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Core Network and Interoperability Testing (INT);
GTPv2-C Conformance Testing for S11 Interface;
(3GPP™ Release 10);
Part 2: Test Suite Structure and Test Purposes (TSS&TP)

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Contents

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Foreword

This Technical Specification (TS) has been produced by ETSI Technical Committee Core Network and Interoperability Testing (INT).

The present document is part 2 of a multi-part deliverable. Full details of the entire series can be found in part 1 [2].

Modal verbs terminology

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

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1 Scope

The present document provides the Test Suite Structure (TSS) and Test Purposes (TP) for the test specifications for the GTPv2-C protocol on the S11 interface as specified in ETSI TS 129 274 [1] in compliance with the relevant requirements and in accordance with the relevant guidance given in ISO/IEC 9646-7 [4] and ETSI ETS 300 406 [5].

2 References

2.1 Normative references

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

Referenced documents which are not found to be publicly available in the expected location might be found at http://docbox.etsi.org/Reference.

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

[1] ETSI TS 129 274 (V10.14.0): "Universal Mobile Telecommunications System (UMTS); LTE; 3GPP Evolved Packet System (EPS); Evolved General Packet Radio Service (GPRS) Tunnelling Protocol for Control plane (GTPv2-C); Stage 3 (3GPP TS 29.274 version 10.14.0 Release 10)".

[2] ETSI TS 103 202-1: "Core Network and Interoperability Testing (INT); GTPv2-C Conformance Testing for S11 Interface; (3GPP Release 10); Part 1: Protocol Implementation Conformance Statement (PICS)".

[3] ISO/IEC 9646-1: "Information technology - Open Systems Interconnection - Conformance testing methodology and framework - Part 1: General concepts".

[4] ISO/IEC 9646-7: "Information technology - Open Systems Interconnection - Conformance testing methodology and framework - Part 7: Implementation Conformance Statements".

[5] ETSI ETS 300 406: "Methods for testing and Specification (MTS); Protocol and profile conformance testing specifications; Standardization methodology".

[6] ETSI TS 123 401: "LTE; General Packet Radio Service (GPRS) enhancements for Evolved Universal Terrestrial Radio Access Network (E-UTRAN) access (3GPP TS 23.401)".

[7] ETSI TS 124 301: "Universal Mobile Telecommunications System (UMTS); LTE; Non-Access-Stratum (NAS) protocol for Evolved Packet System (EPS); Stage 3 (3GPP TS 24.301)".

[8] ETSI TS 123 007: "Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); LTE; Restoration procedures (3GPP TS 23.007)".

[9] ETSI TS 123 402: "Universal Mobile Telecommunications System (UMTS); LTE; Architecture enhancements for non-3GPP accesses (3GPP TS 23.402)".

[10] ETSI TS 123 216: "Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); LTE; Single Radio Voice Call Continuity (SRVCC); Stage 2 (3GPP TS 23.216)".

[11] ETSI TS 123 203: "Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); LTE; Policy and charging control architecture (3GPP TS 23.203)".

2.2 Informative references

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

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

Not applicable.

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in ETSI TS 129 274 [1] and the following apply:

Abstract Test Method (ATM): Refer to ISO/IEC 9646-1 [3].

Abstract Test Suite (ATS): Refer to ISO/IEC 9646-1 [3].

Implementation Under Test (IUT): Refer to ISO/IEC 9646-1 [3].

Test Purpose (TP): Refer to ISO/IEC 9646-1 [3].

3.2 Abbreviations

For the purposes of the present document, the abbreviations given in ETSI TS 129 274 [1] and the following apply:

AMBR	Aggregate Maximum Bit Rate
APN	Access Point Name
APN-NI	Access Point Name Network Identifier
APN-OI	Access Point Name Operator Identifier
ARP	Allocation and Retention Priority
AS	Access Stratum
CDMA	Code Division Multiple Access
CN	Core Network
CS	Circuit Switched
DL	Downlink
eNB	E-UTRAN NodeB
EPC	Evolved Packet Core
EPS	Evolved Packet System
E-UTRAN	Evolved UTRAN
FQ-CSID	Fully Qualified PDN Connection Set Identifier
FQ-TEID	Fully Qualified Tunnel Endpoint Identifier
GBR	Guaranteed Bit Rate
GERAN	GSM/EDGE Radio Access Network
GPRS	General Packet Radio Service
GSM	Global System for Mobile Communications
GTP	GPRS Tunneling Protocol
GTP-U	GPRS Tunneling Protocol-User plane
GTPv2-C	GPRS Tunneling Protocol Version2-Control-plane
GW	Gateway
HLR	Home Location Register
HO	Handover
HRPD	High Rate Packet Data
HSS	Home Subscriber Server

ID	Identifier
IE	Information Element
IETF	Internet Engineering Task Force
IMSI	International Mobile Subscriber Identity
IP	Internet Protocol
IP-CAN	IP IP-Connectivity Access Network
LTE	Long Term Evolution
MEI	Mobile Equipment Identity
MME	Mobility Management Entity
NAS	Non Access Stratum
Non-GBR	Non-Guaranteed Bit Rate
OAM	Operation and Maintenance
PCC	Policy and Charging Control
PCRF	Policy and Charging Rules Function
PDN	Packet Data Network
PDN-GW	PDN-GateWay
PDP	Packet Date Protocol
PMIP	Proxy Mobile IP
QCI	Quality of Service Class Indicator
QoS	Quality of Service
RRC	Radio Resource Control
S1	S1-Interface
S1-AP	S1-Application Part
SGSN	Serving GPRS Support Node
S-GW	Serving Gateway
SN	Sequence Number
SRVCC	Single Radio Voice Call Continuity
TAD	Traffic Aggregate Description
TAI	Tracking Area Identity
TEID	Tunnel End Point Identifier
TFT	Traffic Flow Template
TP	Test Purpose
TSS	Test Suite Structure
UDP	User Datagram Protocol
UE	User Equipment
UE-AMBR	UE-Aggregate Maximum Bit Rate
UL	Uplink
UMTS	Universal Mobile Telecommunication System
UP	User Plane
UTRAN	UMTS Terrestrial Radio Access Network

4 Test configurations

4.1 Introduction

This clause lists the test equipment necessary to perform the test cases detailed in the present document, along with the network configurations required to execute all test cases included in the present document.

4.2 Network & Interface Configuration (Overview)

Figure 1 depicts the Network Configuration for regular test cases.

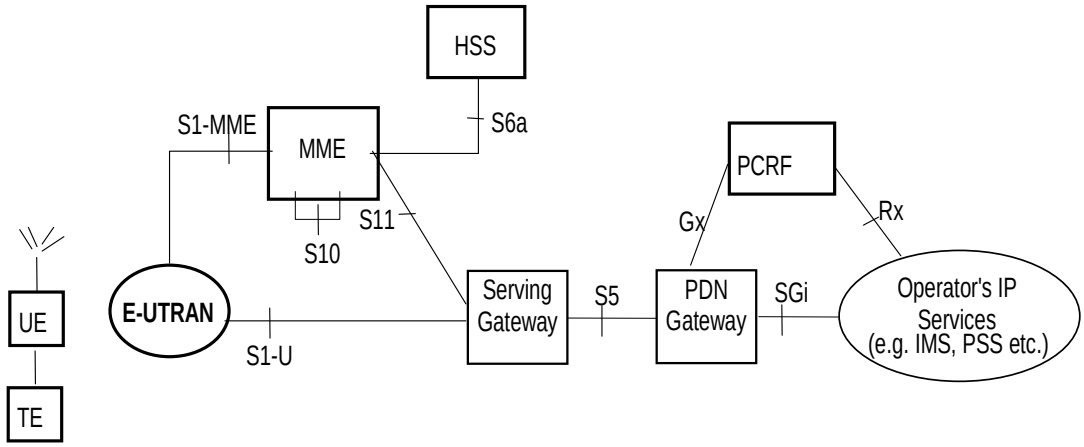


Figure 1: Network configuration for regular test cases

Figure 2 depicts the network configuration for intra-RAT HO test cases.

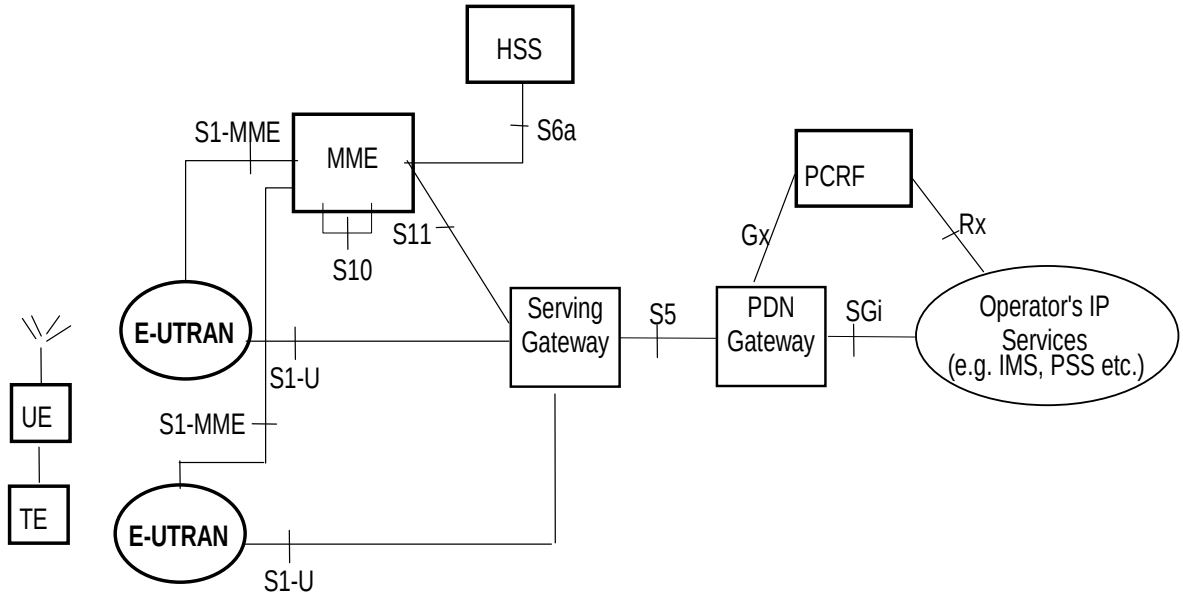


Figure 2: Network Configuration for Intra-RAT HO Test Cases

Figure 3 depicts the network configuration for inter-RAT HO test cases.

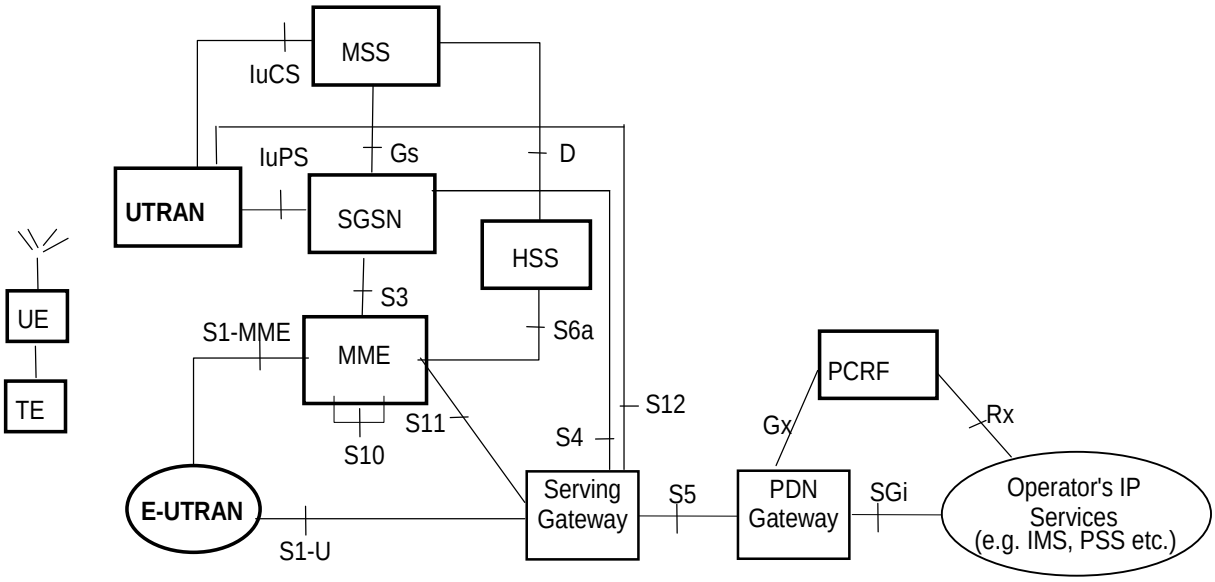


Figure 3: Network Configuration for Inter-RAT HO Test Cases

5 Test Suite Structure (TSS) and Test Purposes (TP)

5.1 Test Suite Structure

5.1.1 TP naming convention

TPs are numbered, starting at 001, within each group. Groups are organized according to the TSS.

Table 1: TP identifier naming convention scheme

Identifier: **<TP>_<scope>_<nn>**				
<tp>	=	Test Purpose:		fixed to "TP"
<scope>	=	group	PM	Path Management
			TM	Tunnel Management
			CSF_SRVCC	CS Fallback and SRVCC Related Messages
			N3GPP_AR	Non-3GPP Access Related Messages
			RR	Restoration and Recovery
			TMM	Trace Management Messages
<nn>	=	sequential number		(01 to 99)

5.1.2 Test strategy

As the base standard ETSI TS 129 274 [1] contains no explicit requirements for testing, the TPs were generated as a result of an analysis of the base standard and the PICS specification ETSI TS 103 202-1 [2].

5.1.3 TP structure

Each TP has been written in a manner which is consistent with all other TPs. The intention of this is to make the TPs more readable and checkable.

