Network Element(s) involved in the Trace.

5.7 Trace Recording Session Reference (M)

This parameter shall be a 2 byte Octet String.

5.8 Void

5.9 IP Address of Trace Collection Entity (CM,CO)

This is a parameter which defines the IP address to which the Trace records shall be transferred. IPv4 and/or IPv6 address(es) may be signalled.

This parameter is mandatory when tracing in EPS is supported.

This parameter is mandatory when MDT is supported.

This parameter is optional when tracing in UMTS is supported.

5.9a Job type (CM)

The Job type is a conditional mandatory parameter. The condition is either MDT or RLF or RCEF data collection functionality is supported. It defines if a single trace job, a combined MDT and trace job or RLF report collection job or RCEF report collection job is activated. This parameter also defines the MDT mode. The Job type parameter is an enumerated type with the following values:

- Immediate MDT only (0);
- Logged MDT only (1);
- Trace only (2);
- Immediate MDT and Trace (3);
- RLF reports only (4);
- RCEF reports only (5).

NOTE: The Job type "RLF reports only" and "RCEF reports only" are applicable only in management based trace activation in E-UTRAN.

5.9b PLMN Target (CM)

This parameter defines the PLMN for which sessions shall be selected in the Trace Session in case of management based activation when several PLMNs are supported in the RAN (this means that shared cells and not shared cells are allowed for the specified PLMN. Furthermore, several PLMNs can be used for not shared RAN cases as well as for shared RAN cases.). Only the sessions may be selected where the PLMN that the UE reports as selected PLMN is the same as the PLMN Target.

Note that the PLMN Target might differ from the PLMN specified in the Trace Reference, as that specifies the PLMN that is containing the EM/NM requesting the Trace Session from the NE.

5.10 MDT specific configuration parameters (CM)

5.10.1 Void

5.10.2 Area Scope

The Area Scope optional parameter defines the area in terms or Cells or Tracking Area/Routing Area/Location Area where the MDT data collection shall take place. The area scope specified in a MDT session shall support the PLMN s of the MDT PLMN list (defined in clause 5.10.24). If the parameter is not present the MDT data collection shall be done throughout the PLMNs of the MDT PLMN list For further details see also TS 37.320 [30]..

The Area Scope parameter in UMTS is either

- list of Cells, identified by CGI. Maximum 32 CGI can be defined.
- List of Routing Area, identified by RAI. Maximum of 8 RAIs can be defined.
- List of Location Area, identified by LAI. Maximum of 8 LAIs can de defined.

The Area Scope parameter in LTE is either

- list of Cells, identified by E-UTRAN-CGI. Maximum 32 CGI can be defined.
- List of Tracking Area, identified by TAC with associated plmn-Identity-perTAC-List containing the PLMN identity for each TAC. Maximum of 8 TAC can be defined. For further details see also TS 36.331 [32].

5.10.3 List of measurements

This parameter is mandatory if the Job type is configured for Immediate MDT or combined Immediate MDT and Trace. This parameter defines the measurements that shall be collected. For further details see also TS 37.320 [30]. The parameter is 4 octet long bitmap with the following values in UMTS:

• M1: CPICH RSCP and CPICH Ec/No measurement by UE with Periodic or event 1F as reporting triggers.

- M2: For 1.28 Mcps TDD, P-CCPCH RSCP and Timeslot ISCP measurement by UE with event 1I as reporting triggers.
- M3: SIR and SIR error (FDD) by NodeB
- M4: UE power headroom (UPH) by the UE, applicable for E-DCH transport channels.
- M5: Received total wideband power (RTWP) by Node B
- M6: Data Volume measurement, separately for DL and UL, by RNC.
- M7: Throughput measurement, separately for DL and UL, per RAB and per UE, by RNC.
- Any combination of the above

•

The parameter can have the following values in LTE:

- M1: RSRP and RSRQ measurement by UE with Periodic, event A2 as reporting triggers
- M2: Power Headroom (PH) measurement by UE NOTE: Available from MAC layer
- M3: Received Interference Power measurement by eNB
- M4: Data Volume measurement separately for DL and UL by eNB
- M5: Scheduled IP Throughput measurement separately for DL and UL by eNB
- And any combination of above

				LTE				
Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	
spare	M5 for UL	M5 for DL	M4 for UL	M4 for DL	M3	M2	M1	
			5	spare				
			Ų	JMTS				
Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	
M7 for DL	M6 for UL	M6 for DL	M5	M4	M3	M2	M1	
spare								

5.10.4 Reporting Trigger

This parameter is mandatory if the list of measurements parameter is configured for UE side measurement (such as M1 measurement in LTE and M1/M2 measurement in UMTS) and the jobtype is configured for Immediate MDT or combined Immediate MDT and Trace.

The parameter shall not have the combination of periodical, event based and event based periodic reporting at the same time, i.e.:

- For LTE, only one of the bits 1, 2, and 5 can be set.
- For UMTS, bit 1 cannot be set at the same time with either bit 3 or bit 4.

The parameter is one octet long bitmap and can have the following values (detailed definition of the parameter is in 3GPP TS 37.320 [30]):

- Periodical,
- Event A2 for LTE:
- Event 1F for UMTS,

- Event 1I for UMTS 1.28 Mcps TDD,
- A2 event triggered periodic for LTE.
- All configured RRM event triggers for M1 measurement. S ee also TS 37.320 section 5.2.1.1 [30]

Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1
Reserved	All configured	All configured	A2 event triggered	Event 1I for UMTS 1.28 MCPS TDD	Event 1F for UMTS	Event A2 for LTE	Periodical
	RRM event	RRM event	periodic for LTE	1.20 WOT 0 100	OMIO	IOI ETE	
	triggers for UMTS	triggers for LTE					

5.10.5 Report Interval

This parameter is mandatory if the Reporting trigger is configured for Periodic UE side measurements a(such as M1 measurement in LTE and M1/M2 measurements in UMTS)nd the jobtype is configured for Immediate MDT or combined Immediate MDT and Trace. The parameter indicates the interval between the periodical measurements to be taken when UE is in connected.

