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Core Network and Interoperability Testing (INT);
Network Interoperability Test Description for emergency services over VoLTE;
(3GPP™ Release 15);
Part 2: Test Descriptions

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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 [1].

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 Descriptions (TDs) for network interoperability test description for emergency services over VoLTE in compliance with the relevant requirements and in accordance with the Test Purposes (TPs) presented in ETSI TS 103 795-1 [1].

2 References

2.1 Normative references

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

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

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

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

[1] ETSI TS 103 795-1: "Core Network and Interoperability Testing (INT); Network Interoperability Test Description for emergency services over VoLTE; (3GPP™ Release 15); Part 1: Test Purposes (TP)".

[2] ETSI TS 124 229: "Digital cellular telecommunications system (Phase 2+) (GSM); Universal Mobile Telecommunications System (UMTS); LTE; 5G; IP multimedia call control protocol based on Session Initiation Protocol (SIP) and Session Description Protocol (SDP); Stage 3 (3GPP TS 24.229 Release 15)".

[3] ETSI TS 129 165: "Digital cellular telecommunications system (Phase 2+) (GSM); Universal Mobile Telecommunications System (UMTS); LTE; 5G; Inter-IMS Network to Network Interface (NNI) (3GPP TS 29.165 Release 15)".

[4] ETSI TS 129 228: "Digital cellular telecommunications system (Phase 2+) (GSM); Universal Mobile Telecommunications System (UMTS); LTE; IP Multimedia (IM) Subsystem Cx and Dx Interfaces; Signalling flows and message contents (3GPP TS 29.228 Release 15)".

[5] ETSI TS 129 229: "Digital cellular telecommunications system (Phase 2+) (GSM); Universal Mobile Telecommunications System (UMTS); LTE; Cx and Dx interfaces based on the Diameter protocol; Protocol details (3GPP TS 29.229 Release 15)".

[6] ETSI TS 129 214: "Universal Mobile Telecommunications System (UMTS); LTE; Policy and charging control over Rx reference point (3GPP TS 29.214 Release 15)".

[7] ETSI TS 129 212: "Universal Mobile Telecommunications System (UMTS); LTE; Policy and Charging Control (PCC); Reference points (3GPP TS 29.212 Release 15)".

[8] ETSI TS 129 272: "Universal Mobile Telecommunications System (UMTS); LTE; 5G; Evolved Packet System (EPS); Mobility Management Entity (MME) and Serving GPRS Support Node (SGSN) related interfaces based on Diameter protocol (3GPP TS 29.272 Release 15)".

[9] ETSI TS 129 215: "Digital cellular telecommunications system (Phase 2+) (GSM); Universal Mobile Telecommunications System (UMTS); LTE; Policy and Charging Control (PCC) over S9 reference point; Stage 3 (3GPP TS 29.215 Release 15)".

[10] ETSI TS 129 328: "Digital cellular telecommunications system (Phase 2+) (GSM); Universal Mobile Telecommunications System (UMTS); LTE; 5G; IP Multimedia (IM) Subsystem Sh interface; Signalling flows and message contents (3GPP TS 29.328 Release 15)".

[11] ETSI TS 129 329: "Digital cellular telecommunications system (Phase 2+) (GSM); Universal Mobile Telecommunications System (UMTS); LTE; Sh interface based on the Diameter protocol; Protocol details (3GPP TS 29.329 Release 15)".

[12] IETF RFC 3261: "SIP: Session Initiation Protocol".

[13] ETSI TS 134 229-1: "Universal Mobile Telecommunications System (UMTS); LTE; Internet Protocol (IP) multimedia call control protocol based on Session Initiation Protocol (SIP) and Session Description Protocol (SDP); User Equipment (UE) conformance specification; Part 1: Protocol conformance specification (3GPP TS 34.229-1 Release 15)".

[14] ETSI TS 123 167: "Universal Mobile Telecommunications System (UMTS); LTE; IP Multimedia Subsystem (IMS) emergency sessions (3GPP TS 23.167)".