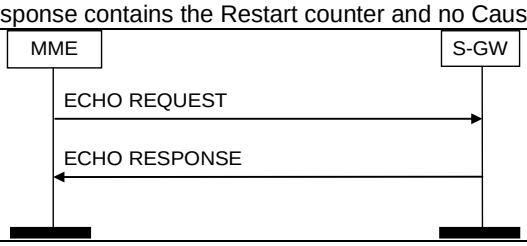
5.2 Test Purposes

5.2.1 PICS references

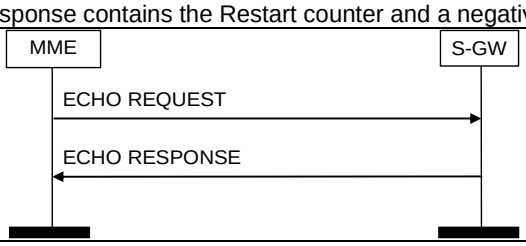
All PICS items referred to in this clause are as specified in ETSI TS 103 202-1 [2] unless indicated otherwise by another numbered reference. PICS items are only meant for test selection, therefore only PICS items with status optional or conditional are explicitly mentioned.

5.2.2 Path Management

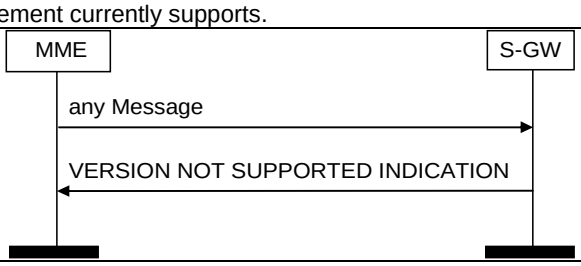
5.2.2.1 Successful Echo Request

TP_PM_01	**Standards Reference:** **ETSI TS 129 274 [1], clauses 7.1.1, 7.1.2**	**PICS item:**
Summary:	Successful Echo Request Procedure.	
Test purpose:	Verify the successful answering of Echo Request with Echo Response.	
Test Procedure:	1) EPC and RAN network available. 2) MME is configured with the GTP Tunnel Parameter. 3) S-GW is configured with the GTP Tunnel Parameter. 4) Verify IP connectivity between the two nodes. 5) Power on the MME and S-GW. 6) Trigger MME/S-GW to initiate the Echo Request Procedure.	
Expected Results:	1) GTP Echo Request is sent which contains the Recovery Information Element (IE). 2) The Recovery IE contains the local Restart counter. 3) The Echo Response contains the Restart counter and no Cause value.	
Expected Message Flow:		
Comments:		

5.2.2.2 Unsuccessful Echo Request

TP_PM_02	Standards Reference: ETSI TS 129 274 [1], clauses 7.1.1, 7.1.2	PICS item:
Summary:	Unsuccessful Echo Request Procedure.	
Test purpose:	Verify the successful answering of Echo Request with Echo Response with a negative cause value.	
Test Procedure:	1) EPC and RAN network available. 2) MME is configured with the GTP Tunnel Parameter. 3) S-GW is configured with the GTP Tunnel Parameter. 4) Verify IP connectivity between the two nodes. 5) Power on the MME and S-GW. 6) Trigger MME/S-GW (or simulator) initiates the Echo Request Procedure with an error.	
Expected Results:	1) GTP Echo Request is sent which contains the Recovery Information Element (IE). 2) The Recovery IE is either incorrect or has the wrong format. 3) The Echo Response contains the Restart counter and a negative Cause value.	
Expected Message Flow:		
Comments:		

5.2.2.3 Version Not Supported Indication

TP_PM_03	Standards Reference: ETSI TS 129 274 [1], clauses 7.1.3	PICS item:
Summary:	Version Not Supported Indication.	
Test purpose:	Verify the GTP version that the sending entity supports. If a GTP network element receives a message of unsupported GTP version, verify that the network element returns a Version Not Supported Indication message and that it discards the received message.	
Test Procedure:	1) EPC and RAN network available. 2) Network should be configured as show in Figure 3. 3) MME is configured with the GTP Tunnel Parameter. 4) S-GW is configured with the GTP Tunnel Parameter. 5) Verify IP connectivity between the two nodes. 6) Power on the MME and S-GW. 7) MME/S-GW (or simulator) initiates the Version Not supported Procedure by sending a GTP message which contains a version higher than the latest version.	
Expected Results:	1) Verify that any given GTP message (e.g. Echo Request) contains a version that is higher than the latest supported version. 2) Verify that the Version not Supported Indication contains the GTP version the network element currently supports.	
Expected Message Flow:		
Comments:		

5.2.3 Tunnel Management

5.2.3.1 Create Session Request/Response and Modify Bearer Request/Response Procedures

TP_TM_01	**Standards Reference: ETSI TS 129 274 [1], clauses 7.2.1, 7.2.2, 7.2.7, 7.2.8**	**PICS item:**
Summary:	Create Session Request/Response and Modify Bearer Request/Response.	
Test purpose:	Validate the Create Session Request/Response and the Modify Bearer Request/Response Procedure between MME and S-GW as part of the ATTACH Procedure.	
Test Procedure:	1) EPC, RAN, and one UE are available. 2) MME is configured the GTP Tunnel Parameter. 3) S-GW is configured with the GTP Tunnel Parameter. 4) Verify IP connectivity between the two nodes. 5) UE registers with and attaches to the network to receive services that require registration. 6) A default EPS bearer is setup as result of attachment. 7) This forces the Create Session and Modify Bearer Procedure.	
Expected Results:	1) Verify that the MME sends Create Session Request and receives the Create Session Response. 2) Verify that the MME sends the Modify Bearer Request and receives the Modify Bearer Response as part of the Attach procedure.	
Expected Message Flow:	See Figure 4.	
Comments:	The following notes apply to the message flow diagram in Figure 4. NOTE 1: For a PMIP-based S5/S8, procedure steps (A), (B), and (C) are defined in ETSI TS 123 402 [9]. Steps 7, 10, 13, 14, 15 and 23a/b concern GTP based S5/S8. NOTE 2: The Serving GWs and PDN-GWs involved in steps 7 and/or 10 may be different to those in steps 13-15. NOTE 3: The steps in (D) are executed only upon handover from non-3GPP access. NOTE 4: More detail on procedure steps (E) is defined in the procedure steps (B) in clause 5.3.8.3 of ETSI TS 123 401 [6]. NOTE 5: More detail on procedure steps (F) is defined in the procedure steps (B) in clause 5.3.8.4 of ETSI TS 123 401 [6].	

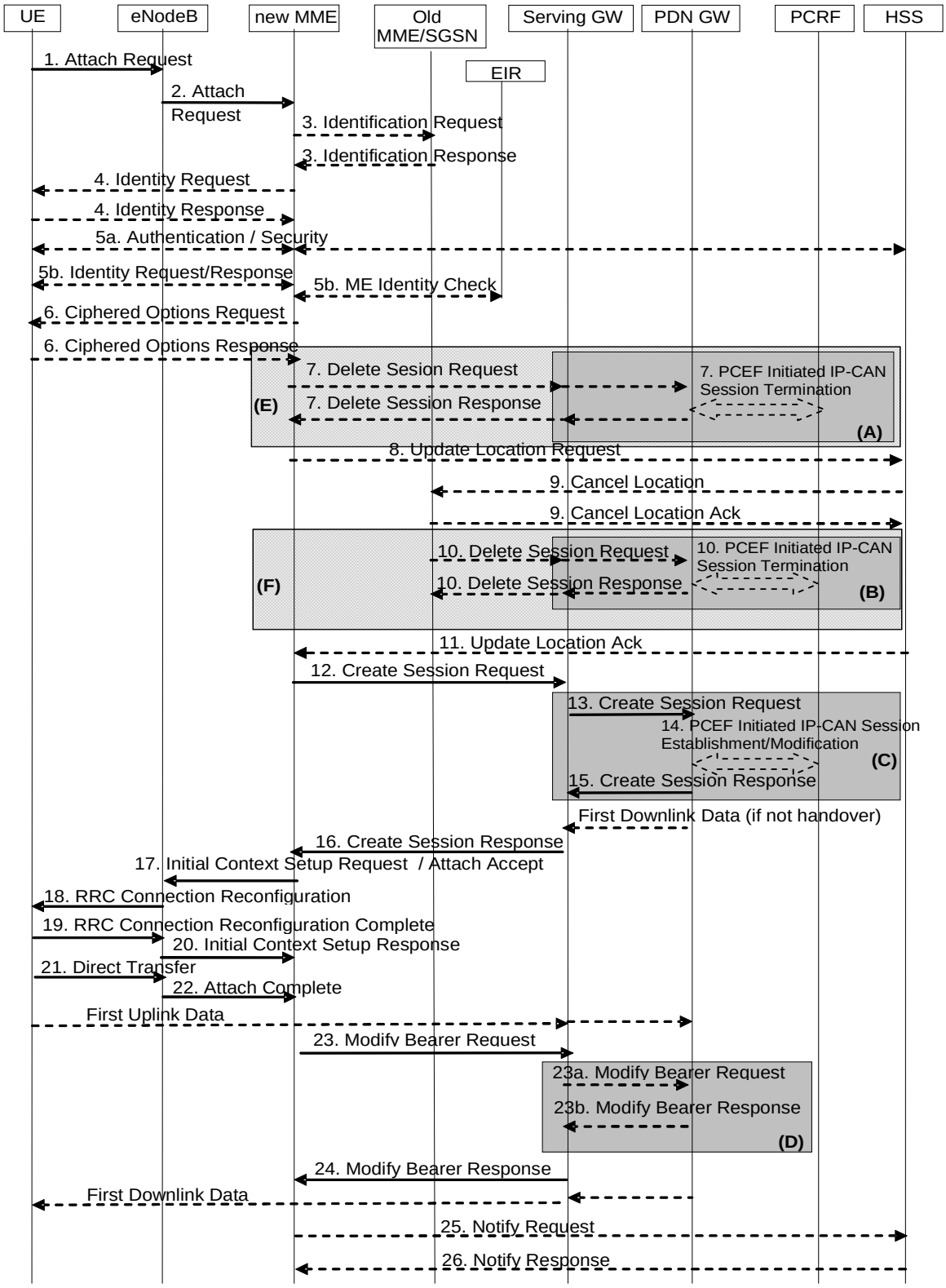
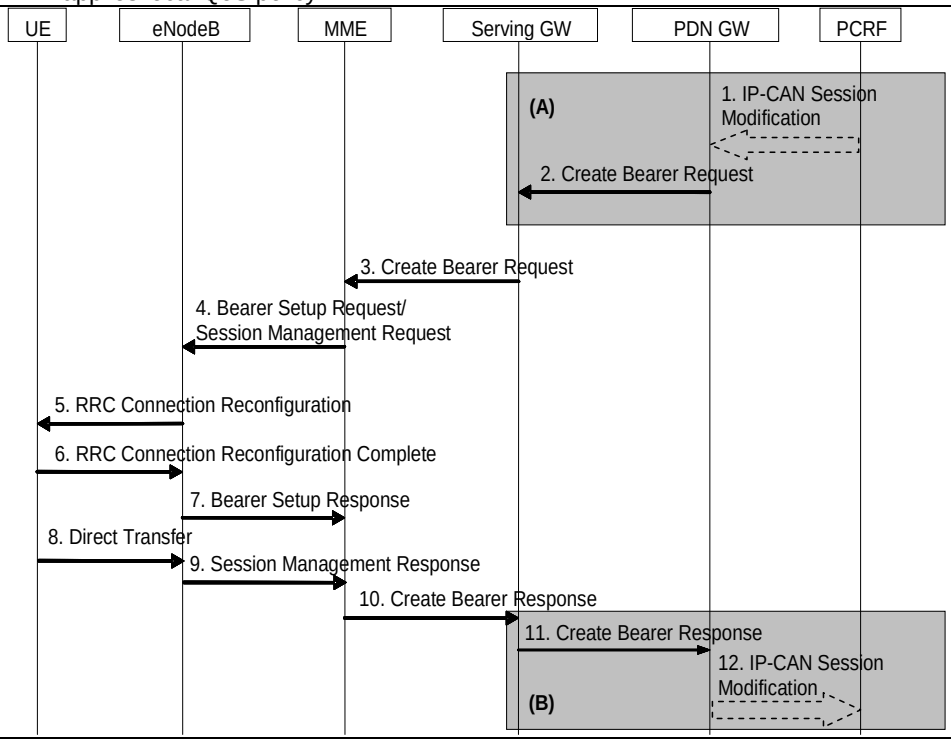
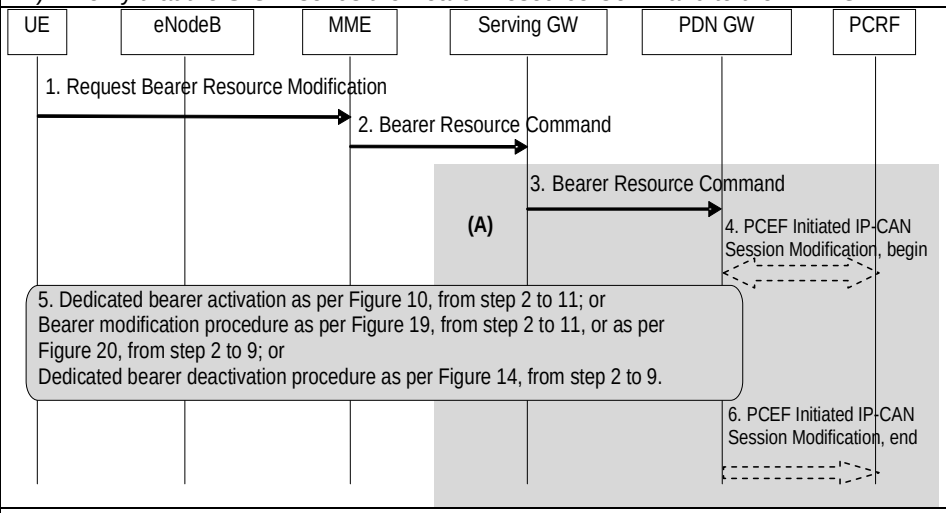