The parameter is enumerated type with the following values in milliseconds in case of UMTS (detailed definition is in 3GPP TS 25.331 [31]:

- 250 ms (0),
- 500 ms (1),
- 1000 ms (2),
- 2000 ms (3),
- 3000 ms (4),
- 4000 ms (5),
- 6000 ms (6),
- 8000 ms (7),
- 12000 ms (8),
- 16000 ms (9),
- 20000 ms (10),
- 24000 ms (11),
- 28000 ms (12),
- 32000 ms (13),
- 64000 ms (14)

The parameter can have the following values in LTE (detailed definition is in 3GPP TS 36.331 [32]):

- 120 ms (15),
- 240 ms (16),
- 480 ms (17),
- 640 ms (18),

- 1024 ms (19),
- 2048 ms (20),
- 5120 ms (21),
- 10240ms (22),
- 1 min=60000 ms (23),
- 6 min=360000 ms (24),
- 12 min=720000 ms (25),
- 30 min=1800000 ms (26),
- 60 min=3600000 ms (27)

5.10.6 Report Amount

The parameter is mandatory if the reporting trigger is configured for periodical UE side measurement (such as M1 measurement in LTE and M1/M2 measurements in UMTS) and the jobtype is configured for Immediate MDT or combined Immediate MDT and Trace. The parameter defines the number of measurement reports that shall be taken for periodical reporting while UE is in connected. Detailed definition of the paremeter is in 3GPP TS 36.331 and 3GPP TS 25.331[31].

The parameter is an enumerated type with the following values in UMTS and in LTE:

- 1 (0),
- 2 (1),
- 4 (2),
- 8 (3),
- 16 (4),
- 32 (5),
- *64 (6)*,
- *infinity* (7)

5.10.7 Event Threshold for RSRP

The parameter is mandatory if the report trigger parameter is configured for A2 event reporting or A2 event triggered periodic reporting and the job type parameter is configured for Immediate MDT or combined Immediate MDT and Trace.

Detailed definition of the parameter is in 3GPP TS 36.331 [32].

• The parameter is an Integer number between 0-97.

5.10.7a Event Threshold for RSRQ

The parameter is mandatory if the report trigger parameter is configured for A2 event reporting or A2 event triggered periodic reporting and the job type parameter is configured for Immediate MDT or combined Immediate MDT and Trace.

Detailed definition of the parameter is in 3GPP TS 36.331 [32].

The parameter is an Integer number between 0-34.

5.10.8 Logging Interval

The parameter is mandatory if the job type is configured for Logged MDT. The parameter defines the periodicity for logging MDT measurement results for periodic downlink pilot strength measurement when UE is in Idle.

Detailed definition of the parameter is in 3GPP TS 37.320 [30].

The parameter is an enumerated type with the following values in UMTS and LTE as per defined in 3GPP TS 25.331 [31] and 36.331 [32]:

- 1.28 (0),
- 2.56 (1),
- 5.12 (2),
- 10.24 (3),
- 20.48 (4),
- 30.72 (5),
- 40.96 (6),
- 61.44 (7)

5.10.9 Logging Duration

The parameter is mandatory if the the job type parameter is configured for Logged MDT. The parameter determines the validity of MDT logged configuration for IDLE. The timer starts at time of receiving configuration by the UE, and continues independent of UE state transitions and RAT or RPLMN changes.

Detailed definition of the parameter is in 3GPP TS 37.320 [30], 3GPP TS 25.331 [31] and 3GPP TS 36.331 [32]:

The parameter is an enumerated type with the following values in UMTS and LTE:

- 600 sec (0),
- 1200 sec (1),
- 2400 sec (2),
- 3600 sec (3),
- 5400 sec (4),
- 7200 sec (5)

5.10.10 Void

5.10.11 Trace Collection Entity Id

This is a mandatory parameter for Logged MDT which defines the TCE Id which is sent to the UE. The UE returns it to the network together with the logged data. The network has a configured mapping of the IP address of the TCE (to which the Trace records shall be transferred) and the TCE Id. The mapping needs to be unique within the PLMN. The size of the parameter is one byte.

5.10.12 Anonymization of MDT data

This is a mandatory parameter for area based MDT when Job Type is

- Immediate MDT only (0);

- Logged MDT only (1);
- Immediate MDT and Trace (3).

This configuration parameter provides anonymization of MDT data (Refer to clause 4.4).

The parameter is an enumerated type with the following possible values:

- No Identity (0);
- IMEI-TAC (1)

5.10.13 Event Threshold for Event 1F

The parameter is mandatory if the reporting trigger parameter is configured for 1F event reporting and the job type parameter is configured for Immediate MDT or combined Trace and Immediate MDT.

The parameter defines the threshold for reporting UMTS M1 measurements for 1F event based reporting trigger Detailed definition of the parameter is in 3GPP TS 25.331 section 14.1.2.6 [31].

• The parameter is an Integer number between -120-165

The range used depends on the measurement:

- CPICH RSCP the range is: -120 25 dBm
- For CPICH Ec/No the range is -24 0 dB
- For Pathloss 30-165 dB.

5.10.14 Event threshold for Event 11

The parameter is mandatory if the reporting trigger parameter is configured for 11 event reporting and the job type parameter is configured for Immediate MDT or combined Trace and Immediate MDT.

The parameter defines the threshold for reporting UMTS M2 measurements for 1I event based reporting trigger. Detailed definition of the parameter is in 3GPP TS 25.331 section 14.1.3.3. [31].

• The parameter is an Integer number between -120 .. -25

5.10.15 Measurement quantity

The parameter is mandatory if the reporting trigger parameter is configured for 1F reporting and the job type parameter is configured for Immediate MDT or combined Trace and Immediate MDT.

The parameter describes for what M1 measurements the Event Threshold 1F parameter is applicable.

The parameter is a bitmap with the following values:

Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1
Reserved	Reserved	Reserved	Reserved	Reserved	Pathloss	CPICH RSCP	CPICH Ec/N0

No more than one bit shall be selected at a time.

- 5.10.16 void
- 5.10.17 void
- 5.10.18 void

5.10.19 Positioning Method

This parameter is optional and is used only if the job type is set to Immediate MDT or Immediate MDT and Trace.

This parameter defines what positioning method should be used for the MDT job. The parameter is a bitmap, each bit represents a positioning method. The parameter is applicable only for LTE. The bit1 (GNSS) may be selected only if the M1 measurement is selected in the "List of measurements" parameter (defined in Section 5.10.3).