[15] ETSI TS 103 653-1: "Core Network and Interoperability Testing (INT); VoLTE/ViLTE interoperability test description over 4G/early 5G in physical/virtual environments; (3GPP™ Release 15); Part 1: Test Purposes (TP) and Protocol Implementation Conformance Statement (PICS) for VoLTE/ViLTE interoperability".

[16] ETSI TS 103 653-2: "Core Network and Interoperability Testing (INT); VoLTE/ViLTE interoperability test description over 4G/early 5G in physical/virtual environments; (3GPP™ Release 15); Part 2: Test Descriptions for VoLTE/ViLTE interoperability".

[17] IETF RFC 7090: "Public Safety Answering Point (PSAP) Callback".

[18] IETF RFC 5031: "A Uniform Resource Name (URN) for Emergency and Other Well-Known Services".

[19] IETF RFC 8147: "Next-Generation Pan-European eCall".

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 referenced document (including any amendments) applies.

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

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

[i.1] ETSI TR 184 008: "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); Infrastructure ENUM Options for a TISPAN IPX".

[i.2] IETF RFC 3761: "The E.164 to Uniform Resource Identifiers (URI); Dynamic Delegation Discovery System (DDDS) Application (ENUM)".

[i.3] ETSI TS 103 189 (V1.2.1): "Core Network and Interoperability Testing (INT);Assessment of end-to-end Quality for VoLTE and RCS".

[i.4] ISO/IEC 9646-1: "Information technology - Open Systems Interconnection - Conformance testing methodology and framework - Part 1: General concepts".

3 Definition of terms, symbols and abbreviations

3.1 Terms

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

Abstract Test Method (ATM): Refer to ISO/IEC 9646-1 [i.4].

Abstract Test Suite (ATS): Refer to ISO/IEC 9646-1 [i.4].

Implementation Under Test (IUT): Refer to ISO/IEC 9646-1 [i.4].

Test Purpose (TP): Refer to ISO/IEC 9646-1 [i.4].

3.2 Symbols

Void.

3.3 Abbreviations

For the purposes of the present document, the abbreviations given in ETSI TS 124 229 [2], ETSI TS 129 165 [3], ETSI TS 129 228 [4], ETSI TS 129 229 [5], ETSI TS 129 214 [6], ETSI TS 129 212 [7], ETSI TS 129 272 [8], ETSI TS 129 215 [9], ETSI TS 129 328 [10], ETSI TS 129 329 [11] and the following apply:

3GPP	3rd Generation Partnership Project
ACK	SIP 'ACK' message
AGW	Access GateWay
AN-GW	Access Network Gateway
AS	(IMS) Application Server
ATS	Abstract Test Suite
CF	(Test) ConFiguration
DL/UL	DownLink/UpLink
ENUM	E.164 Number Mapping
EPC	Evolved Packet Core
E-UTRAN	Enhanced Universal Terrestrial Radio Access Network
GSMA	GSM Association
IOP	InterOPerability
IPX	Internet Packet eXchange
IUT	Implementation Under Test
MMI	Man-Machine Interface
MSC	Message Sequence Chart
NAPTR	Naming Authority Pointer Record
NAS	Non Access Stratum
NAT	Network Address Translation
NGN	Next Generation Network
NS	Name Server
NWK	Network
PDCP	Packet Data Convergence Protocol
PGW	PDN Gateway
PHY	Physical
PIXIT	Protocol Implementation eXtra Information for Testing
PMN	Public Mobile Networks
PO	Point of Observation
PO_UE	Point of Observation on UE
RAN	Radio Access Network
RCS	Rich Communication Services
REL	RELease
RRC	Radio Resource Control
SGW	Serving Gateway

SIP UA	SIP User Agent
SUT	System Under Test
TD	Test Description
TN	Telephone Number
TP	Test Purpose
TSS	Test Suite Structure
UL	UpLink
UNI	User Network Interface

4 Test Environment

4.1 Introduction

The following architectural test configurations are referenced in the VoLTE NNI interoperability emergency TDs in the present document. They are intended to give a general rather than a specific view of the required connections between IMS and EPC network SUT(s) and associated UE(s), PSAP(s), AS(s), and DNS(s)/ENUM(s). Other configuration variants are currently not in the scope of the present document.