Figure 4: Message Flow for Test Case 5.2.3.1

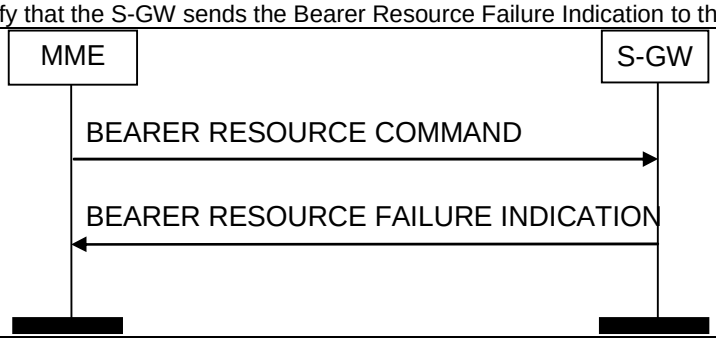
5.2.3.2 Dedicated Bearer Activation Procedure with GTP Create Bearer Request Procedure

TP_TM_02	**Standards Reference:** **ETSI TS 129 274 [1], clauses 7.2.3, 7.2.4** **ETSI TS 123 401 [6], clause 5.4.1**	**PICS item:**
Summary:	Dedicated Bearer Activation Procedure with GTP Create Bearer Request Procedure.	
Test purpose:	Validate that S-GW is able to request the MME to start Create Bearer Request Procedure.	
Test Procedure:	1) EPC, RAN and one UE available and access to the PDN-GW (P-GW) parameters/database. 2) MME is configured with the GTP tunnel parameter. 3) S-GW is configured with the GTP tunnel parameter. 4) Verify IP connectivity between the two nodes. 5) UE attaches to network. During the attach procedure the S-GW sends the Create Bearer Request message to the MME as part of the Dedicated Bearer Activation Procedure. 6) The QoS parameter is updated in the P-GW. The trigger is an IP-CAN Session Modification or the PDN-GW may apply local QoS policy (change over PDN-GW OAM the QoS parameter for this UE). An IP-CAN Session Modification is triggered e.g. due to a charging change (e.g. from flat rate to dedicated charging) or a QoS change (e.g. from GBR to Non-GBR) in the PCRF.	
Expected Results:	1) Verify that the MME sends back a Create Bearer Response message to the S-GW. 2) Verify that, in the case where dynamic PCC is deployed, the PCRF sends a PCC decision provision (QoS policy) message to the PDN GW. This is done via the IP-CAN Session Modification procedure as defined in ETSI TS 123 203 [11] up to the point that the PDN GW requests IP-CAN Bearer Signalling. 3) Verify that, in the case where dynamic PCC is not deployed, the PDN GW optionally applies local QoS policy.	
Expected Message Flow:		
Comments:	Messages 3-10 are common for architecture variants with GTP based S5/S8 and PMIP-based S5/S8. For a PMIP-based S5/S8, procedure message blocks (A) and (B) are defined in ETSI TS 123 402 [9]. Messages 1, 2, 11 and 12 concern GTP based S5/S8.	

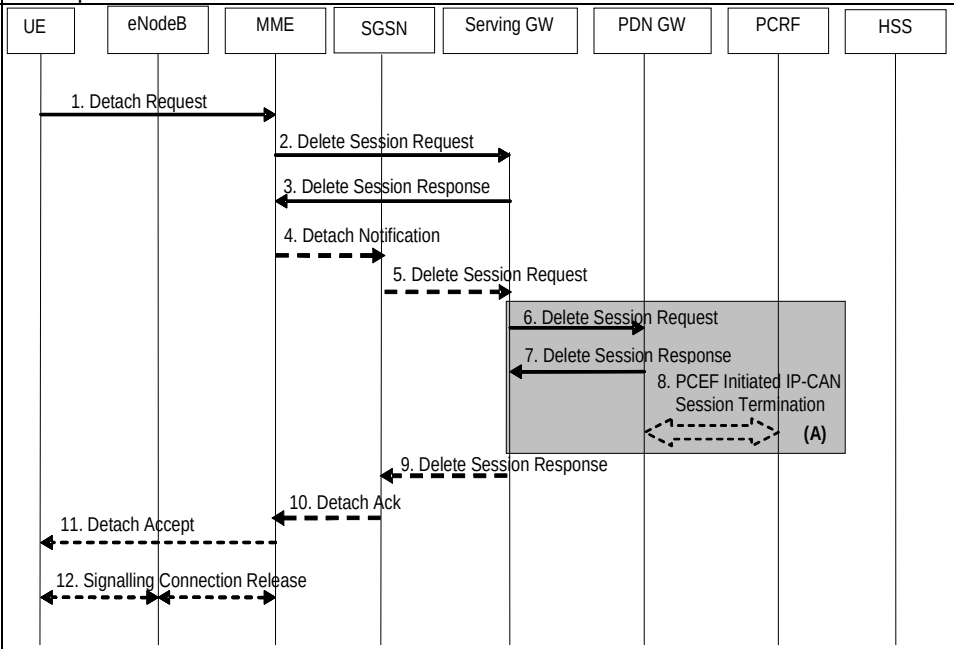
5.2.3.3 Bearer Resource Command Procedure

TP_TM_03	Standards Reference: ETSI TS 129 274 [1], clause 7.2.5 ETSI TS 123 401 [6], clause 5.4.5	PICS item:
Summary:	Bearer Resource Command Procedure.	
Test purpose:	A Bearer Resource Command message shall be sent from a MME to an S-GW and forwarded to the PDN-GW as a part of the UE requested bearer resource allocation procedure or UE requested bearer resource modification procedure. The UE triggers this procedure.	
Test Procedure:	1) EPC, RAN, and one UE available. 2) MME is configured with the GTP Tunnel Parameter. 3) S-GW is configured with the GTP Tunnel Parameter. 4) Verify IP connectivity between the two nodes. 5) UE attaches to the network. 6) The user starts an application on the UE and then changes to a different application (e.g. from Web browsing to FTP). 7) The MME sends a Bearer Resource Command to the S-GW.	
Expected Results:	1) Verify that the S-GW sends the Bearer Resource Command to the PDN-GW.	
Expected Message Flow:		
Comments:	Messages 1, 2, and 5 are common for architecture variants with GTP-based S5/S8 and PMIP-based S5/S8. The messages identified as (A) differ in the case that PMIP-based S5/S8 is employed and is defined in ETSI TS 123 402 [9]. The Bearer Resource Command Procedure allows the UE to request for a modification of bearer resources (e.g. allocation or release of resources) for one traffic flow aggregate with a specific QoS demand. Alternatively, the procedure allows the UE to request for the modification of the packet filters used for an active traffic flow aggregate, without changing QoS. If accepted by the network, the request invokes either the Dedicated Bearer Activation Procedure, the Bearer Modification Procedure or a dedicated bearer is deactivated using the PDN-GW Initiated Bearer Deactivation Procedure. The deactivation procedure is used by the UE when the UE already has a PDN connection with the PDN-GW. A UE can send a subsequent Request Bearer Resource Modification Message before the previous procedure is completed.	

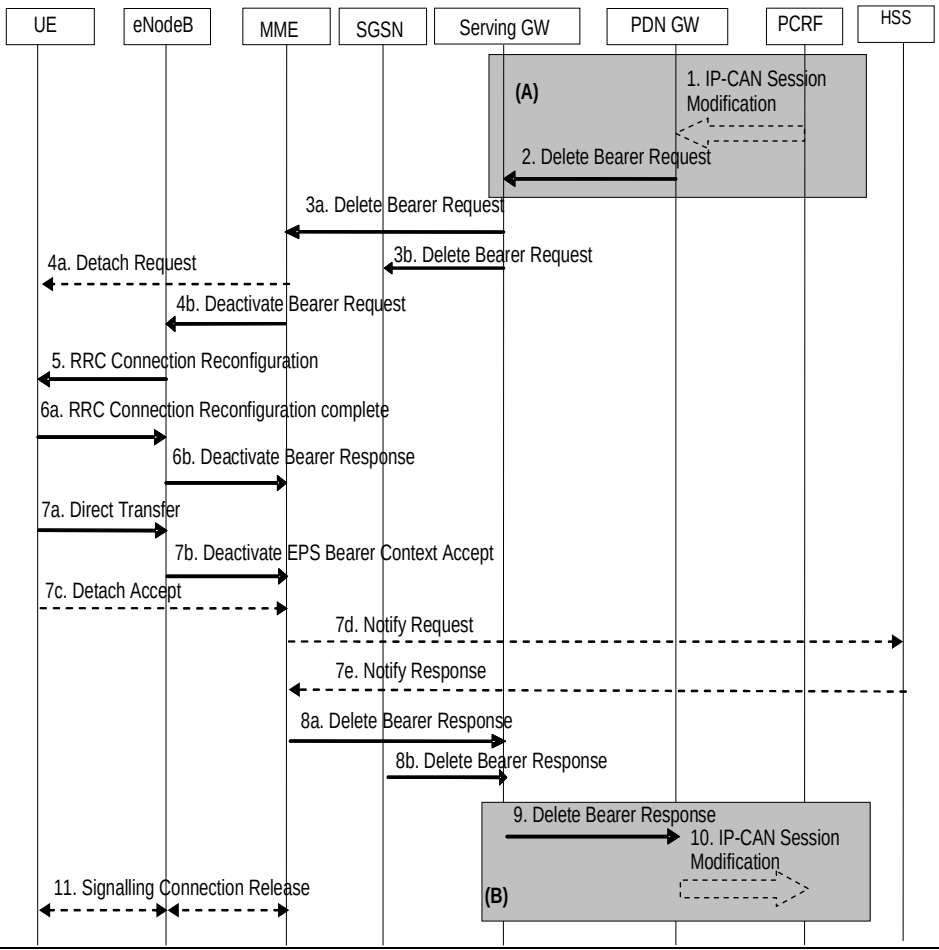
5.2.3.4 Bearer Resource Failure Indication Procedure

TP_TM_04	Standards Reference: ETSI TS 129 274 [1], clause 7.2.6	PICS item:
Summary:	Bearer Resource Failure Indication Procedure.	
Test purpose:	A Bearer Resource Failure Indication shall be sent by the PDN-GW to an S-GW and forwarded to the MME to indicate failure of the UE requested bearer resource allocation procedure or UE requested bearer resource modification procedure.	
Test Procedure:	1) CORE, RAN, and one UE available. A simulation platform may be necessary to emulate the PDN-GW. 2) MME is configured with the GTP Tunnel Parameter. 3) S-GW is configured with the GTP Tunnel Parameter. 4) Verify IP connectivity between the two nodes. 5) The resources or the memory in the PDN-GW are limited via the OAM interface in order to trigger the Bearer Resource Failure Indication. 6) Attach the UE. 7) The user changes the application being used on the UE. For example, the user changes the application being used on the UE from web browsing to FTP.	
Expected Results:	1) Verify that the MME sends a Bearer Resource Command to the S-GW. S-GW sends it to the PDN-GW (Simulation tool). 2) Verify that the PDN-GW sends back the Bearer Resource Failure Indication with cause value. 3) Verify that the S-GW sends the Bearer Resource Failure Indication to the MME.	
Expected Message Flow:		
Comments:	Using an actual S-GW, the PDN-GW should be configured through the OAM interface to force it to send back a cause value of "No resources available" or "No memory available". Possible cause values are: - "No resources available". - "No memory available". - "User authentication failed". - "System failure". - "Semantic error in the TAD operation". - "Syntactic error in the TAD operation". - "Semantic errors in packet filter(s)". - "Syntactic errors in packet filter(s)". - "Mandatory IE incorrect". - "Mandatory IE missing". - "Conditional IE missing". - "Invalid message format". - "Collision with network initiated request". - "Invalid length". - "Service denied". If the requested QoS is not granted (i.e. the requested QoS cannot be accepted or resources could not be allocated) the PDN-GW sends a Bearer Resource Failure Indication (with a cause indicating the reason why the request failed or was rejected) message, which is delivered to the UE.	

5.2.3.5 Delete Session Request Procedure

TP_TM_05	Standards Reference: ETSI TS 129 274 [1], clauses 7.2.9.1, 7.2.10.1 ETSI TS 123 401 [6], clause 5.3.8.2	PICS item:
Summary:	Delete Session Request Procedure.	
Test purpose:	Check the exchange of Delete Session Request/Response after NAS Detach Request.	
Test Procedure:	1) EPC, RAN, and one UE is required. 2) MME is configured with GTP Tunnel Parameter. 3) S-GW is configured with the GTP Tunnel Parameter. 4) Verify IP connectivity between the two nodes. 5) UE attaches to network. 6) Switch off the UE to trigger the Detach procedure.	
Expected Results:	1) Verify that the MME sends the Delete Session Request to the S-GW. 2) Verify that the S-GW forwards the Delete Session Request to the PDN-GW. 3) Verify that the PDN-GW sends back the Delete Session Response. 4) Verify that the S-GW sends the Delete Session Response to the MME. Possible cause values in the Delete Session Response are: - "Request accepted". - "Context not found". - "Mandatory IE incorrect". - "Conditional IE missing". - "Invalid message format". - "Unexpected repeated IE". The cause value is used to inform the MME about the status of the Detach procedure.	
Expected Message Flow:		
Comments:	For a PMIP-based S5/S8, procedure steps (A) are defined in ETSI TS 123 402 [9]. Steps 6, 7 and 8 concern GTP based S5/S8. Only if the UE is on the MME will send the Detach Accept message in response to the Detach Request message.	