If the positioning method parameter indicates both E-Cell ID and GNSS positioning, the eNB may use E-Cell ID measurement collection only if the UE does not provide GNSS based location information.

Bit 8	Bit 7	Bit 6	Bit 6 Bit 5 Bit 4		Bit 3	Bit 2	Bit 1
		E-Cell ID	GNSS				

If the parameter is not present, then best effort positioning method is used (i.e. in worst scenario only cell ID).

5.10.20 Collection period for RRM measurements LTE

This parameter is mandatory if the job type is set to Immediate MDT or Immediate MDT and Trace and any of the bits 2 (M2) or 3 (M3) of the list of measurements parameter (defined in Section 5.10.3) in LTE is set to 1. The parameter is used only in case of RAN side measurements whose configuration is determined by RRM.

This measurement parameter defines the collection period that should be used to collect available measurement samples in case of RRM configured measurements. The same collection period should be used for all such measurements that are requested in the same MDT or combined Trace and MDT job.

The parameter is an enumerated type with the following values:

- 1024 ms (0),
- 1280 ms (1),
- 2048 ms (2),
- 2560 ms (3),
- 5120 ms (4),
- 10240 ms (5),
- 1 min (6).

Some values may not be always available e.g., due to the large amount of logging they would generate in a highly loaded network. The selection of a specific subset of supported values at the eNB is vendor-specific.

5.10.21 Collection period for RRM measurements UMTS

This parameter is mandatory if the job type is set to Immediate MDT or Immediate MDT and Trace and any of the bits 3 (M3), 4 (M4), 5 (M5) of the list of measurements parameter (defined in Section 5.10.3) in UMTS is set to 1. The parameter is used only in case of RAN side measurements whose configuration is determined by RRM.

This measurement parameter defines the collection period that should be used to collect available measurement samples in case of RRM configured measurements. The same collection period should be used for all such measurements that are requested in the same MDT or combined Trace and MDT job.

The parameter is an enumerated type with the following values:

- 250 ms (0)
- 500 ms (1)
- 1000 ms (2),
- 2000 ms (3),
- 3000 ms (4),
- 4000 ms (5),
- 6000 ms (6),
- 8000 ms (7),
- 12000 ms (8),
- 16000 ms (9),
- 20000 ms (10),
- 24000 ms (11),
- 28000 ms (12),
- 32000 ms (13),
- 64000 ms (14)

Some values may not be always available e.g., due to the large amount of logging they would generate in a highly loaded network. The selection of a specific subset of supported values at the RNC is vendor-specific.

5.10.22 Measurement period UMTS

This parameter is mandatory if the job type is set to Immediate MDT or Immediate MDT and Trace and either the bit 6 or bit 7 or bit 8 or bit 9 of list of measurements parameter in UMTS (M6 for DL or M6 for UL or M7 for UL) is set to 1.

This measurement parameter defines the measuremet period that should be used for the Data Volume and Throughput measurements made by the RNC. The same measurement period should be used for the UL and DL.

The parameter is an enumerated type with the following values (the values 250ms (0) and 500ms (1) are not valid for this parameter):

- 250 ms (0),
- 500 ms (1),
- 1000 ms (2),
- 2000 ms (3),
- 3000 ms (4),
- 4000 ms (5),
- 6000 ms (6),
- 8000 ms (7),

- 12000 ms (8),
- 16000 ms (9),
- 20000 ms (10),
- 24000 ms (11),
- 28000 ms (12),
- 32000 ms (13),
- 64000 ms (14).

Some values may not be always available e.g., due to the large amount of logging they would generate in a highly loaded network. The selection of a specific subset of supported values at the RNC is vendor-specific.

5.10.23 Measurement period LTE

This parameter is mandatory if the job type is set to Immediate MDT or Immediate MDT and Trace and either the bit 4 or bit 5 or bit 6 or bit 7 of list of measurements parameter in LTE (M4 for DL or M4 for UL or M5 for DL or M5 for UL) is set to 1.

This measurement parameter defines the measuremet period that should be used for the Data Volume and Scheduled IP Throughput measurements made by the eNB. The same measurement period should be used for the UL and DL.

The parameter is an enumerated type with the following values:

- 1024 ms (0),
- 1280 ms (1),
- 2048 ms (2),
- 2560 ms (3),
- 5120 ms (4),
- 10240 ms (5)
- 1 min (6).

Some values may not be always available e.g., due to the large amount of logging they would generate in a highly loaded network. The selection of a specific subset of supported values at the eNB is vendor-specific.

5.10.24 MDT PLMN List

This is an optional parameter indicating the PLMNs where measurement collection, status indication and log reporting is allowed. E.g. the UE performs these actions for Logged MDT when the RPLMN is part of this set of PLMNs. Maximum of 16 PLMNs can be defined.

To the UE it is communicated as the plmn-IdentityList. Between the NEs it is communicated either as the Management Based MDT PLMN List or as the Signalling Based MDT PLMN List, depending on how the MDT was activated. For further details see also TS 37.320 [30], TS 36.331 [32] and TS 36.413 [36]

6 MDT Reporting

MDT reporting in case of Immediate MDT:

Figure 6.1 illustrates an example of the procedure for Immediate MDT reporting.

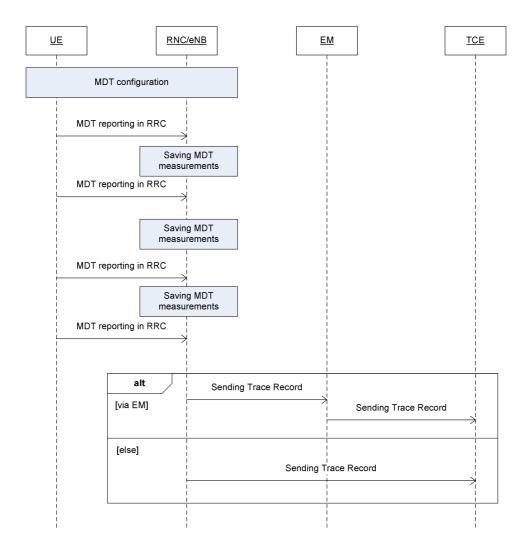


Figure 6.1

In case of Immediate MDT, the MDT related measurements are sent in RRC as part of the existing RRC measurements. Whenever the eNB/RNC receives the MDT measurements it shall save it to a Trace Record. The Trace Records are sent to the TCE either directly or via EM (where EM can reside in the eNB/RNC).