NOTE: Note that in the following figures observable Diameter interfaces are indicated as a solid green line, SIP interfaces are indicated as a solid blue line and user data interfaces are indicated as a solid yellow line. Non-observable interfaces are indicated as dashed lines.

4.2 Test configurations/architecture

4.2.1 Configuration CF_VoLTE_INT_ES

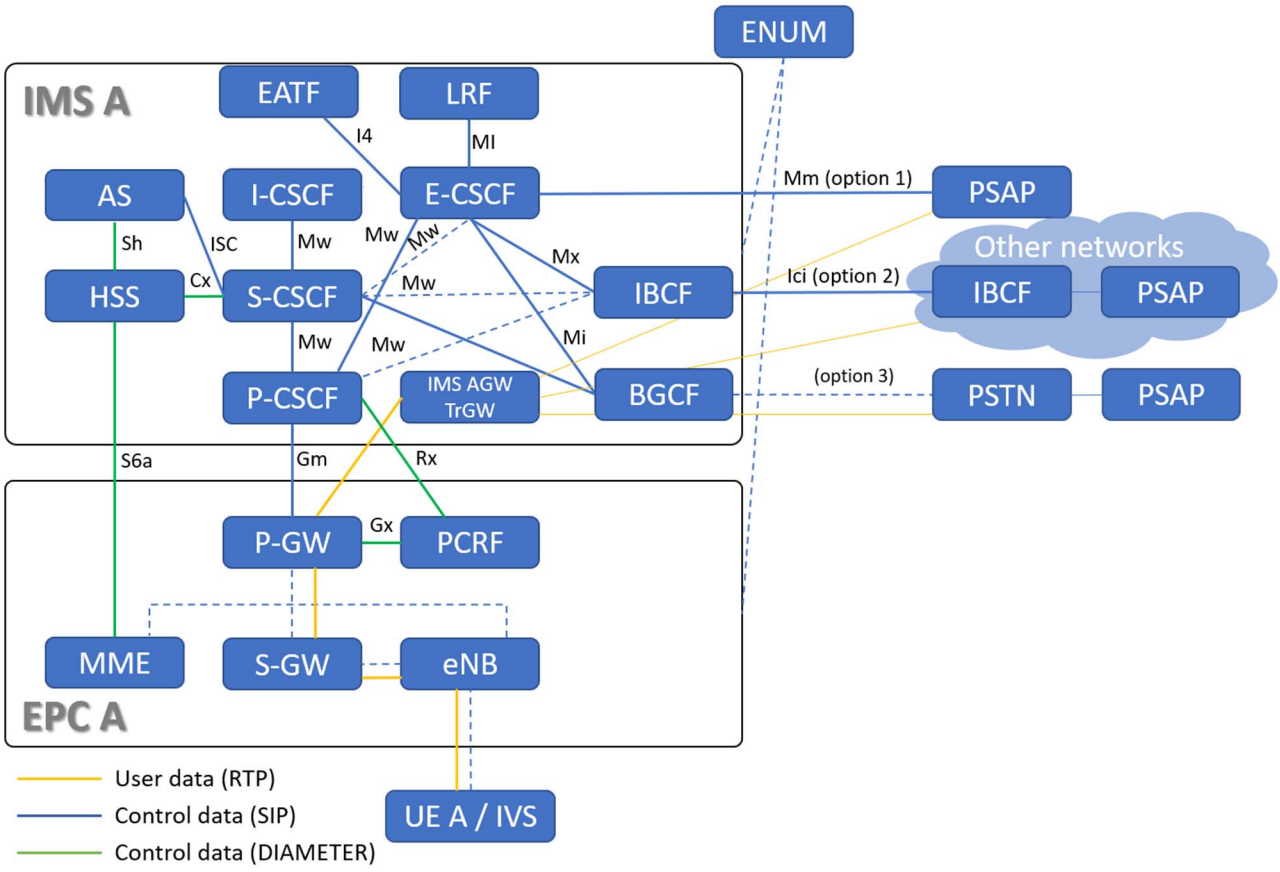


Figure 1: Configuration CF_VoLTE_INT_ES

Configuration CF_VoLTE_INT_ES is used for one home public line mobile network (HPLMN) where users are attached and registered to their home network. The suffix INT stands for home interoperability scenario and ES postfix stands for Emergency service. UE-A or IVS connects to home network represented by EPC A and IMS A. E-CSCF may route emergency IMS session directly to PSAP (option 1). Another option is routing of emergency IMS session from E-CSCF towards IBCF to another IP multimedia network towards PSAP (option 2 in the Figure 1) and to support legacy networks E-CSCF may route emergency IMS session to the BGCF via PSTN and towards PSAP (option 3 in the Figure 1). Attachment, Registration, Detachment and Deregistration procedures of user are performed locally in their own home network. For Call establishment, call modification and call release procedures signalling are going in HPLMN network and therefore all related TDs are named as home interoperability tests.

NOTE: It is assumed that operator emergency requests are forwarded from P-CSCF to E-CSCF as described in ETSI TS 124 229 [2], clause 5.2.10.3 (item 1B).