5.2.3.6 Delete Bearer Request Procedure

TP_TM_06	Standards Reference: ETSI TS 129 274 [1], clauses 7.2.9.2, 7.2.10.2 ETSI TS 123 401 [6], clause 5.4.4	PICS item:
Summary:	Delete Bearer Request Procedure.	
Test purpose:	Check the exchange of Delete Bearer Request/Response as part of the PDN-GW initiated bearer deactivation procedure.	
Test Procedure:	1) EPC, RAN, and one UE available. 2) OAM access to PDN-GW database is required to modify QoS parameters. 3) MME is configured with the GTP Tunnel Parameter. 4) S-GW is configured with the GTP Tunnel Parameter. 5) Verify IP connectivity between two nodes. 6) UE attaches to network and is in the ECM-CONNECTED state. 7) Change a local QoS parameter for this UE.	
Expected Results:	1) Verify that the PDN-GW sends the Delete Bearer Request to the S-GW. 2) Verify that the S-GW forwards the Delete Bearer Request to the MME. 3) Verify that the MME sends back to the S-GW the Delete Bearer Response. 4) Verify that the S-GW sends the Delete Bearer Response to the PDN-GW. 5) Verify that the MME sends the Delete Bearer Response to the S-GW.	
Expected Message Flow:		
Comments:	Steps 3-8 are common for architecture variants with GTP based S5/S8 and PMIP-based S5/S8. For a PMIP-based S5/S8, procedure steps (A) and (B) are defined in ETSI TS 123 402 [9]. Steps 1, 2, 9 and 10 concern GTP-based S5/S8. If dynamic PCC is not deployed, the PDN-GW is triggered to initiate the Bearer Deactivation procedure due either a QoS policy or on request from the MME (as outlined in ETSI TS 129 274 [1], clause 6.1.2.13). Optionally, the PCRF sends QoS policy to the PDN GW. This corresponds to the initial steps of the PCRF-initiated IP CAN Session Modification procedure or the response to the PCEF initiated IP-CAN Session Modification procedure as defined in ETSI TS 123 203 [11], up to the point that the PDN-GW requests IP CAN Bearer Signalling. If dynamic PCC is not deployed, the PDN-GW may apply local QoS policy.	

5.2.3.7 Downlink Data Notification Procedure

TP_TM_07	Standards Reference: ETSI TS 129 274 [1], clauses 7.2.11.1, 7.2.11.2 ETSI TS 123 401 [6], clause 5.3.4.3	PICS item:
Summary:	Downlink Data Notification Procedure.	
Test purpose:	To verify that the Serving GW sends a Downlink Data Notification message to the MME for which it has control plane connectivity for a given UE. The MME responds to the S-GW with a Downlink Data Notification Ack message.	
Test Procedure:	1) EPC, RAN, and one UE is required. 2) MME is configured with the GTP Tunnel Parameter. 3) S-GW is configured with the GTP Tunnel Parameter. 4) Verify IP connectivity between the two nodes. 5) UE attaches to the network and is in an ECM-IDLE (inactive) state. 6) Send a data packet from the EPC (Internet) to the UE.	
Expected Results:	1) Verify that the arrival of user data at the S-GW triggers a Downlink Data Notification message to be sent on the S11 interface from the S-GW to the MME. 2) Verify that the S-GW sends the Downlink Data Notification message to the MME. 3) Verify that the MME sends back a Downlink Data Notification Ack.	
Expected Message Flow:	See Figures 5 and 6.	
Comments:		

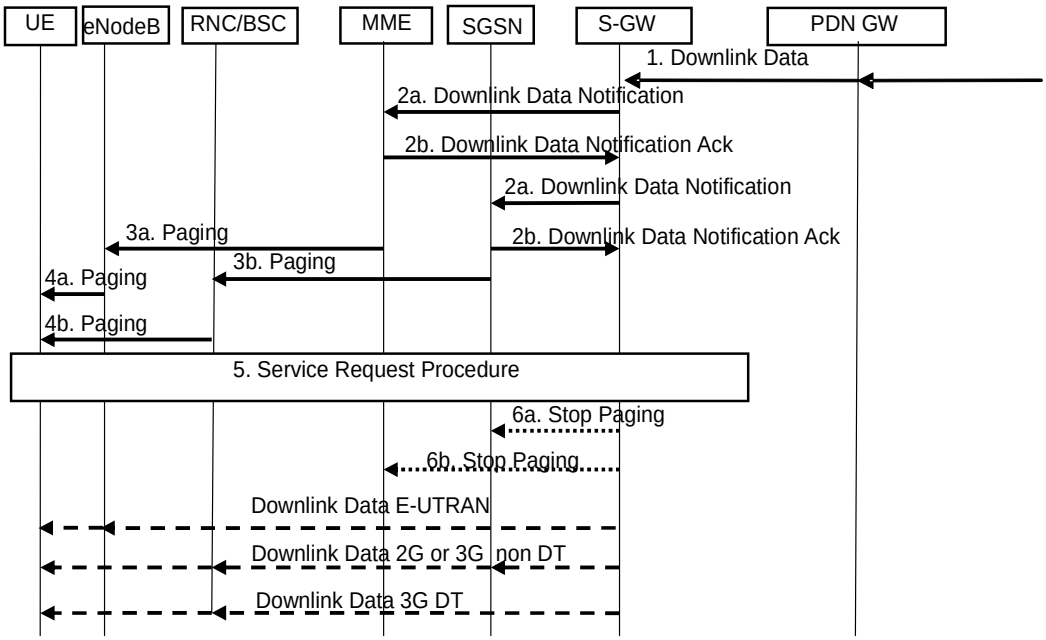


Figure 5: Network Triggered Service Request Procedure

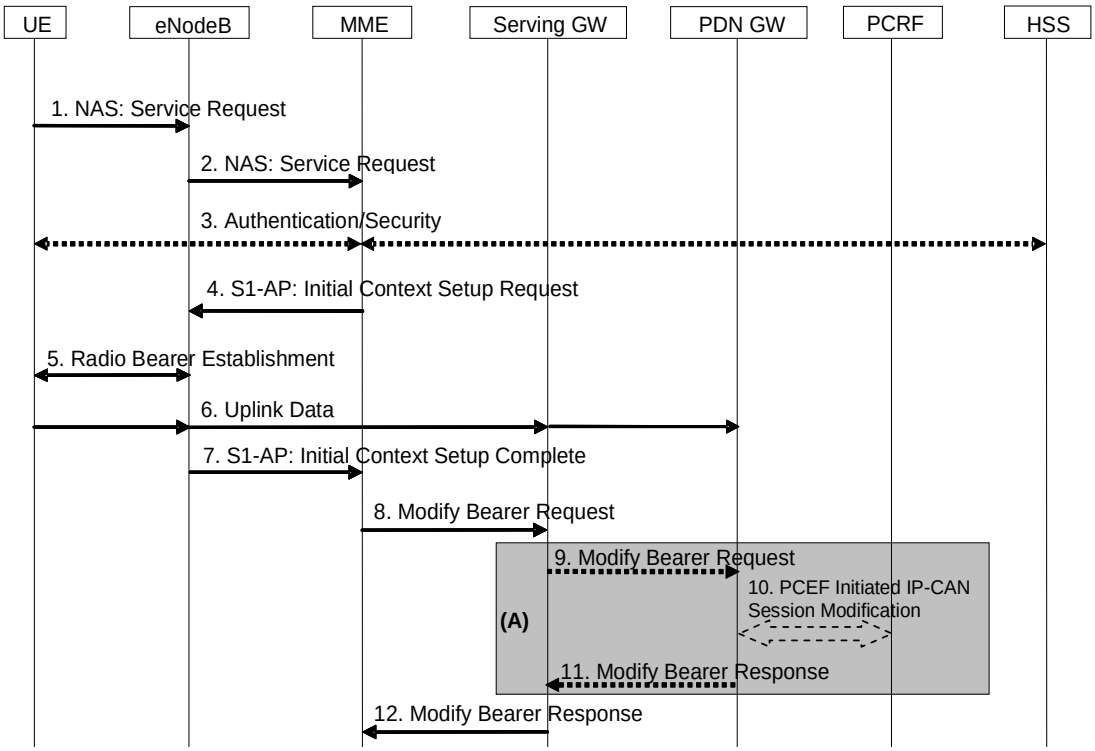
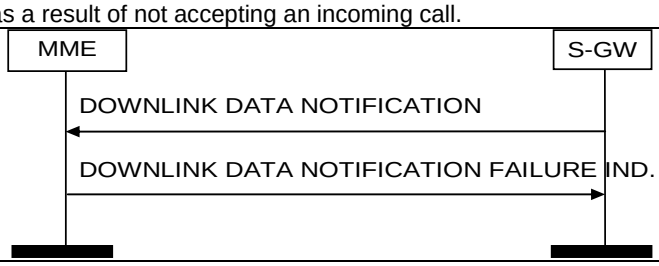


Figure 6: Service Request Procedure

5.2.3.8 Downlink Data Notification Failure Indication Procedure

TP_TM_08	Standards Reference: ETSI TS 129 274 [1], clause 7.2.11.3 ETSI TS 123 401 [6], clause 5.3.4.3	PICS item:
Summary:	Downlink Data Notification Failure Indication	
Test purpose:	Verify that a Downlink Data Notification Failure indication is sent from an MME/SGSN to an S-GW indicating that the: 1) UE did not respond to paging. 2) UE responded to a page with a Service Request but that the MME has rejected the request by sending a Service Reject to the UE. This may happen when the requested service is not supported or there is a bearer context mismatch.	
Test Procedure:	1) EPC, RAN, and one UE is available. 2) The MME is configured with the GTP Tunnel Parameter. 3) The S-GW is configured with the GTP Tunnel Parameter. 4) Verify IP connectivity between the two nodes. 5) Attach the UE to the network and is in the ECM-IDLE state. 6) Do not accept the incoming call. This will cause the UE to not respond to the Paging message.	
Expected Results:	1) Verify that the S-GW sends the Downlink Data Notification to the MME. 2) Verify that the Downlink Data Notification Failure indication message is sent by the MME as a result of not accepting an incoming call.	
Expected Message Flow:		
Comments:		

5.2.3.9 Delete Indirect Data Forwarding Tunnel Procedure

TP_TM_09	Standards Reference: ETSI TS 129 274 [1], clauses 7.2.12, 7.2.13 ETSI TS 123 401 [6], clause 5.5.1.2.2	PICS item:
Summary:	Delete Indirect Data Forwarding Tunnel Procedure	
Test purpose:	Verify as a result of S1-based handover the Delete Indirect Data Forwarding Tunnel Request message is sent on the S4/S11 interface by the SGSN/MME to the S-GW to delete the Indirect Forwarding Tunnels in the Source S-GW/Target S-GW.	
Test Procedure:	1) EPC and one UE available. For the RAN portion, two eNBs connected over two S1 interfaces where each eNB has one cell is required. 2) An MME is configured with the GTP Tunnel Parameter. 3) An S-GW is configured with the GTP Tunnel Parameter. 4) Verify IP connectivity between the two nodes. 5) Attach the UE to the network and verify it is in ECM-CONNECTED state. 6) UE performs an S1 handover to the cell of the second eNB.	
Expected Results:	1) Verify that the MME sends the Delete Indirect Data Forwarding Tunnel Request Message at the end of the handover after the UE context release procedure. 2) Verify that the S-GW sends back the Delete Indirect Data Forwarding Tunnel Response.	
Expected Message Flow:	See Figure 7.	
Comments:	The following notes apply to the message flow diagram in Figure 7 below. NOTE 1: A tool to emulate an S-GW may be required to execute this test. NOTE 2: For PMIP-based S5/S8, items (A) and (B) are defined in ETSI TS 123 402 [9]. Steps 16 and 16a concern GTP based S5/S8. NOTE 3: If the Serving GW is not relocated, the box "Source Serving GW" is acting as the Target Serving GW.	