The time and the criteria when the Trace Records are sent to the TCE is vendor specific however if the Trace Session is deactivated, the Trace Records shall be sent to the TCE latest by 2 hours (the exact time is FFS) after the Trace Session deactivation.

Figure 6.2 illustrates an example of the MDT reporting in case of Logged MDT:

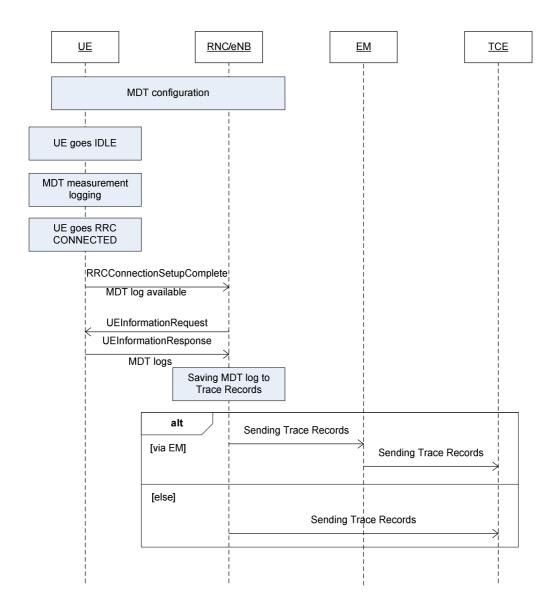


Figure 6.2:

In case of Logged MDT, the UE collects the measurements while it is in IDLE mode. Once the UE goes to RRC CONNECTED mode, the UE indicates MDT log availability in the RRCConnectionSetupComplete message to the eNB/RNC. When the eNB/RNC receives this indication it can request the MDT log (if the UE is still in the same RAT type where the MDT configuration was done) by sending the UEInformationRequest message to the UE. The MDT logs are sent to the network in the UEInformationResponse message. At the reception of the UEInformationResponse message the eNB/RNC shall save the received MDT log to the Trace Record. The Trace Records are sent to the TCE either directly or via EM (where EM can reside in the eNB/RNC).

The time and criteria when the Trace Records are sent to the TCE is vendor specific however if the Trace Session is deactivated, the Trace Records shall be sent to the TCE latest by 2 hours (the exact time is FFS) after the Trace Session deactivation.

Annex A (normative): Trace failure notification file format

A.1 Global structure

See 3GPP TS 32.615 [27].

The following XML namespaces are potentially used in Trace failure notification XML files:

- traceFailureNotification.xsd (see A.5)

A.2 XML elements fileHeader and fileFooter

A.2.1 XML elements fileHeader

See 3GPP TS 32.615 [27]

A.2.2 XML element fileFooter

See 3GPP TS 32.615 [27]

A.3 Trace failure notification specific XML elements

See A.5.

A.4 Trace IRP XML File Name Conventions

For Trace failure notification XML File Name Conventions the generic file name definitions as specified by the FT IRP apply (see [28]) with the "specificIRP extension" defined below.

<SenderType>.<SenderName>

SenderType field is the type of NE defined by IOC attribute managedElementType in 3GPP TS 32.622 [35] that recorded and sent the trace failure notification file; SenderName field is the identifier of the NE that recorded and sent the trace failure notification file.

Some examples describing the use of the "specificIRP_extension" in Trace failure notification naming:

specificIRP_extension: MME.MME04 meaning: file produced by MME<MME04>.

specificIRP_extension: ENB.ENB122 meaning: file produced by ENB<ENB122>.

file name: CT201105131405-060012MME.MME04

meaning: unique call trace (Trace failure notification) file produced by MME<MME04> on May 13, 2011 at 14:05 local with a time differential of -6 hours against UTC and expiring in 12 hours after creation

file name: CT201105131315-060012ENB.ENB122_-_2

meaning: second non-unique (RC="2") call trace (Trace failure notification) file produced by ENB<ENB122> on May 13, 2011 at 13:15 local with a time differential of -6 hours against UTC and expiring in 12 hours after creation.

A.5 Trace failure notification file XML schema

```
<?xml version="1.0" encoding="UTF-8"?>
  3GPP TS 32.422 Trace
  Trace failure notification file XML schema
 traceFailureNotification.xsd
<schema
 targetNamespace=
"http://www.3gpp.org/ftp/specs/archive/32_series/32.422#traceFailureNotification"
  elementFormDefault="qualified"
 xmlns="http://www.w3.org/2001/XMLSchema"
xmlns:tfn=
"http://www.3gpp.org/ftp/specs/archive/32_series/32.422#traceFailureNotification"
"http://www.3gpp.org/ftp/specs/archive/32_series/32.305#notification"
  <import</pre>
   namespace=
"http://www.3gpp.org/ftp/specs/archive/32_series/32.305#notification"
  <!-- XML types specific for trace failure notifications -->
<complexType name="TraceReference">
  <sequence>
    <element name="MCC" type="short" minOccurs="0"/>
<element name="MNC" type="short" minOccurs="0"/>
    <element name="TRACE_ID" type="integer"/>
  </sequence>
</complexType>
<complexType name="NotifyTraceRecordingSessionFailure">
  <complexContent>
    <extension base="xe:Notification">
    <sequence>
      <element name="body">
        <complexType>
          <sequence>
            <element name="NeId" type="string" minOccurs="0"/>
            <element name="TraceRecordingSessionReference" type="hexBinary" maxLength="4"</pre>
minOccurs="0"/>
            <element name="TraceReference" type="tfn:TraceReference"/>
            <element name="Reason" type="string" minOccurs="0"/>
        </complexType>
      </element>
    </sequence>
    </extension>
  </complexContent>
</complexType>
<element name="NotifyTraceRecordingSessionFailure" type="tr:NotifyTraceRecordingSessionFailure"/>
</schema>
```