4.2.2 Configuration CF_VoLTE_RMI_ES

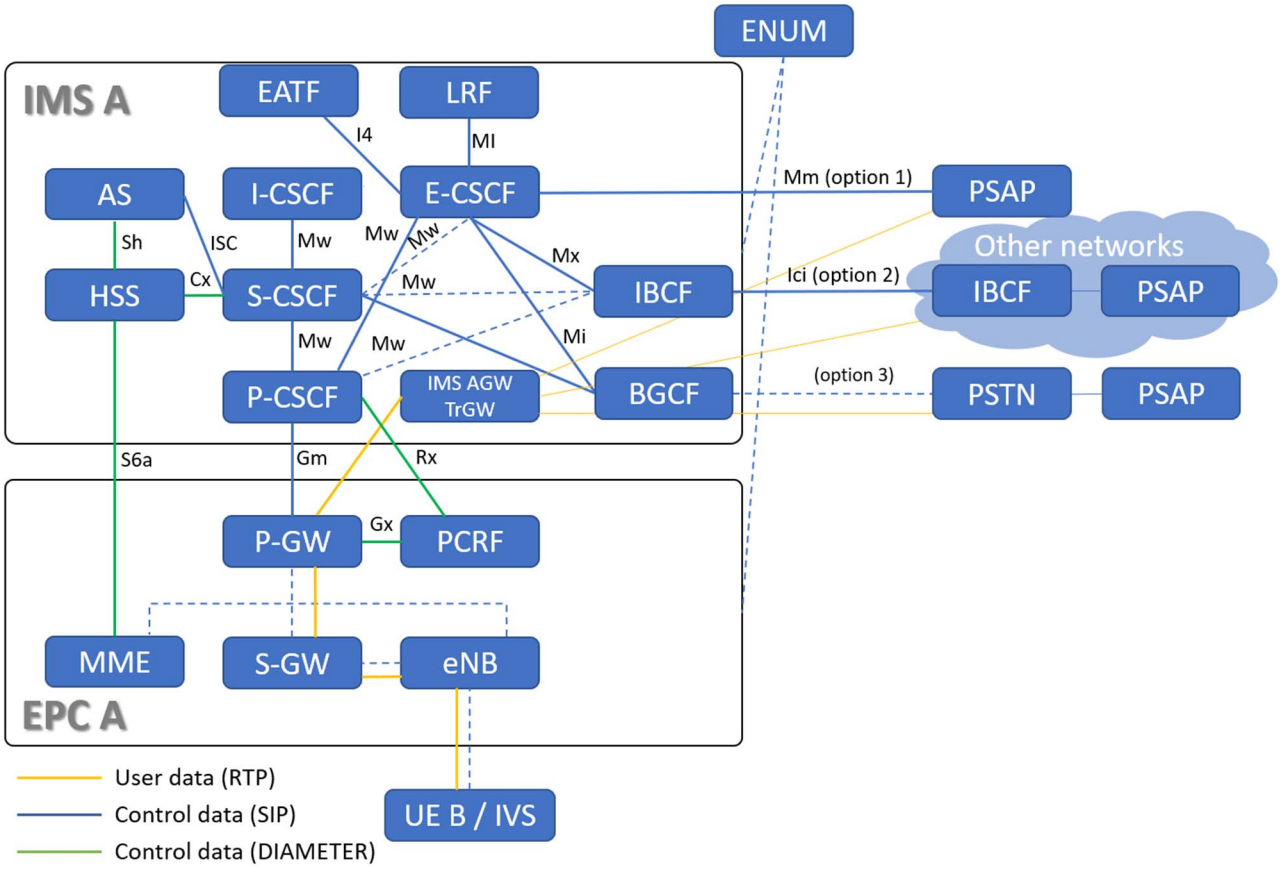


Figure 2: Configuration CF_VoLTE_RMI_ES

Configuration CF_VoLTE_RMI_ES describes roaming scenario. Within CF_VoLTE_RMI_ES, UE-B connects to the visited network A attached to the EPC A. Attachment and detachment of UE-B is performed at the visited network A and provides the ability to subsequently register the visiting user UE-B or IVS at the home network. For call establishment, call modification and call release procedures signalling are going via VPLMN network and therefore all related TDs are named as roaming interoperability tests. Visited E-CSCF may route emergency IMS session directly to PSAP (option 1). Another option is routing of emergency IMS session from visited E-CSCF towards IBCF to another IP multimedia network towards PSAP (option 2) and to support legacy networks visited E-CSCF may route emergency IMS session to the BGCF via PSTN and towards PSAP (option 3).

NOTE: It is assumed that operator emergency requests are forwarded from P-CSCF to E-CSCF as described in ETSI TS 124 229 [2], clause 5.2.10.3 (item 1B).