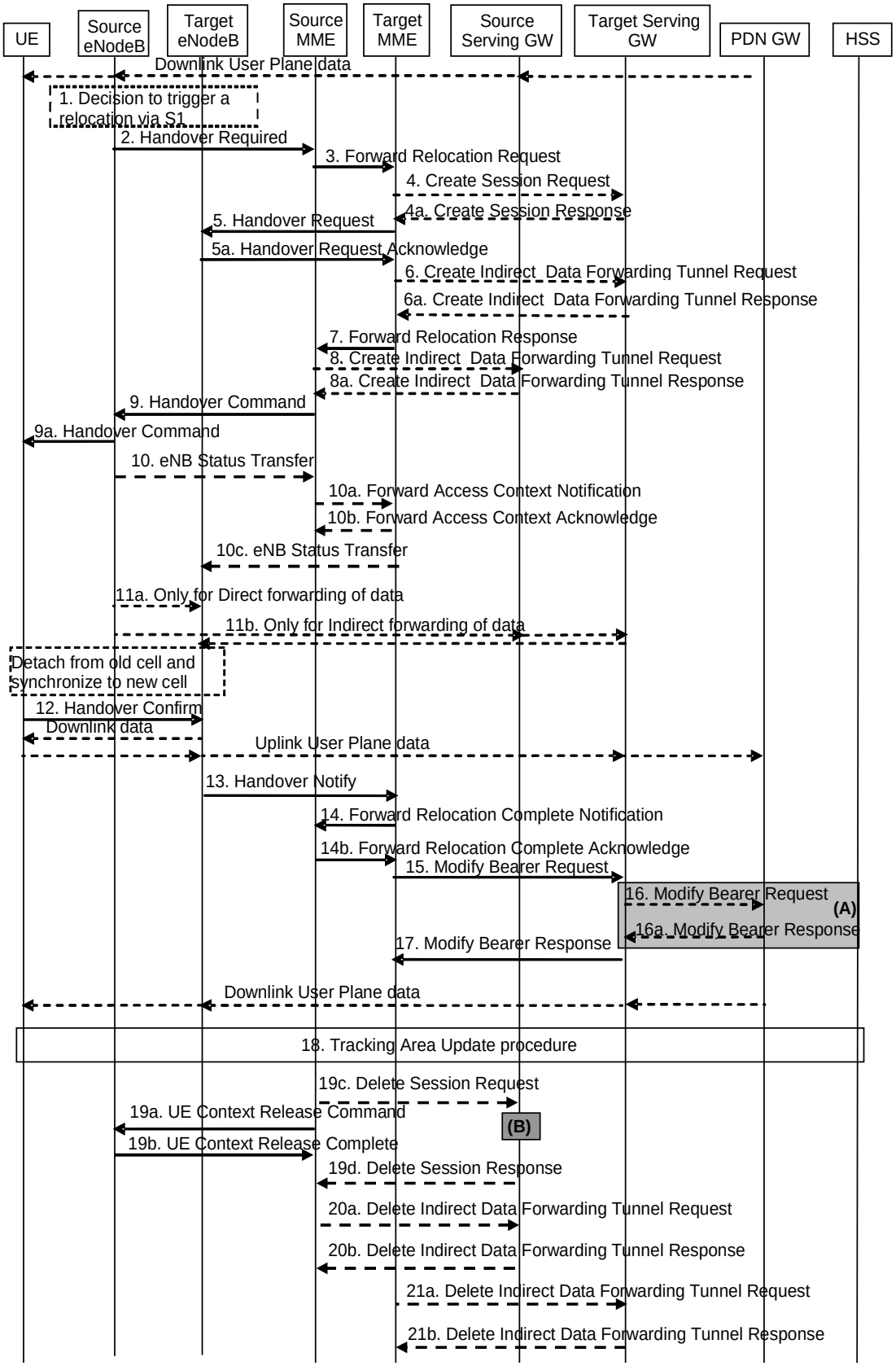


Figure 7: S1-Based Handover

5.2.3.10 Modify Bearer Command Procedure

TP_TM_10	Standards Reference: ETSI TS 129 274 [1], clause 7.2.14 ETSI TS 123 401 [6], clause 5.4.2.2.1	PICS item:
Summary:		
Test purpose:	This procedure is part of the HSS Initiated Subscribed QoS Modification procedure. Verify that the Modify Bearer Command procedure is triggering the Bearer Modification Procedure with Bearer QoS Update.	
Test Procedure:	1) EPC, RAN, and one UE available. 2) Configured the MME with the GTP Tunnel Parameter. 3) Configure the S-GW with the GTP Tunnel Parameter. 4) Verify IP connectivity between the two nodes. 5) Turn on the UE. Verify the UE is in ECM-IDLE mode. 6) Trigger the procedure by generating an Insert Subscriber Data (IMSI, Subscription Data) message at the HSS. This message will terminate at the MME. This message can be triggered via the HSS OAM interface, where the user can change the ARP or QCI value associated with the UE. The Insert Subscriber Data message includes EPS subscribed QoS (both QCI and ARP) and the subscribed UE-AMBR and APN AMBR. 7) Attach the UE to the network. Verify the UE is in ECM-CONNECTED mode. 8) Repeat Step #6.	
Expected Results:	1) Verify that the MME sends the Modify Bearer Command Message to the S-GW. 2) Verify that the S-GW starts the Bearer Modification Procedure with Bearer QoS Update. 3) Verify that a successful Update Bearer Response Message is generated.	
Expected Message Flow:	See Figures 8, 9 and 10.	
Comments:	The following notes apply to the message flow diagram in Figures 8, 9 and 10. NOTE 1: For a PMIP-based S5/S8, procedure steps (A) and steps (B) in Figure 8 are defined in ETSI TS 123 402 [9]. Steps 3, 4, 5, 7, and 8 concern GTP based S5/S8. NOTE 2: It is possible that an HSS emulation tool may be necessary to generate the Insert Subscriber Data message. NOTE 3: Steps 3-10 in Figure 9 are common for architecture variants with GTP based S5/S8 and PMIP-based S5/S8. For a PMIP-based S5/S8, procedure steps (A) and (B) are defined in ETSI TS 123 402 [9]. Steps 1, 2, 11 and 12 concern GTP based S5/S8. NOTE 4: In Figure 9, steps 5, 6, 8 and 9 are skipped only if the QoS parameter ARP is modified. NOTE 5: In Figure 10, steps 3-8 are common for architecture variants with GTP based S5/S8 and PMIP-based S5/S8. For a PMIP-based S5/S8, procedure steps (A) and (B) are defined in ETSI TS 123 402 [9]. Steps 1, 2, 9 and 10 concern GTP based S5/S8. Steps 3-8 may also be used within the HSS Initiated Subscribed QoS Modification.	

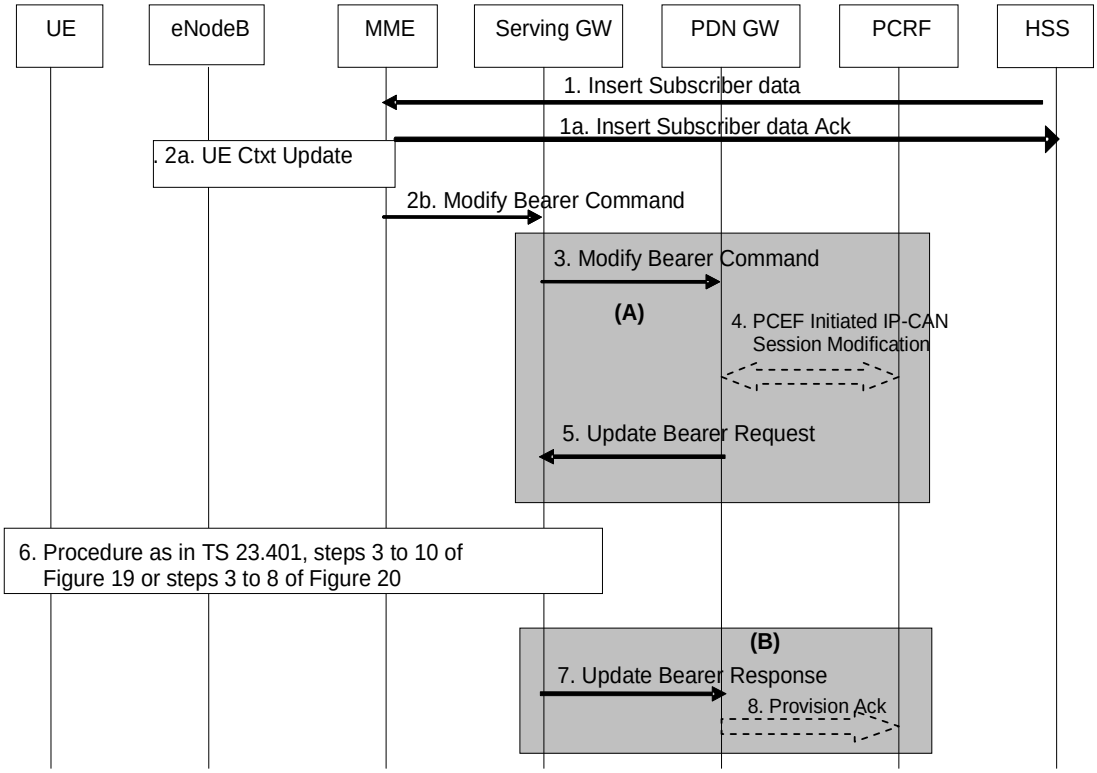


Figure 8: HSS Initiated Subscribed QoS Modification (Master Flow)

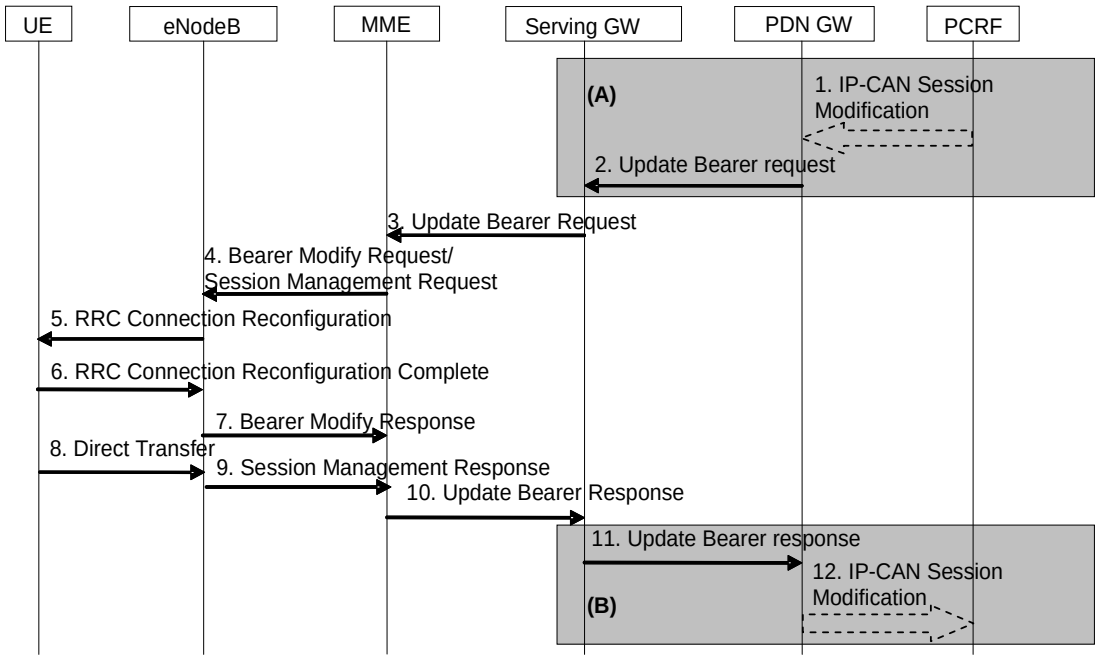


Figure 9: UE in ECM-IDLE State

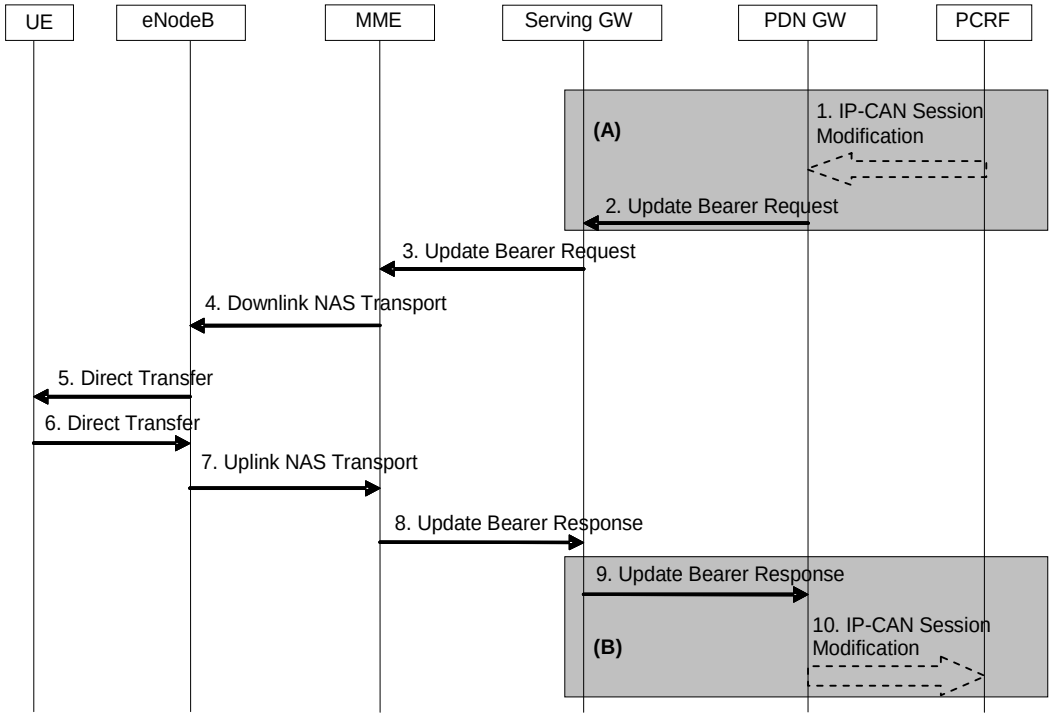
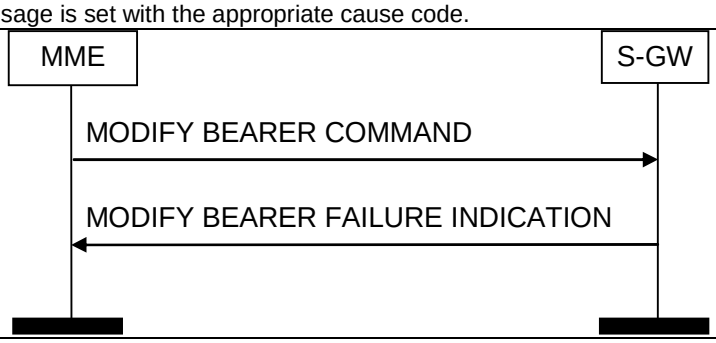


Figure 10: UE in ECM-CONNECTED State

5.2.3.11 Modify Bearer Failure Indication Procedure

TP_TM_11	**Standards Reference:** **ETSI TS 129 274 [1], clause 7.2.14** **Test Case 5.2.3.10 - Modify Bearer Command Procedure**	**PICS item:**
Summary:	Modify Bearer Failure Indication Procedure.	
Test purpose:	Verify that the Modify Bearer Failure Indication shall be sent on the S11 interface by the S-GW to the MME as part of the failure of HSS Initiated Subscribed QoS Modification procedure.	
Test Procedure:	1) EPC, RAN, and one UE available. 2) Configured the MME with the GTP Tunnel Parameter. 3) Configure the S-GW with the GTP Tunnel Parameter. 4) Verify IP connectivity between the two nodes. 5) Turn UE on and attach to the network. 6) Via the OAM interface of the P-GW modify the available resources or memory in the P-GW so they are not available. 7) Verify that the MME sends the Modify Bearer Command Message to the S-GW. 8) Verify that the S-GW starts the Bearer Modification Procedure due to a Bearer QoS Update.	
Expected Results:	1) Verify that the Bearer Modification Procedure initiated by the S-GW fails. 2) Verify that the S-GW sends back a Modify Bearer Failure Indication. 3) Verify that the IE (Information Element) within the Modify Bearer Failure Indication Message is set with the appropriate cause code.	
Expected Message Flow:		
Comments:	When using a real S-GW, parameters within the P-GW should be modified (via OAM) in order to generate a cause code associated with "No resources available" or "no memory available". The cause code IE indicates that the EPC bearer has not been update in the P-GW. Possible Causes Code Values are: - "Context not found". - "No resources available". - "No memory available". - "System failure". - "Mandatory IE incorrect". - "Mandatory IE missing". - "Conditional IE missing". - "Invalid message format". - "Unexpected repeated IE". - "Invalid Length". - "Service Denied".	