Annex B (informative): Change history

D 4	T00 "	T00 D	100		Change history		1
Date		TSG Doc.	CR		Subject/Comment	Old	New
			0021		Introduction of Service Level Tracing for IMS	6.5.0	7.0.0
Sep 2006	SA_33	SP-060552	0022		Add general mechanism for starting trace recording sessions at IMS Network Elements and UE - to support end-to-end Service Level Tracing for IMS	7.0.0	7.1.0
Sep 2006	SA_33	SP-060552	0023		Add definition of Service Level Tracing Start Triggering Event	7.0.0	7.1.0
		SP-060552			Clarification of Trace session deactivation mechanism	7.0.0	7.1.0
Sep 2006	SA_33	SP-060552	0025		Add sending of trace control and configuration parameters for service level tracing	7.0.0	7.1.0
Sep 2006	SA_33	SP-060552	0026		Add starting trace recording at IMS network elements	7.0.0	7.1.0
		SP-060552			Add charging concepts for Service Level Tracing for IMS	7.0.0	7.1.0
•		SP-060552			Add stopping trace recording mechanism for service level tracing	7.0.0	7.1.0
			0029		Clarification to the sending of optional trace parameters	7.1.0	7.2.0
			0030		Network initiated re-authentication for SLT	7.1.0	7.2.0
			0031		Trace Session Deactivation at an IMS NE	7.1.0	7.2.0
			0032		Service level trace processes at the UE	7.1.0	7.2.0
			0033		Reception of SLT Start Trigger Event at an IMS NE	7.1.0	7.2.0
			0034		Service level tracing for IMS starting mechanism	7.1.0	7.2.0
		SP-060727 SP-060727	0035		Consistent usage of Service Level Tracing Start Triggering Event	7.1.0	7.2.0
		SP-060727 SP-080069			Retrieval of Trace Records from a UE Add Signalling Based Trace Activation procedures to EPC and E-	7.1.0 7.2.0	7.2.0 8.0.0
					UTRAŇ		
		SP-080287			Add definition of Trace control and configuration parameters for EPC and E-UTRAN	8.0.0	8.1.0
		SP-080287	0039		Add Trace Session deactivation procedures	8.0.0	8.1.0
	_	SP-080287			Add procedures for starting/stopping a trace recording session in EPC and E-UTRAN	8.0.0	8.1.0
			0041		Providing subscriber identities for Cell Traffic Trace - Procedures	8.1.0	8.2.0
		SP-080846		-	Identifying IMS network elements and interfaces for trace	8.2.0	8.3.0
		SP-080846		-	Trace starting and stopping trigger events for IMS	8.2.0	8.3.0
		SP-080846		-	Introduction of EPS in 32.422	8.2.0	8.3.0
		SP-080846		_	Fix inconsistencies in the definition of trace levels, trace reference parameter	8.2.0	8.3.0
			0046	-	Refinement of the Trace Reference	8.3.0	8.4.0
		SP-090207		-	Enhancement of trigger events in 3GPP TS 32.423 - align with 29.274, 29.272	8.3.0	8.4.0
		SP-090207		-	Trace Session activation/deactivation to PGW in case of non-3GPP access network	8.3.0	8.4.0
			0049	-	Add reference and definitions for trace failure notifications in 32.422	8.3.0	8.4.0
			0050	-	failed procedures	8.3.0	8.4.0
Mar 2009	SA_43	SP-090207	0051	-	EPC signalling activation mechanisms	8.3.0	8.4.0
		SP-090207		-	EPC and E-UTRAN signalling deactivation mechanisms	8.3.0	8.4.0
Mar 2009	SA_43	SP-090207	0053	-	Add the missing PGW to EPC trace recording session stopping mechanism	8.3.0	8.4.0
		SP-090289		-	Corrections on XML file format of the trace failure notifications	8.4.0	8.5.0
		SP-090289		-	Correcting Trace activation/deactivation flow to P-GW in case of PMIP based S5 interface	8.4.0	8.5.0
		SP-090289		-	Add missing Trace Interface list	8.4.0	8.5.0
		SP-090542			Clarification on Trace depth level	8.5.0	8.6.0
		SP-090542		-	Alignment of EPS Trace with TS 36.413	8.5.0	8.6.0
<u> </u>	_	SP-090534		-	Add reference to file format for sending IMSI/IMEI information from the MME	8.5.0	8.6.0
		SP-090534		-	Misleading statement on when cell traffic trace should be started	8.5.0	8.6.0
		SP-090542			Correction on XML file format for Trace failure notification	8.6.0	9.0.0
Sep 2009	SA_45	SP-090627	0060	-	Correction of Overview of Intra-PLMN and Inter-PLMN Signalling Activation	8.6.0	9.0.0
Jan 2010					Removal of track changes	9.0.0	9.0.1
		SP-100412		-	Clarification on E-UTRAN signalling based trace activation	9.0.1	9.1.0
		SP-100412			Corrections on UTRAN signalling based trace activation	9.0.1	9.1.0
		SP-100412		-	Correct List of EPC TRACE Starting Mechanisms	9.0.1	9.1.0
		SP-100264		-	Enhancement on E-UTRAN Trace Recording Session failure	9.1.0	10.0.0
		SP-100488		-	Corrections to start and stop triggering events in MME	10.0.0	10.1.0
		SP-100489		-	Addition of PGW in management based trace	10.0.0	10.1.0
		SP-100489		-	Correction of the figure of EPC Trace Session activation mechanism	10.0.0	10.1.0
•		SP-100489		<u> </u>	Unclarity about the list of Trace Control and Configuration parameters in case of management based activation		10.1.0
			0076		Add missing interfaces S3, S4 and S6d in the interface table of SGSN	10.1.0	10.2.0
Dec 2010	SA_50	SP-100858	00/8		Refine Trace conflict resolution to restrict no parallel TRSRs under one TR	10.1.0	10.2.0