4.2.3 Configuration CF_VoLTE_RMI_S8HR

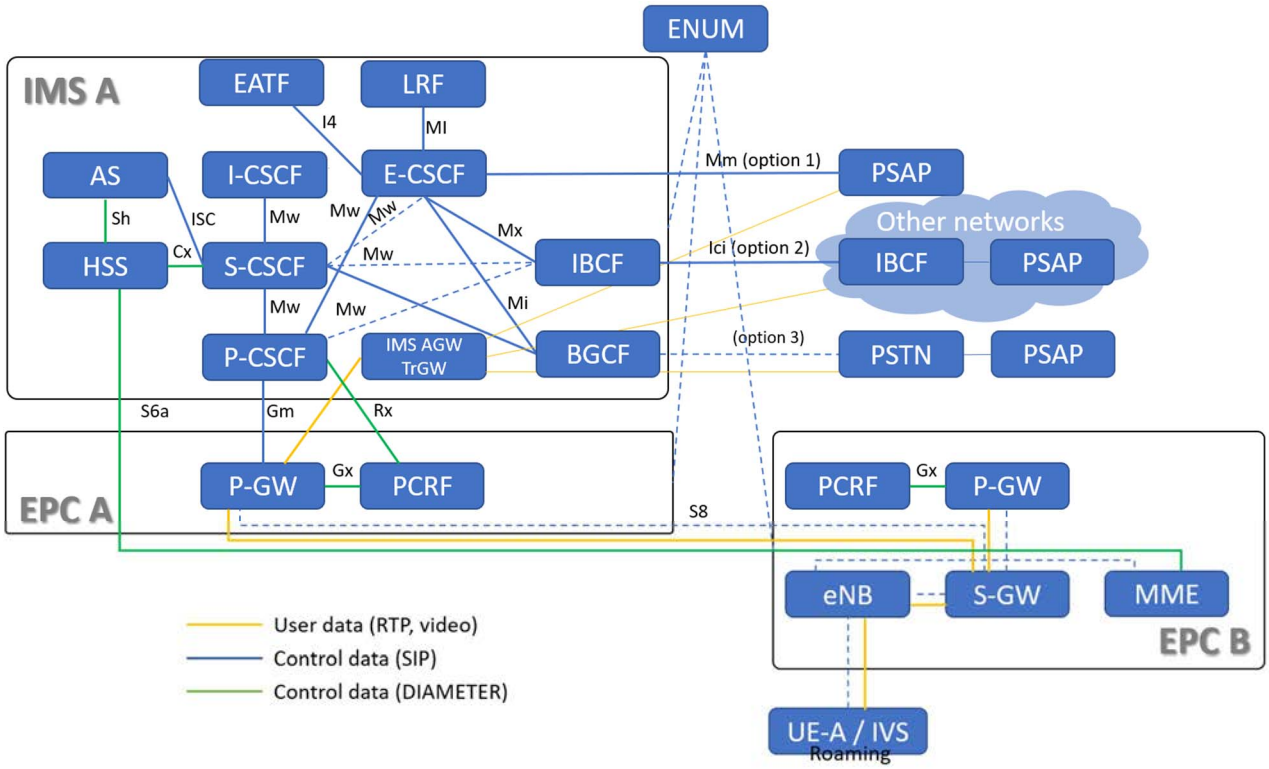


Figure 3: Configuration CF_VoLTE_RMI_S8HR

Configuration CF_VoLTE_RMI_S8HR describes an additional roaming scenario. Within CF_VoLTE_RMI_S8HR, UE-A connects to visited network B attached to the EPC B. Attachment and detachment of UE-A is performed at the visited network A and provides the ability to subsequently register the visited user UE-A at the home network over the S8 interface. UE_A or IVS acts as originating user and when an emergency call is trying to be established the signalling runs from UE_A or IVS over roaming/visited network B towards the home network A. The related roaming interoperability configuration is named CF_VoLTE_RMI_S8HR where 'S8' signifies routing over interface S8.

4.3 Test infrastructure

4.3.1 Introduction

The present clause covers the list of relevant emergency service components and interfaces used for testing interoperability between EPC, PCRF and IMS. VoLTE/ViLTE components are described in ETSI TS 103 653-2 [16] under clause 4.3. For components that are not present here or in ETSI TS 103 653-2 [16], standard functionality is assumed.

4.3.2 VoLTE component descriptions

4.3.2.1 E-CSCF

The E-CSCF is a component of the IP Multimedia Subsystem (IMS) network responsible for managing emergency sessions. When an emergency session request is received from a P-CSCF or an S-CSCF, the E-CSCF performs several functions, including validating the user's credentials and location information, requesting additional information if necessary, and determining the proper routing information for the session. The E-CSCF may also use the Location Retrieval Function (LRF) to retrieve or validate location information, and it may route the emergency session to an appropriate destination such as a Public Safety Answering Point (PSAP), including anonymous sessions. Overall, the E-CSCF ensures that emergency sessions are routed and managed appropriately throughout the IMS network and may generate Call Detail Records (CDRs) for billing or other purposes.