5.2.3.12 Update Bearer Request Procedure

TP_TM_12	Standards Reference: ETSI TS 129 274 [1], clauses 7.2.15, 7.2.16 ETSI TS 123 401 [6], clauses 5.4.2.1, 5.4.3	PICS item:
Summary:	Update Bearer Request Procedure	
Test purpose:	Verify for GTP based on S5/S8 (not PMIP), the Update Bearer Request is sent by the P-GW to the S-GW and then forwarded to the MME as part of the following procedures: 1) P-GW Initiated Bearer Modification with Bearer QoS Update (see clause 5.2.2.10, Figure 8). 2) HSS Initiated Subscribed QoS Modification (see clause 5.2.2.10, Figures 8, 9 and 10). 3) P-GW Initiated Bearer Modification without Bearer QoS Update (see clause 5.2.2.10, Figure 10). 4) UE Request Bearer Resource Modification procedure (see ETSI TS 124 301 [7] or clause 5.2.2.3 in the present document).	
Test Procedure:	1) EPC, RAN, and one UE available. 2) Configured the MME with the GTP Tunnel Parameter. 3) Configure the S-GW with the GTP Tunnel Parameter. 4) Verify IP connectivity between the two nodes. 5) Turn on the UE. Verify it is in ECM-IDLE mode. 6) Verify the results described in the "Expect Results" section of this test. 7) Attach the UE to the network. Verify it is in ECM-CONNECTED mode.	
Expected Results:	1) Verify that the S-GW sends the Update Bearer Request Message to the MME. 2) Verify that the MME responds with the Update Bearer Response Message to the S-GW.	
Expected Message Flow:	1) When the UE is in the ECM-IDLE mode the expected message flow is as described in Figure 9. 2) When the UE is in the ECM-CONNECTED mode then expected message flow is as described in Figure 10.	
Comments:	An IP-CAN Session Modification is triggered, for example, due to a charging change (e.g. from flat rate to dedicated charging) or QoS change for the UE in the PCRF.	

5.2.3.13 Delete Bearer Command Procedure

TP_TM_13	Standards Reference: ETSI TS 129 274 [1], 7.2.17.1 ETSI TS 123 401 [6], 5.4.4.2	PICS item:
Summary:	Delete Bearer Command Procedure.	
Test purpose:	Verify that a Delete Bearer Command message is sent on the S11 interface by the MME to the S-GW as a part of the eNB requested bearer release or MME-Initiated Dedicated Bearer Deactivation procedure.	
Test Procedure:	1) EPC, RAN, and one UE available. 2) Configured the MME with the GTP Tunnel Parameter. 3) Configure the S-GW with the GTP Tunnel Parameter. 4) Verify IP connectivity between the two nodes. 5) Attach a UE to the network. 6) Start an application to initiate a data transfer (e.g. FTP, iPERF, etc.). 7) Close the application.	
Expected Results:	Verify that: 1) Verify a NAS PDN Disconnect Request is sent from the UE to delete the dedicated bearer. 2) Verify that the MME sends the Delete Bearer Command message to the S-GW. 3) Verify that the Delete Bearer Request Procedure has occurred. This is where the S-GW sends a Delete Bearer Request to the MME and expects the Delete Bearer Response back from the MME.	
Expected Message Flow:	See Figure 11.	
Comments:	The following note applies to the message flow diagram in Figure 11. NOTE: For a PMIP-based S5/S8, procedure steps (A) and (B) in Figure 11 are defined in ETSI TS 123 402 [9]. Steps 3,4,5 and 9 are related to GTP based S5/S8.	

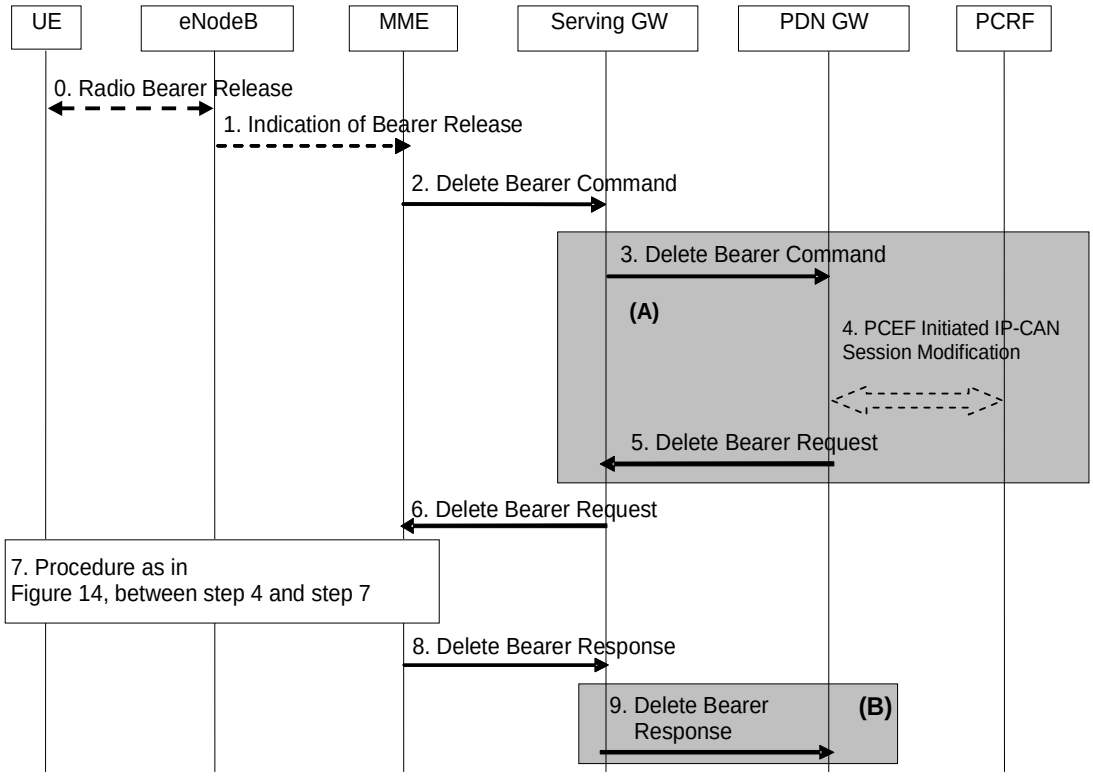
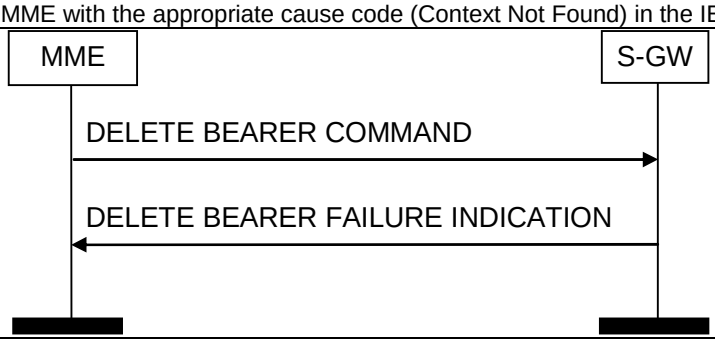


Figure 11: MME initiated Dedicated Bearer Deactivation

5.2.3.14 Delete Bearer Failure Indication Procedure

TP_TM_14	Standards Reference: ETSI TS 129 274 [1], clause 7.2.17.2 Test Case 5.2.3.13 - Delete Bearer Command Procedure	PICS item:
Summary:	Delete Bearer Failure Indication Procedure.	
Test purpose:	Verify that a Delete Bearer Failure Indication is sent on the S11 interface by the S-GW to the MME as part of the failure of an eNB requested bearer release or MME Initiated Dedicated Bearer Deactivation procedure.	
Test Procedure:	1) EPC, RAN, and one UE available. 2) Configured the MME with the GTP Tunnel Parameter. 3) Configure the S-GW with the GTP Tunnel Parameter. 4) Verify IP connectivity between the two nodes. 5) Attach the UE to the network. 6) Initiate a data session using an application such as iPERF or FTP. 7) Delete the dedicated bearer via the P-GW OAM interface. 8) Close the application. 9) Disconnect UE from network.	
Expected Results:	1) Verify that a NAS PDN Disconnect Request is sent from the UE to delete the dedicated bearer. 2) Verify that the MME sends the Delete Bearer Command Message to the S-GW. 3) Verify that the database in the P-GW contains the context of this UE. 4) Verify that, after disconnecting the UE from the network, a Delete Bearer Failure Indication message is generated by the P-GW. 5) Verify that the S-GW sends back a Delete Bearer Failure Indication Message to the MME with the appropriate cause code (Context Not Found) in the IE.	
Expected Message Flow:		
Comments:	The Delete Bearer Failure Indication message is sent back if all the bearers included in the Delete Bearer Command message could not be deleted. The cause code IE indicates the an EPS bearer has not been deleted in the P-GW. Possible Causes Code Values are: - "Context not found". - "Mandatory IE incorrect". - "System Failure". - "Invalid Message Format". - "Unexpected Repeated IE".	

5.2.3.15 Create Indirect Data Forwarding Tunnel Request Procedure

TP_TM_15	Standards Reference: ETSI TS 129 274 [1], clauses 7.2.18, 7.2.19 ETSI TS 123 401 [6], clause 5.5.1.2.2	PICS item:
Summary:	Create Indirect Data Forwarding Tunnel Request Procedure.	
Test purpose:	Verify that the Create Indirect Data Forwarding Tunnel Request message is sent on the S11 interface by the MME to the S-GW as part of a handover procedure.	
Test Procedure:	1) EPC, two eNBs, and one UE available, two attenuators. Each eNB should be connected to the EPC via the S1 interface. 2) Configured the MME with the GTP Tunnel Parameter. 3) Configure the S-GW with the GTP Tunnel Parameter. 4) Verify IP connectivity between the two nodes. 5) Attach the UE to the network. 6) Initiate a data session using an application such as iPERF or FTP. 7) Start the test with one eNB's signal strength significantly stronger than the other eNB. 8) Increase the attenuation on the eNB whose signal strength is significantly stronger, while decrease the attenuation on the eNB who's signal strength is significantly weaker. This will force a handover.	
Expected Results:	1) Verify that the target MME sends a Create Indirect Data Forwarding Tunnel Request message to the target S-GW. 2) Verify that the target S-GW sends back a Create Indirect Data Forwarding Tunnel Response to the target MME. 3) Verify that, in the case where indirect forwarding applies and S-GW is relocated, the target MME sets up forwarding parameters by sending a Create Indirect Data Forwarding Tunnel Request (containing target eNB addresses and TEIDs for forwarding) to the S-GW. In this case, verify that the S-GW sends a Create Indirect Data Forwarding Tunnel Response (containing target S-GW addresses and TEIDs for forwarding) to the target MME. If the S-GW is not relocated, indirect forwarding may be set up in step 8 of Figure 7.	
Expected Message Flow:	See Figure 7: S1 Based Handover.	
Comments:	A simulation tool may be needed. The handover parameter in the eNB will trigger one of the following events in the UE: - Event A2: Severing becomes worse than threshold. - Event A3: Neighbour signal strength is stronger than serving cell signal strength. - Event A4: Neighbour signal strength is stronger than a given threshold. - Event A5: Serving cell signal strength is lower than threshold 1 and the neighbour cell's signal strength is higher than threshold 2. The above parameters and the thresholds for the serving and the neighbour cell are configured in the eNB.	

5.2.3.16 Release Access Bearer Procedure

TP_TM_16	Standards Reference: ETSI TS 129 274 [1], clauses 7.2.21, 7.2.22 ETSI TS 123 401 [6], clause 5.3.5	PICS item:
Summary:	Release Access Bearer Procedure.	
Test purpose:	Verify that all logical S1-AP signalling (S1 - MME) and all S1 bearers over S1-U are released for a given data session. Verify that the UE changes from ECM-CONNECTED state to ECM-IDLE state. Also verify that all UE related context information is deleted in the eNB.	
Test Procedure:	1) EPC, RAN, and one UE available. 2) Configured the MME with the GTP Tunnel Parameter. 3) Configure the S-GW with the GTP Tunnel Parameter. 4) Verify IP connectivity between the two nodes. 5) Attach the UE to the network. 6) Initiate a data session using an application such as iPERF or FTP. 7) Stop the data session and close the application. 8) Detach the UE from the network.	
Expected Results:	Verify that: 1) Verify that no context (signalling and bearers) exist anymore between the eNB and MME. 2) Verify that the MME sends the Release Access Bearer Request message to the S-GW. 3) Verify that the S-GW releases all eNB related information (address and TEIDs) for the UE and responds with a Release Access Bearers Response message to the MME. 4) Verify that all other elements of the UE's S-GW context are not affected.	
Expected Message Flow:	See Figure 12: S1 Release Procedure.	
Comments:	The following notes apply to the message flow diagram in Figure 12. NOTE 1: Possible Cause values contained in the Release Access Bearer Response are: - "Request accepted". - "Request accepted partially". - "Request rejected". - "Context not found". - "System failure". - "Invalid message format". - "Unexpected repeated IE". - "Mandatory IE incorrect". - "Conditional IE missing". NOTE 2: The first message in the expected message flow (S1 UE Context Release Request) is only performed when the eNB-initiated S1 release procedure is considered. If the MME initiates the S1 release procedure Step 1 is not performed.	