Dec 2010 SA, 50 SP-100753 0080 1 Addinerfaces S13 (MME trace) and S13 (SSSN trace) - Align with 10.10 10.20 32.42 SP-100753 0080 1 Adding the procedures for managing Minimization of Drive Tests (MDT) 10.10 10.20 Interfaces 10.20 Interface 10.20 Int								
Dec 2010 SA_50 SP-1007S3 0800 1 Adding the procedures for managing Minimization of Drive Tests (MDT) 10.2	Dec 2010	SA_50	SP-100833	0074	3		10.1.0	10.2.0
Jan 2011	Dec 2010	SA_50	SP-100753	0800	1	Adding the procedures for managing Minimization of Drive Tests (MDT)	10.1.0	10.2.0
Mar 2011 SA_51 SP_11002 2081 2 Pandovers 2 Pan	Jan 2011	-	-	-	-	MCC editorial clean-up of clause 5.10.x numbering introduced by	10.2.0	10.2.1
Mar 2011 SA_51 SP-11002 00081 Mort	Mar 2011	SA_51				Correcting the handling of Minimization of Drive Tests (MDT) trace at	10.2.1	10.3.0
Mar 2011 S.4.51 S.2.10	Mar 2011	SA_51	SP-110102	0081	2		10.2.1	10.3.0
SP-110094 OBS 1 Entity (IMME) SP-110094 OBS 1 SP-110095 OBS 2 IRR Requirements IRR R	Mar 2011	SA 51	SP-110102	0083	1		10 2 1	10 3 0
Mar 2011 S.A.51 SP-110094 0.092 1 Server Requirements			SP-110094	0085	1	Entity (MME)		
Mar 2011 SA_51 SP-110094 0094 1 Session Activation for the attach procedure 10.2.1 10.3.0 10.3.			SP-110095	0088	2	update EPC starting mechanism - Align with 32.441 Trace Management IRP Requirements		
Mar 2011 S. S. S. S. S. S. S.	Mar 2011	SA_51	SP-110094	0092	1		10.2.1	10.3.0
Mar 2011 SA, 51 SP-110095 0008 1 Aldd support for subscribert trace on PDN-GW for GTP based S2b - 10.2.1 10.3.0	Mar 2011	SA_51	SP-110094	0094	1		10.2.1	10.3.0
Mar 2011 SA 51 SP-110102 0098 Parameters SP-110102 0098 Parameters SP-110102 0099 Align roses 3GP terminology on MDT work SP-110102 0101 O1010 O	Mar 2011	SA_51			1	Add support for subscriber trace on PDN-GW for GTP based S2b -	10.2.1	10.3.0
Mar 2011 S.A. 51 SP-111012 0099	Mar 2011	SA_51				Removing UE capability from Minimization of Drive Tests (MDT)	10.2.1	10.3.0
Mar 2011 SA 51 SP-110102 0100 2 Align the reporting trigger with RANZ TS 37.320 10.2.1 10.3.0	Mar 2011	SA_51			-	Change "UE based network performance measurements" to "MDT" -	10.2.1	10.3.0
Mar 2011 SA 51 SP-110102 O101 2 Update the E-UTRAN activation mechanism for area based MDT 10.2.1 10.3.0	M== 0044	0.4 54			-		40.0.4	40.0.0
Mar 2011 SA 51 SP-110095 0102 1 Add the trace interfaces for EIR and HSS 10.2.1 10.3.0								
Mar 2011 SA, 51 SP+110120 0103 3 Using TCE identity in logged MDT configuration 10.2.1 10.3.0								
Mar 2011 SA, 51 SP-110186 010 1 Clarify inconsistency in EPC initiated MDT text 10.3.0								
May SA					_			
May SA S2 2011 S P-110292 0103 4 Clairfy that there can be only one TRSR per TR at a given time per UE 10.3.0 10.4.0								
2011				0107	3			
May SA_52 SP-110292 0114 SP-110292 0115 3 Add error handling for Management based MDT scenarios 10.3.0 10.4.0		SA_52		04.00	,		10.3.0	10.4.0
Sp-110292 0114		04 50	SP-110292	0103	4	trace session for signalling based trace.	40.00	40.40
SP-110292 0115 3 Add error handling for Management based MDT scenarios 10.3.0 10.4.0	2011		SP-110292	0114	-	Modify UMTS M2 measurement - Align with RAN2 25.215 and 25.225		
May SA_52 SP-110292 0124 2 Add error handling for EPC Signalling based MDT scenarios 10.3.0 10.4.0		SA_52	SP-110292	0115	3	Add error handling for Management based MDT scenarios	10.3.0	10.4.0
May		SA_52		0116	3	Add error handling for EPC Signalling based MDT scenarios	10.3.0	10.4.0
May SA_52 SP-110292 O121 2 Add error handling for PS domain MDT activation scenarios 10.3.0 10.4.0	May	SA_52			1		10.3.0	10.4.0
May SA SP SP 110292 O122 2 Add error handling for CS domain MDT activation scenarios 10.3.0 10.4.0	May	SA_52					10.3.0	10.4.0
May SA_52 SP-110292 0124 2 Aligning MDT activation procedures with SA3 privacy requirements 10.3.0 10.4.0 10.4.0 10.3.0 10.4.0 10.4.0 10.3.0 10.4.0 10.4.0 10.3.0 10.4.0	May	SA_52					10.3.0	10.4.0
SP-110292 0124 2 Aligning MDT activation procedures with SA3 privacy requirements SA_52 SP-110292 0125 2 Adding definition of area based MDT and subscription based MDT 10.3.0 10.4.0		SA_52		0122	2	Add error handling for CS domain MDT activation scenarios	10.3.0	10.4.0
2011 SP-110292 0125 2 Adding definition of area based MDT and subscription based MDT 10.3.0 10.4.0	2011			0124	2	Aligning MDT activation procedures with SA3 privacy requirements	10 3 0	10.4.0