4.3.2.2 LRF

The LRF is responsible for managing location information in IMS networks. It receives location information from different sources such as the Home Subscriber Server (HSS), User Equipment (UE), and other network elements. The LRF processes this information to determine the location of a user or a device within the network.

4.3.2.3 EATF

EATF is a component of IMS that enables the transfer of emergency calls from a non-IMS network to an IMS network.

When a user initiates an emergency call from a non-IMS network (such as a traditional circuit-switched network), the call is first routed to a gateway that connects the non-IMS network to the IMS network. The gateway then sends the call to the EATF, which determines the appropriate IMS emergency service to handle the call.

The EATF is responsible for identifying the user's location, which is essential for routing the call to the appropriate emergency service. It also ensures that emergency calls receive priority treatment in the IMS network, including resource allocation and admission control.

4.3.3 VoLTE Reference Points and Protocols

4.3.3.1 The Mw reference point between x-CSCF and x-CSCF (SIP)

The Mw interface is between an x-CSCF and another x-CSCF within the IMS core network (e.g. P-CSCF to E-CSCF). The protocols used on the Mw interface are SIP and SDP and are defined in ETSI TS 124 229 [2].

4.3.3.2 The Ml reference point between E-CSCF and LRF

Ml is a reference point between an E-CSCF and an LRF. See ETSI TS 123 167 [14].

4.3.3.3 The Mx reference point between E-CSCF and IBCF

Mx is a reference point between an E-CSCF and an IBCF. See ETSI TS 123 167 [14].