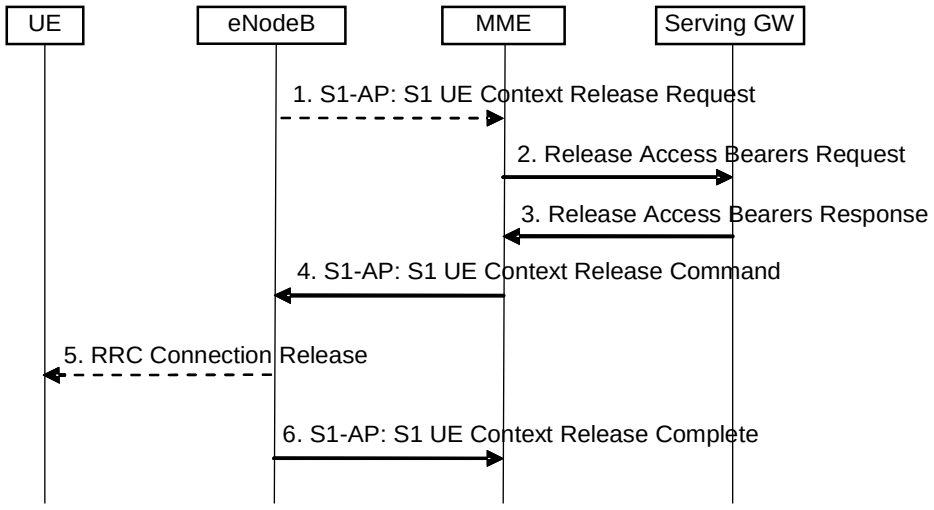


Figure 12: S1 Release Procedure

5.2.3.17 Stop Paging Indication

TP_TM_17	Standards Reference: ETSI TS 129 274 [1], clause 7.2.23 ETSI TS 123 401 [6], clause 5.3.4.3	PICS item:
Summary:	Stop Paging Indication.	
Test purpose:	Verify that a Stop Paging Indication message is sent on the S11/S4 interface by the S-GW to the MME/SGSN as part of the network triggered service request procedure.	
Test Procedure:	1) EPC, RAN, and one UE available. 2) Configured the MME with the GTP Tunnel Parameter. 3) Configure the S-GW with the GTP Tunnel Parameter. 4) Verify IP connectivity between the two nodes. 5) UE is in ECM-IDLE state (no data is being exchanged) on E-UTRA network. 6) UE should be attached to a UTRA network. 7) From the E-UTRA EPC Initiate a data session by using an application such as iPerf or FTP. This will force the UE to respond to paging from the E-UTRA network. 8) Repeat steps 5 through 7 except now the UTRA network initiates a data session and pages the UE. The stop paging message is sent via the S11 which makes its way down to the UE through the rest of the LTE components.	
Expected Results:	1) Verify that if the UE responds to the Paging on E-UTRA the S-GW sends the Stop Paging Indication over the S4 interface to the SGSN. 2) Verify that if the UE responds to the Paging on UTRA the S-GW sends the Stop Paging Indication over the S11 interface to the MME.	
Expected Message Flow:	See Figure 13: Network Triggered Service Request Procedure Used for Stop Paging Indication Tests.	
Comments:	The following notes apply to the message flow diagram in Figure 13. NOTE 1: UE has to be E-UTRA capable. NOTE 2: If the UE accepts the service on E-UTRAN the paging indication goes to UTRAN. If the UE accepts the service on UTRAN the Paging Indication goes E-UTRAN. NOTE 3: The Service Request Procedure is described in Figure 6.	

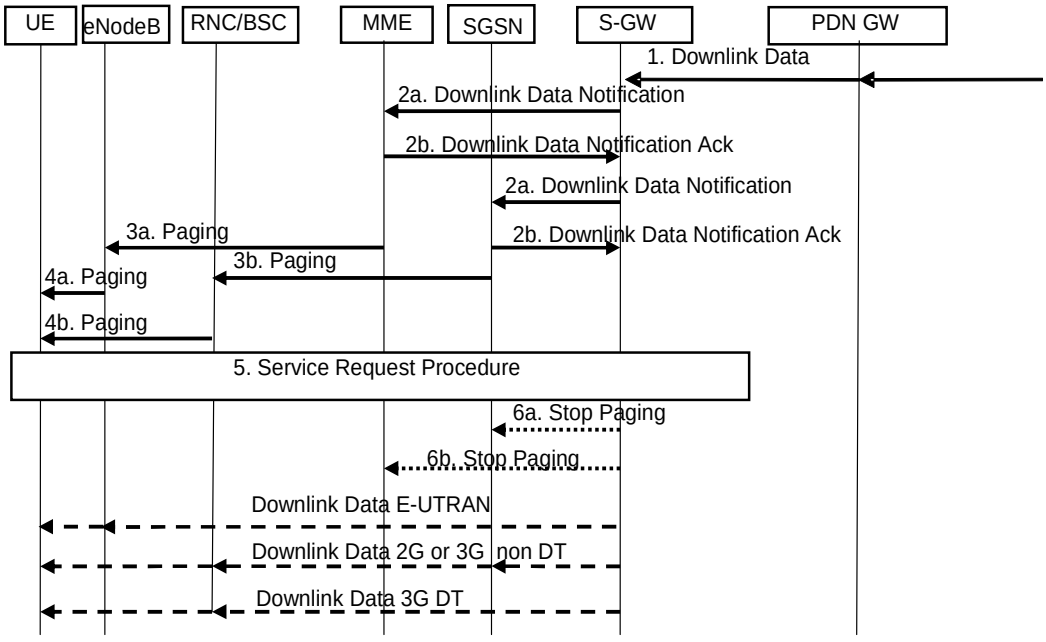


Figure 13: Network Triggered Service Request Procedure Used for Stop Paging Indication Tests

5.2.4 CS Fallback and SRVCC Related Messages

5.2.4.1 Suspend Notification Procedure

TP_CSF_SRVCC_01	**Standards Reference:** **ETSI TS 129 274 [1], clauses 7.4.1, 7.4.2** **ETSI TS 123 216 [10], clause 6.1.3**	**PICS item:**
Summary:	Suspend Notification Procedure	
Test purpose:	Verify that the Suspend Notification message is sent on the S11 interface by the MME to the S-GW as part of the 1xRTT CS fallback procedures. After receiving the Suspend Notification message from the MME, verify that the S-GW discards packets it receives from the P-GW for the suspended UE. Verify that the Suspend Acknowledge message is sent on the S11 interface by the S-GW to the MME as part of the 1xRTT CS fallback procedures.	
Test Procedure:	1) EPC, RAN, and one UE available. 2) CDMA 2000 1xRTT network as a neighbour RAT or a simulation of 1xRTT base station. 3) Configured the MME with the GTP Tunnel Parameter. 4) Configure the S-GW with the GTP Tunnel Parameter. 5) Verify IP connectivity between the two nodes. 6) Attach UE to the network. 7) Establish a VoIP call 8) Through the use of attenuators force a handover from the LTE network to the CDMA2000 1xRTT network.	
Expected Results:	1) Verify that after a successful SRVCC Handover to CDMA2000 1xRTT the MME sends the Suspend Notification to the S-GW. 2) Verify that the S-GW acknowledges this message with the Suspend Acknowledge message.	
Expected Message Flow:	See Figure 14.	
Comments:	The following notes apply to the message flow diagram in Figure 14. NOTE 1: It is expected that Handover parameters (A2-A5) are already configured. NOTE 2: The expected measurement reports from the UE are: - Event B1 (Inter-RAT neighbour is greater than a given threshold). - Event B2 (Serving cell's power level is lower than threshold1 and inter-RAT neighbour signal level is greater than threshold2). NOTE 3: It is possible that simulation tool maybe necessary. NOTE 4: Possible Cause Code Values in the Suspend Acknowledge message are: - "Request Accepted". - "Mandatory IE incorrect". - "Mandatory IE missing". - "Optional IE correct". - "Invalid message format". - "Conditional IE missing". NOTE 5: For backward compatibility, if the IMSI IE is missing in the Suspend Notification message that is received on the S11 interface, the cause value "Mandatory IE missing" is used.	

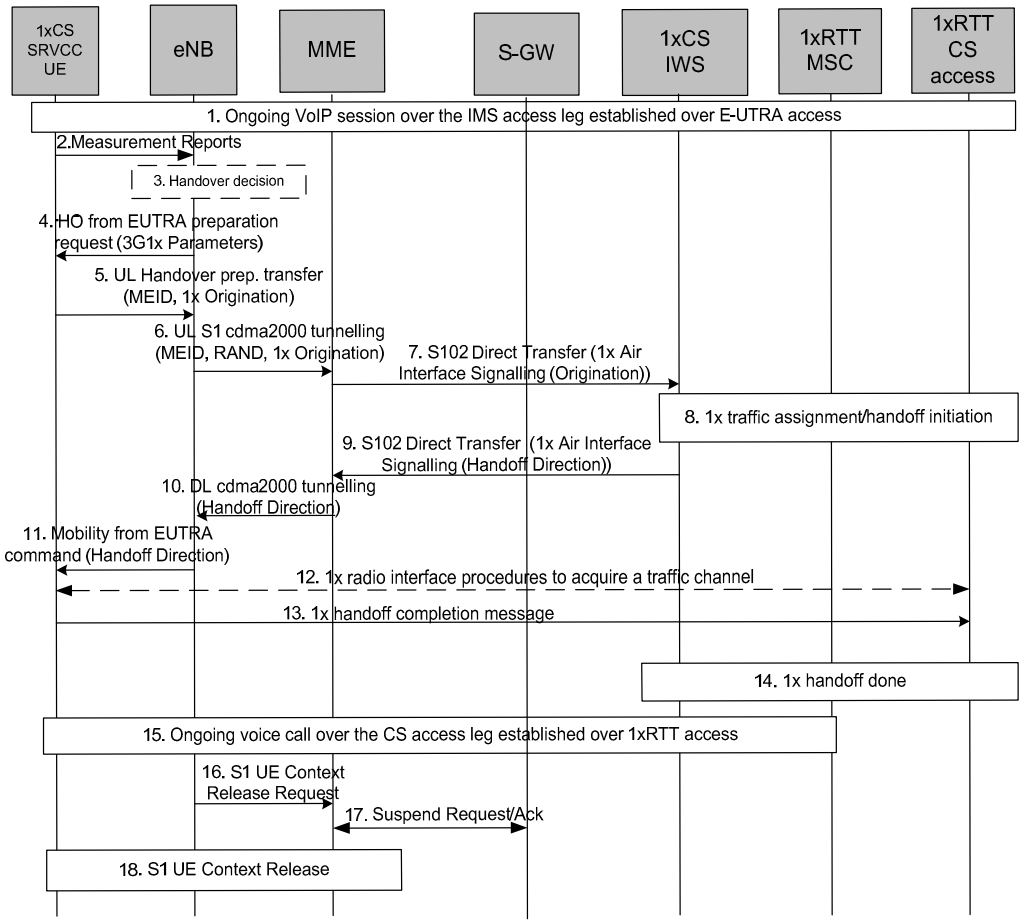
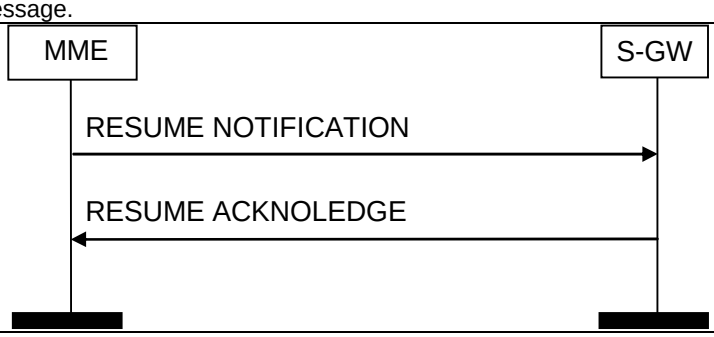


Figure 14: LTE VoIP-to-CDMA2000 1xRTT CS Voice Service Continuity

5.2.4.2 Resume Notification Procedure

TP_CSF_SRVCC_02	Standards Reference: ETSI TS 129 274 [1], clauses 7.4.3, 7.4.4	PICS item:
Summary:	Resume Notification Procedure	
Test purpose:	Verify that the Resume Notification message is sent on the S11 interface by the MME to the S-GW as part of the resume procedure upon returning from CS fallback to E-UTRA. Verify after receiving a Resume Notification message from the MME, the S-GW forwards packets it receives from the P-GW for the UE.	
Test Procedure:	1) EPC, RAN, and one UE available. 2) CDMA 2000 1xRTT network as a neighbour RAT or a simulation of 1xRTT base station. 3) Configured the MME with the GTP Tunnel Parameter. 4) Configure the S-GW with the GTP Tunnel Parameter. 5) Verify IP connectivity between the two nodes. 6) Setup a call on E-UTRA system. 7) Force the UE to perform CSFB to CDMA2000 1xRTT network (or emulator). 8) Now force the UE back to E-UTRA.	
Expected Results:	1) Verify that upon successful return to the E-UTRA network the MME generates a Resume Notification message that is sent to the S-GW. 2) Verify that the S-GW acknowledges this message with a Resume Acknowledge message.	
Expected Message Flow:		
Comments:	Possible emulation tool necessary for a 1xRTT base station. The Resume Acknowledge message is sent on the S11 interface by the S-GW to the MME as part of the resume procedure returning from CS fallback to E-UTRA.. Possible Cause Values are: - "Request Accepted". - "Mandatory IE incorrect". - "Mandatory IE missing". - "Optional IE incorrect". - "Invalid Message Format".	