2011 SP-110292 0128 2 Add behaviour of signalling-based MDT when area criterion is not met May SA_52 SP-110286 112 - Update file naming convention for Trace failure notification files 11.0.0 11.0.0 11.1.0 Sep 2011 SA_53 SP-110537 0134 - Add PS domain MDT activiation procedure after UE attach 11.0.0 11.1.0 Sep 2011 SA_53 SP-110537 0144 1 RAI in MDT/LAI area scope 11.0.0 11.1.0 Sep 2011 SA_53 SP-110537 0149 1 MDT measurement alignment 11.0.0 11.1.0 Sep 2011 SA_53 SP-110537 0151 - Error correction on description of "TCE IP address" in MDT report 11.0.0 11.1.0 Sep 2011 SA_53 SP-110537 0154 1 Cleanup text forpropagation of Immediate MDT for inter MME scenario 11.0.0 11.1.0 Sep 2011 SA_53 SP-110537 0156 1 Correction in flow chart for area based MDT activation in E-UTRAN 11.0.0 11.1.0 Sep 2011 SA_53 SP-110538 0157 1 Enhancement for MDT Initiation with IMEI-TAC usage 11.0.0 11.1.0 Sep 2011 SA_53 SP-110537 0160 1 Align the user consent description with RAN3 and add description on activating MDT in home operator that uses more than one PLMN 11.0.0 11.1.0 11.2.0 Sep 2011 SA_54 SP-110715 0176 - Clean-up Immediate MDT handling at handover 11.1.0 11.2.0 Sep 2011 SA_54 SP-110715 0182 1 Error handling correction 11.1.0 11.2.0 Sep 2011 SA_54 SP-110715 0182 1 Error handling correction 11.1.0 11.2.0 Sep 2011 SA_54 SP-110715 0184 2 Add TCE address for UTRAN MDT activation 11.1.0 11.2.0 Sep 2011 SA_54 SP-110715 0184 2 Add TCE address for UTRAN MDT activation 11.1.0 11.2.0 Sep 2011 SA_54 SP-110715 0184 2 Add TCE address for UTRAN MDT activation 11.1.0 11.2.0 Sep 2011 SA_54 SP-110715 0184 2 Add TCE address for UTRAN MDT activation 11.1.0 11.2.0 Sep 2011 SA_54 SP-110715 0164 2 Correct MDT UE selection procedures to protect user privacy 11.1.0 11.2.0 Sep 2011	2011		SP-110292	0125	2	Adding definition of area based MDT and subscription based MDT		
SP-110286 112 - Update file naming convention for Trace failure notification files Sep 2011 SA_53 SP-110537 0144 1 RAI in MDT/LAI area scope 11.0.0 11.1.0 Sep 2011 SA_53 SP-110537 0149 1 MDT measurement alignment 11.0.0 11.1.0 11.1.0 Sep 2011 SA_53 SP-110537 0149 1 MDT measurement alignment 11.0.0 11.1.0 11.1.0 Sep 2011 SA_53 SP-110537 0154 1 Cleanup text forpropagation of Immediate MDT for inter MME scenario 11.0.0 11.1.0 Sep 2011 SA_53 SP-110538 0154 1 Cleanup text forpropagation of Immediate MDT for inter MME scenario 11.0.0 11.1.0 Sep 2011 SA_53 SP-110537 0156 1 Correction in flow chart for area based MDT activation in E-UTRAN 11.0.0 11.1.0 Sep 2011 SA_53 SP-110538 0157 1 Enhancement for MDT Initiation with IMEI-TAC usage 11.0.0 11.1.0 11.1.0 Sep 2011 SA_53 SP-110537 0160 1 Enhancement for MDT Initiation with IMEI-TAC usage 11.0.0 11.1.0 11.1.0 Sep 2011 SA_54 SP-110715 0176 - Clean-up Immediate MDT handling at handover 11.1.0 11.2.0 Dec 2011 SA_54 SP-110715 0182 1 Error handling correction 11.1.0 11.2.0 Dec 2011 SA_54 SP-110715 0184 2 Add TCE address for UTRAN MDT activation 11.1.0 11.2.0 Dec 2011 SA_54 SP-110715 0188 - Support multiple cells in area based MDT 11.1.0 11.2.0 Dec 2011 SA_54 SP-110715 0164 2 Correct MDT UE selection procedures to protect user privacy 11.1.0 11.2.0 Mar 2012 SA_55 SP-120053 0193 1 Aligning the MDT specification with RAN specifications TS 36.413 and 11.2.0 11.3.		SA_52	SP-110292	0128	2	Add behaviour of signalling-based MDT when area criterion is not met	10.3.0	10.4.0
Sep 2011 SA_53 SP-110537 0134 - Add PS domain MDT activiation procedure after UE attach 11.0.0 11.1.0 Sep 2011 SA_53 SP-110537 0141 1 RAI in MDT/LAI area scope 11.0.0 11.1.0 Sep 2011 SA_53 SP-110537 0149 1 MDT measurement alignment 11.0.0 11.1.0 Sep 2011 SA_53 SP-110537 0151 - Error correction on description of "TCE IP address" in MDT report 11.0.0 11.1.0 Sep 2011 SA_53 SP-110537 0156 1 Cleanup text forpropagation of Immediate MDT for inter MME scenario 11.0.0 11.1.0 Sep 2011 SA_53 SP-110537 0156 1 Correction in flow chart for area based MDT activation in E-UTRAN 11.0.0 11.1.0 Sep 2011 SA_53 SP-110538 0157 1 Enhancement for MDT Initiation with IMEI-TAC usage 11.0.0 11.1.0 Sep 2011 SA_54 SP-110715 0176 - Clean-up Immediate MDT handling at handover 11.1.0 11.1.0 11.1.0		SA_52	SP-110286	112	_	Update file naming convention for Trace failure notification files	10.4.0	11.0.0
Sep 2011 SA_53 SP-110537 0141 1 RAI in MDT/LAI area scope 11.0.0 11.1.0 11.1.0 Sep 2011 SA_53 SP-110537 0149 1 MDT measurement alignment 11.0.0 11.1.0 11.1.0 Sep 2011 SA_53 SP-110537 0151 - Error correction on description of "TCE IP address" in MDT report 11.0.0 11.1.0 Sep 2011 SA_53 SP-110538 0154 1 Cleanup text forpropagation of Immediate MDT for inter MME scenario 11.0.0 11.1.0 Sep 2011 SA_53 SP-110537 0156 1 Correction in flow chart for area based MDT activation in E-UTRAN 11.0.0 11.1.0 Sep 2011 SA_53 SP-110537 0160 1 Enhancement for MDT Initiation with IMEI-TAC usage 11.0.0 11.1.0 Sep 2011 SA_53 SP-110537 0160 1 Align the user consent description with RAN3 and add description on activating MDT in home operator that uses more than one PLMN 11.1.0 11.1.0 11.2.0 Dec 2011 SA_54 SP-110715 0176 -		SA 53			-		11.0.0	11.1.0