4.3.3.4 The I4 reference point between E-CSCF and EATF

I4 is a reference point between an E-CSCF and an EATF. See ETSI TS 123 167 [14].

4.3.3.5 The Mm reference point between E-CSCF and PSAP

Mm is a reference point between an E-CSCF and an PSAP. See ETSI TS 123 167 [14].

4.3.3.6 The Mi reference point between E-CSCF and BGCF

Mm is a reference point between an E-CSCF and an BGCF. See ETSI TS 123 167 [14].

4.3.4 Applicable 3GPP Release Number

Considering that the purposes of these tests is to prove base IOP between two different systems from potentially different vendors, the functionality has been limited to common/typical procedures, while exhaustive conformance testing is out of the scope of the present document. The present document is aimed at Release 15 but (given its scope), Release 14 implementations should still be able to perform most of the tests without major difficulties.

4.4 Test pre-requisites

4.4.1 IP Version

Whether the EPC system uses Ipv4 or Ipv6 to transport (i.e. tunnelling method) the User Plane data inside the EPS is irrelevant to the outcome of the tests. Options for encapsulating either Ipv4 or Ipv6 packets into both Ipv4 and Ipv6 transported tunnels exist. There are no differences in the User Plane provided services by the EPC platform relevant to the used IP transport version, such that this decision can be taken by the EPC vendors as to maximize performance and optimize their platforms.

The UE attachment to the EPS is assumed to be a dual Ipv4 and Ipv6. It is assumed that for the test purposes, the IMS client software will be capable of SIP signalling and media transport over both protocol version. The choice will be a configuration parameter (e.g. P-CSCF provisioned address in ISIM, DHCP or DNS). The SDP media should use the same IP version protocol as discovered for SIP signalling.

The IMS-EPC IOP Test Suite will be executed once for IMS clients using Ipv4 and once for IMS clients using Ipv6.

4.4.2 Number Resolution

"ENUM (IETF RFC 3761 [i.2]) is a capability that transforms E.164 numbers into domain names and then uses the DNS (Domain Name System) to discover NAPTR records that specify the services available for a specific domain name" (ETSI TR 184 008 [i.1]).

The test infrastructure focuses on the use of Infrastructure ENUM to map a telephone number into a SIP URI that may identify a specific Point of Interconnection (PoI) to that communication provider's network that may enable the originating party to establish communication with the associated terminating party either directly or through an IPX.

The Infrastructure ENUM platform has a tiered structure and provides authoritative, service specific information to the querying party. A combination of Tier 0, Tier 1 and Tier 2 registries enables global discovery of ENUM data.

When returning the SIP URI of a PoI the ENUM solution acts a hosted T2 ENUM registry for the number range holder. When returning a NS record the ENUM solution acts as either a Tier 0 or Tier 1 registry.

4.4.3 QoS aspects

The present document describes only the functional signalling aspects of the interworking of IMS networks. ETSI TS 103 189 [i.3] defines a set of test descriptions that allow the evaluation of the Quality of Service (QoS) that is available on a connection established via the NNI interface between two Ues following the use cases and test descriptions described in the present document. Wherever QoS testing can be applied a link is given to the relevant clause of ETSI TS 103 189 [i.3].

4.5 Test description overview

The test descriptions are documented in clauses 5 and 6.

Clause 5 represents test descriptions in the single network (non-roaming) case and clauses 6 in the roaming case respectively. For each clause, the test descriptions are presented in the following groupings:

- Emergency attachment and Emergency Registration;
- Emergency SIP Session/Emergency Bearer Operations:
  - Emergency SIP Session Establishment.

- Emergency SIP Session Modification.
- Emergency SIP Session Release.
- Emergency SIP Session Abort/Reject.

- Emergency De-registration (with/without Emergency sessions).
- Emergency Detachment (with/without SIP sessions, with/without Emergency registration).

The Test Descriptions present a definitive signalling and procedural flow through the test's execution. As a very high number of test variations may be generated, here only the most common scenarios are approached.