5.2.5 Non-3GPP Access Related Messages

5.2.5.1 Create Forward Tunnel Request Procedure

TP_N3GPP_AR_01	**Standards Reference:** **ETSI TS 129 274 [1], clauses 7.5.1, 7.5.2** **ETSI TS 123 402 [9], clause 9.3.2**	**PICS item:**
Summary:	Create Forwarding Tunnel Request Procedure.	
Test purpose:	Verify that a Create Forwarding Tunnel Request message is sent by the MME to a Serving GW as a part of the MME configuration of resources for indirect data forwarding during active handover procedure from E-UTRA to CDMA2000 HPRD access.	
Test Procedure:	1) EPC, RAN, and one UE available. 2) CDMA 2000 HRPD network as a neighbour RAT or a simulation of HRPD base station. 3) Configured the MME with the GTP Tunnel Parameter. 4) Configure the S-GW with the GTP Tunnel Parameter. 5) Verify IP connectivity between the two nodes. 6) Verify handover parameters are properly configured. 7) Attach UE to the E-UTRA network. 8) Start a data session (e.g. FTP). 9) Using attenuators, force a handover to the CDMA2000 HRPD network.	
Expected Results:	1) Verify that the MME sends the Create Forwarding Tunnel Request message to the S-GW. 2) Verify that the S-GW sends back the Create Forwarding Tunnel Response to the MME. 3) Verify that the Cause IE is only included in the Create Forwarding Tunnel Response if the Cause IE contains another value other than "Request accepted". 4) Verify that the S1-U Data Forwarding Info IE is included in the Create Forward Tunnel Response message if the Cause contains the value "Request accepted". For each EPS bearer requesting data forwarding which is included in the S103 PDN Data Forwarding Info fields of corresponding Create Forwarding Tunnel Request message, the Serving GW shall assign a Serving GW S1-U Address and Serving GW S1-U TEID pair and included it in the response message as S1-U Data Forwarding Info information element. The eNB shall forward downlink data of the EPS bearer to the Serving GW via the GTP-U tunnel identified by the Serving GW S1-U Address and Serving GW S1-U TEID.	
Expected Message Flow:	See Figure 15.	
Comments:	The following notes apply to the message flow diagram in Figure 15. NOTE 1: Emulation tool may be necessary for the CDMA2000 HPRD network. NOTE 2: A Create Forwarding Tunnel Response message is sent by an S-GW to a MME as a response to a Create Forwarding Tunnel Request message. NOTE 3: The Cause value indicates if Data Forwarding Resources has been created in the S-GW. Data Forwarding Resources have not been created in the S-GW if the cause differs from "Request Accepted". Possible Cause Code Values are: - "Request Accepted". - "No Resources Available". - "System Failure". - "Mandatory IE Incorrect". - "Mandatory IE Missing". - "Invalid Message Format".	

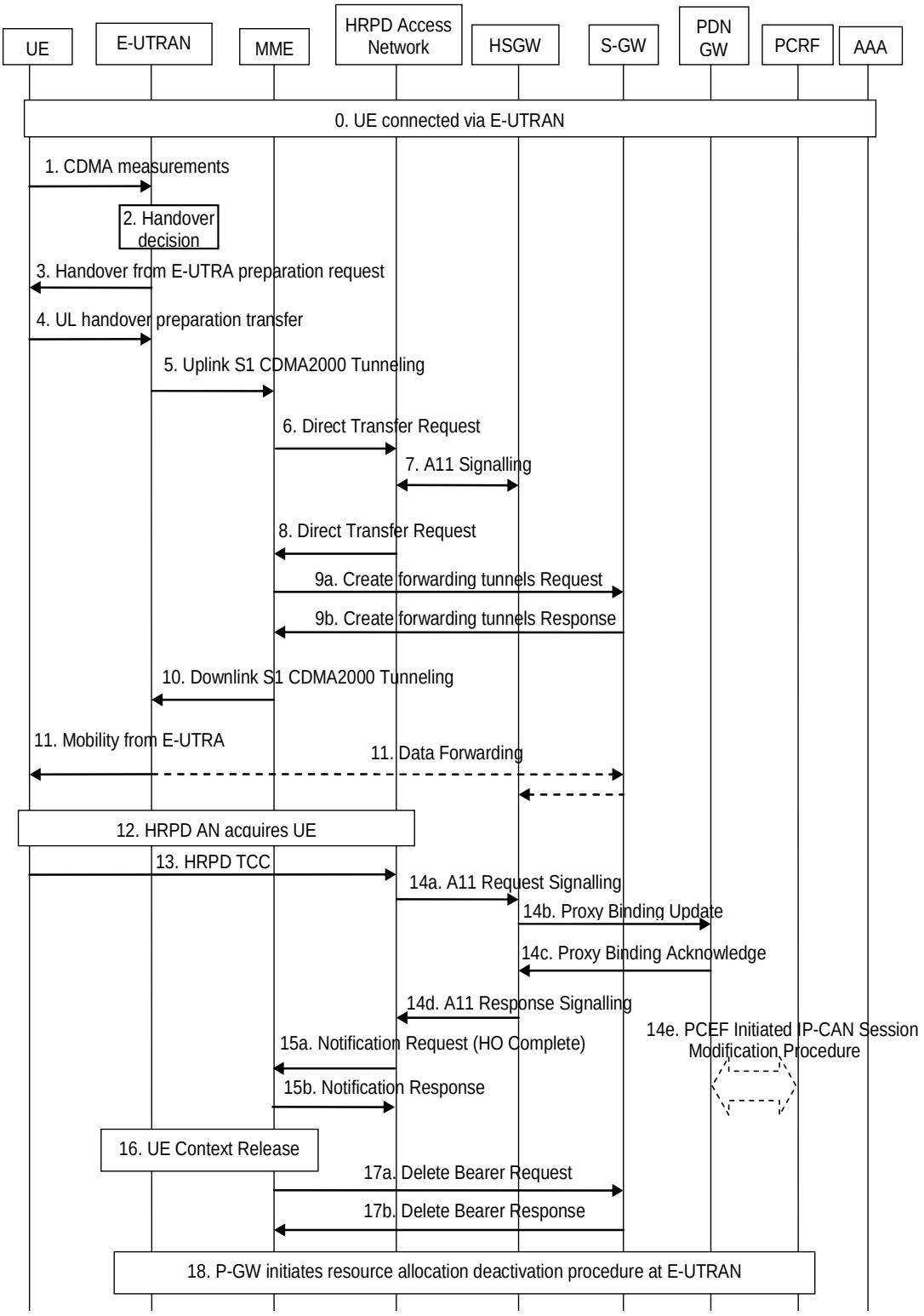
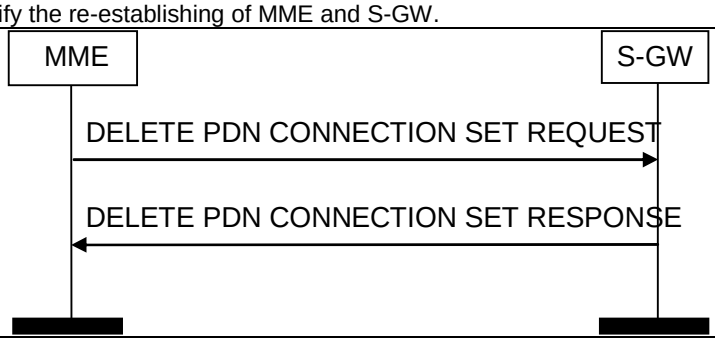


Figure 15: E-UTRAN to CDMA2000 HPRD Handover

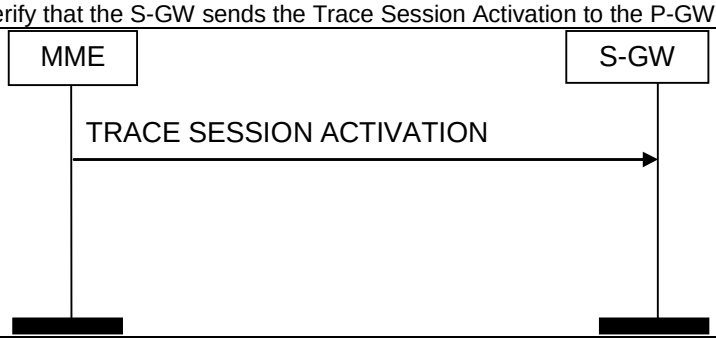
5.2.6 Restoration and Recovery

5.2.6.1 Delete PDN Connection Set Request Procedure

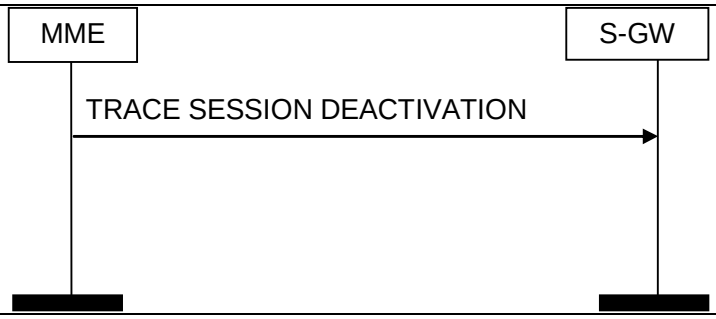
TP_RR_01	Standards Reference: ETSI TS 129 274 [1], clauses 7.9.1, 7.9.2 ETSI TS 123 007 [8], clauses 14.3, 16.2	PICS item:
Summary:	Delete PDN Connection Set Request Procedure	
Test purpose:	**Procedures during MME/S-GW partial failure.** When an MME/S-GW detects that it has undergone a partial failure, it shall verify that one or more corresponding CSID(s) are present for the component(s) undergoing a partial fault. If there is no such CSID, then the following does not apply. When one or more CSIDs are currently assigned, the MME/S-GW shall perform the following. The MME/S-GW shall send a GTPv2 Delete PDN Connection Set Request containing all the MME/S-GW CSID(s) of the component(s) failing in MME FQ-CSID(s) to the S-GW/MME peers that support the feature. Upon receiving a GTPv2 Delete PDN Connection Set Response message with Cause value "Success", the MME/S-GW shall conclude that the S-GW/MME peer has initiated the internal deletion of the PDN connections corresponding to the FQ-CSID(s) present in the GTPv2 Delete PDN Connection Set Request message. **Procedures during a Peer's Partial Failure.** When an MME/S-GW receives a GTPv2 Delete PDN Connection Set Request message from an S-GW/MME, the MME/S-GW shall retrieve all the PDN connections corresponding to each of the FQ-CSID(s) present in the message. The MME/S-GW shall delete all the retrieved PDN connections and the associated resources. Other implementation-specific actions may be performed. As a response, the MME/S-GW shall send a GTPv2 Delete PDN Connection Set Response message with appropriate Cause value immediately to the S-GW/MME.	
Test Procedure:	1) EPC, RAN, and one UE available. 2) Configured the MME with the GTP Tunnel Parameter. 3) Configure the S-GW with the GTP Tunnel Parameter. 4) Verify IP connectivity between the two nodes. 5) Attach the UE to the network. 6) Initiate a data session (e.g. FTP). 7) Force a partial reset of the MME/S-GW. This will delete all data sessions. 8) Initiate another data session (e.g. FTP). 9) After re-establishing perform a partial reset of the S-GW/MME. This will delete all data sessions.	
Expected Results:	1) Verify that the MME/S-GW sends the Delete PDN Connection Set Request message to the S-GW/MME. 2) Verify that the S-GW/MME sends back the Delete PDN Connection Set Response to the MME/S-GW. 3) Verify the deletion of the PDN Connections for both directions. 4) Verify the re-establishing of MME and S-GW.	
Expected Message Flow:		
Comments:	An emulation tool may be necessary for the MME. The Delete PDN Connection Set Response contains the cause IE. The following Cause Code Values are possible: - "Request Accepted" - "Request Rejected" - "System Failure" - "Mandatory IE Incorrect" - "Conditional IE Missing" - "Invalid Message Format"	

5.2.7 Trace Management Messages

5.2.7.1 Trace Session Activation Procedure

TP_TMM_01	Standards Reference: ETSI TS 129 274 [1], clause 7.12.1	PICS item:
Summary:	Trace Session Activation Procedure.	
Test purpose:	Verify that the Trace Session Activation message is sent on the S11/S4 by the MME/SGSN to the S-GW, and on S5/S8 by the S-GW to the P-GW when session trace is activated for a particular IMSI or IMEI for a UE that is attached and active or attached and idle.	
Test Procedure:	1) EPC, RAN, and one UE available. 2) Configured the MME with the GTP Tunnel Parameter. 3) Configure the S-GW with the GTP Tunnel Parameter. 4) Verify IP connectivity between the two nodes. 5) Attach the UE to the network. 6) Via the MME OAM interface start the trace session activation procedure.	
Expected Results:	1) Verify that the MME sends the Trace Session Activation to the S-GW. 2) Verify that the S-GW sends the Trace Session Activation to the P-GW.	
Expected Message Flow:		
Comments:	An emulation tool for the MME may be necessary.	

5.2.7.2 Trace Session Deactivation Procedure

TP_TMM_02	Standards Reference: ETSI TS 129 274 [1], clause 7.12.2	PICS item:
Summary:	Trace Session Deactivation Procedure.	
Test purpose:	Verify that the Trace Session Deactivation message is sent on the S11/S4 by the MME/SGSN to the S-GW, and on S5/S8 by the S-GW to the P-GW when session trace is deactivated for a particular IMSI or IMEI for a UE that is attached and active or attached and idle.	
Test Procedure:	1) EPC, RAN, and one UE available. 2) Configured the MME with the GTP Tunnel Parameter. 3) Configure the S-GW with the GTP Tunnel Parameter. 4) Verify IP connectivity between the two nodes. 5) Attach the UE to the network. 7) If not already started, via the MME OAM interface start the trace session activation procedure. 6) Via the MME OAM interface, stop the trace session.	
Expected Results:	1) Verify that the MME sends the Trace Session Deactivation message to the S-GW. 2) Verify that the S-GW sends the Trace Session Deactivation message to the P-GW.	
Expected Message Flow:		
Comments:	An emulation tool for the MME may be required.	

Annex A (informative): Bibliography

- ETSI TS 136 413: "LTE; Evolved Universal Terrestrial Radio Access Network (E-UTRAN); S1 Application Protocol (S1-AP) (3GPP TS 36.413)".
- ETSI TS 129 281: "Universal Mobile Telecommunications System (UMTS); LTE; General Packet Radio System (GPRS) Tunnelling Protocol User Plane (GTPv1-U) (3GPP TS 29.281)".
- ETSI TS 136 300: "LTE; Evolved Universal Terrestrial Radio Access (E-UTRA) and Evolved Universal Terrestrial Radio Access Network (E-UTRAN); Overall description; Stage 2 (3GPP TS 36.300)".
- ETSI TS 136 331: "LTE; Evolved Universal Terrestrial Radio Access (E-UTRA); Radio Resource Control (RRC); Protocol specification (3GPP TS 36.331)".
- ETSI TS 123 009: "Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); Handover procedures (3GPP TS 23.009)".
- ETSI TS 124 008: "Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); LTE; Mobile radio interface Layer 3 specification; Core network protocols; Stage 3 (3GPP TS 24.008)".

History

Document history		
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