Sep 2011 SA_53 SP-110537 0149 1 MDT measurement alignment 11.0.0 11.1.0 Sep 2011 SA_53 SP-110537 0151 - Error correction on description of "TCE IP address" in MDT report 11.0.0 11.1.0 Sep 2011 SA_53 SP-110538 0154 1 Cleanup text forpropagation of Immediate MDT for inter MME scenario 11.0.0 11.1.0 Sep 2011 SA_53 SP-110537 0156 1 Correction in flow chart for area based MDT activation in E-UTRAN 11.0.0 11.1.0 Sep 2011 SA_53 SP-110538 0157 1 Enhancement for MDT Initiation with IMEI-TAC usage 11.0.0 11.1.0 Sep 2011 SA_53 SP-110538 0157 1 Enhancement for MDT Initiation with IMEI-TAC usage 11.0.0 11.1.0 Sep 2011 SA_53 SP-110538 0157 1 Enhancement for MDT Initiation with IMEI-TAC usage 11.0.0 11.1.0 Sep 2011 SA_53 SP-110538 0157 1 Enhancement for MDT Initiation with IMEI-TAC usage 11.0.0 11.1.0 <t< td=""><td></td><td></td><td></td><td></td><td>1</td><td></td><td></td><td></td></t<>					1			
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Sep 2011 SA_53 Align the user consent description with RAN3 and add description on activating MDT in home operator that uses more than one PLMN 11.0.0 11.1.0 Dec 2011 SA_54 SP-110715 0176 Clean-up Immediate MDT handling at handover 11.1.0 11.2.0 Dec 2011 SA_54 SP-110716 0177 Adding RLF reporting to Trace function 11.1.0 11.2.0 Dec 2011 SA_54 SP-110715 0182 1 Error handling correction 11.1.0 11.2.0 Dec 2011 SA_54 SP-110715 0184 2 Add TCE address for UTRAN MDT activation 11.1.0 11.2.0 Dec 2011 SA_54 SP-110715 0188 - Support multiple cells in area based MDT 11.1.0 11.2.0 Dec 2011 SA_54 SP-110715 0174 1 Align the Reporting Trigger parameter with the RAN implementation 11.1.0 11.2.0 Dec 2011 SA_54 SP-110715 0164 2 Correct MDT UE selection procedures to protect user privacy 11.1.0 11.2.0 Mar 2012 SA_55 SP-120053 <td< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></td<>								
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Mar 2012	SA55	SP-120054	0194	1	Add trace session deactivation of RLF reporting	11.2.0	11.3.0
June- 2012	SA56	SP-120368	0199		Remove MDT Country Restriction	11.3.0	11.4.0
June- 2012	SA56	SP-120368	0201		Align MDT Reporting with TS 32.421	11.3.0	11.4.0
June- 2012	SA56	SP-120367	0205	1	Correcting the Trace Recording Session stopping mechanism at eNB	11.3.0	11.4.0
June- 2012	SA56	SP-120369	0207		Editorial cleanup	11.3.0	11.4.0
Sep- 2012	SA57	SP-120645	0214	1	Clarification of different interpretations of bit significance in the "List of interfaces" parameter bitmap	11.4.0	11.5.0
Sep- 2012	SA57	SP-120570	0219	3	Correcting the missing event threshold parameters for the event 1F and event 1I reporting triggers	11.4.0	11.5.0
Sep- 2012	SA57	SP-120571	0220	1	Adding new MDT parameters to align with TS 37.320	11.4.0	11.5.0
Sep- 2012	SA57	SP-120570	0223	-	Add combined Trace and Immediate MDT job type to the MDT parameters scope	11.4.0	11.5.0
Sep- 2012	SA57	SP-120627	0226	1	Reference list correction to align with the corrected TS 29.212 title	11.4.0	11.5.0
		SP-120795	0217	2	Add RCEF reporting		
		SP-120796	0221	4	All RRM triggers to MDT in LTE and UMTS		
		SP-120783	0227	1	Correction of Trace Recording Session Reference (TRSR) data type		
		SP-120796	0229	1	Cleanup on the scope, references and abbreviations		
		SP-120794	0234	1	Correction of UMTS M2 Reporting trigger configuration		
		SP-120796	0236	1	Adding E-CID positioning measurement collection for MDT		
D:= 0040	C	SP-120796	0237	2	Introducing common measurement period for MDT measurements	44.50	44.00
Dic-2012	SA-58	SP-120795	0238	1	update mdt reporting trigger restriction text	11.5.0	11.6.0
	•	SP-120794	0240	-	add report amount clarification		
		SP-120795	0241	-	split MDT measurements into UL-DL		
		SP-120796	0243	1	Addition of Network Sharing		
		SP-120795	0244	1	Add measurement M7		
		SP-120795	0245	-	Combine measurement period parameters for LTE		
		SP-120794	0247	-	Clarify report interval parameter scope		
		SP-130048	0248	3	Add anonymization mechanism for UMTS MDT		
Mar-2013	SA-59	SP-130047	0250	-	Correct TAC abbreviation error	11.6.0	11.7.0
		SP-130048	0251	1	Support for Inter-RAT Trace/MDT		
June- 2013	SA-60	SP-130304	0252	-	Correction in the UMTS anonymization procedure	11.7.0	11.8.0
					Correction in the history table to the right version	11.8.0	11.8.1
Mar-2014	SA-63	SP-140031	0261	1	Add missing figure for RCEF reporting example scenario	11.8.1	11.9.0
		SP-140344	0263	1	Add missing MDT configuration parameters. Align with RAN specifications	11.9.0	11.10.0
Sep- 2014		SP-140570		1	Adding reference for location measurement Angle of Arrival for MDT	11.10.0	11.11.0
Jun 2015	SA-68	SP-150316	0271a	-	Remove IMS Service Level Trace	11.11.0	11.12.0

	Change history							
Date	Meeting	TDoc	CR	Rev	Cat	Subject/Comment	New version	
2020-07	SA#88e	SP-200488	0329	1	Α	Clean up of the editor notes	11.13.0	

History

	Document history						
V11.5.0	September 2012	Publication					
V11.6.0	January 2013	Publication					
V11.7.0	April 2013	Publication					
V11.8.1	August 2013	Publication					
V11.9.0	March 2014	Publication					
V11.10.0	July 2014	Publication					
V11.11.0	October 2014	Publication					
V11.12.0	July 2015	Publication					
V11.13.0	August 2020	Publication					