Each Test Description can be reconfigured to test various aspects (e.g. Ipv4 and Ipv6 IMS registrations). Yet these reconfigurations are to be regarded only as specific to the individual test executions as they should not affect the test descriptions.

4.6 TD naming convention

TDs are numbered, starting at 01, within each group.

Table 1: TD identifier naming convention scheme

Identifier: **<TD>_<type>_<group>_<network>_<scope>_<nn>**			
<td>	=	Test Description:	fixed to "TD"
<type>	=	Communication:	VoLTE
<group>	=	Emergency:	EMC - Emergency Call
			NGC - NG eCall
			ECO - Emergency Call or NG eCall (common)
<network>	=	Network:	INT - Interoperability
			RMI - Roaming
<scope>	=	Group	ATT - Attachment
			REG - Registration
			INI - Session establishment and modification
			REL - Session Release
			ABT - Session Abort
			REJ - Session Rejection
			DRG - Deregistration
			DTC - Detachment
<nn>	=	Sequential number	(01 to 99)

5 Test Descriptions (Interoperability at HPLMN)

5.0 General

The Interoperability Test Descriptions (TDs) defined in the following clauses are derived from the Emergency Test Purposes (TPs) specified in ETSI TS 103 795-1 [1] (ones containing ECO, EMC or NGC identifier are related to the emergency TPs) and common VoLTE/ViLTE Test Purposes (TPs) specified in ETSI TS 103 653-1 [15], where each TD may realize one or more TPs.

Each TD contains three parts:

1) The TD itself in tabular format.

2) The call flow associated to the TD.

3) A textual description of the call flow.

5.1 Network Attachment

5.1.1 UE Emergency Network Attachment and Establishment of the Emergency Bearer with USIM

Interoperability Test Description		
Identifier:	TD_VoLTE_ECO_INT_ATT_01	
Objective:	To perform UE emergency attachment to the network with USIM and establish an emergency bearer.	
Summary:	On successful emergency attachment, the UE/IVS should discover the P-CSCF IP address. The EPC will create the Emergency Bearers which will allow communication only between the UE and the P-CSCF and allowed forwarding towards E-CSCF.	
Configuration:	CF_VoLTE_INT_ES	
SUT:	IMS A and EPC A	
Interfaces:	Gx, S6a	
References:		ETSI TS 124 229 [2], clauses 9.2.1 and L.2.2.6
	Gx	ETSI TS 129 212 [7], clauses 4.5.15 and 4a.5.12
	S6a	ETSI TS 129 272 [8], clause 5.2.1.1 (MME shall proceed even if Update Location fails)
Pre-test conditions:	• Network emergency attachment credential provisioned in UE A, HSS/SPR and PCRF. • HSS/SPR and UE A provisioned with selectable emergency APN configurations for Ipv4, Ipv6 or Ipv4&Ipv6 PDN types. • P-CSCF address provisioned in the PCRF for the purpose of delivery to UE on emergency attachment. • Emergency Bearer PCRF policies set to allow UE A - P-CSCF communication. • Default EPC Gating Policy set to "Deny". • UE A contains USIM and is not attached to network and EPC.	
Test Sequence:	**Step**	
	1	UE A starts emergency network attachment to EPC
	2	Verify that the message sequence is correct
	3	Verify that EPC establishes Emergency Bearer for allowing UE A - P-CSCF communication, by starting at UE A an Emergency registration
	4	Verify that UE A attached successfully and received the following information: • suitable Ipv4 and/or Ipv6 address(es) • DNS configuration information P-CSCF IP address or FQDN
	5	Verify that arbitrary IP packets from UE A to arbitrary node, other than the P-CSCF, are filtered-out by EPC and not visible on PO_Sgi
	6	Verify that arbitrary IP packets from another node (e.g. PSAP sent over PO_Sgi) to UE A, are filtered-out by EPC and not visible on PO_UE A

Interoperability Test Description			
Conformance criteria of test sequence step:	2	S6a S6a Gx	TP_S6A_MME_ULR_01 (ULR - Event 2) TP_S6A_HSS_ECO_ULA_01 (ULA - Event 3) TP_GX_PCRF_ECO_CCA_01 (CCR, CCA - Events 4, 5)

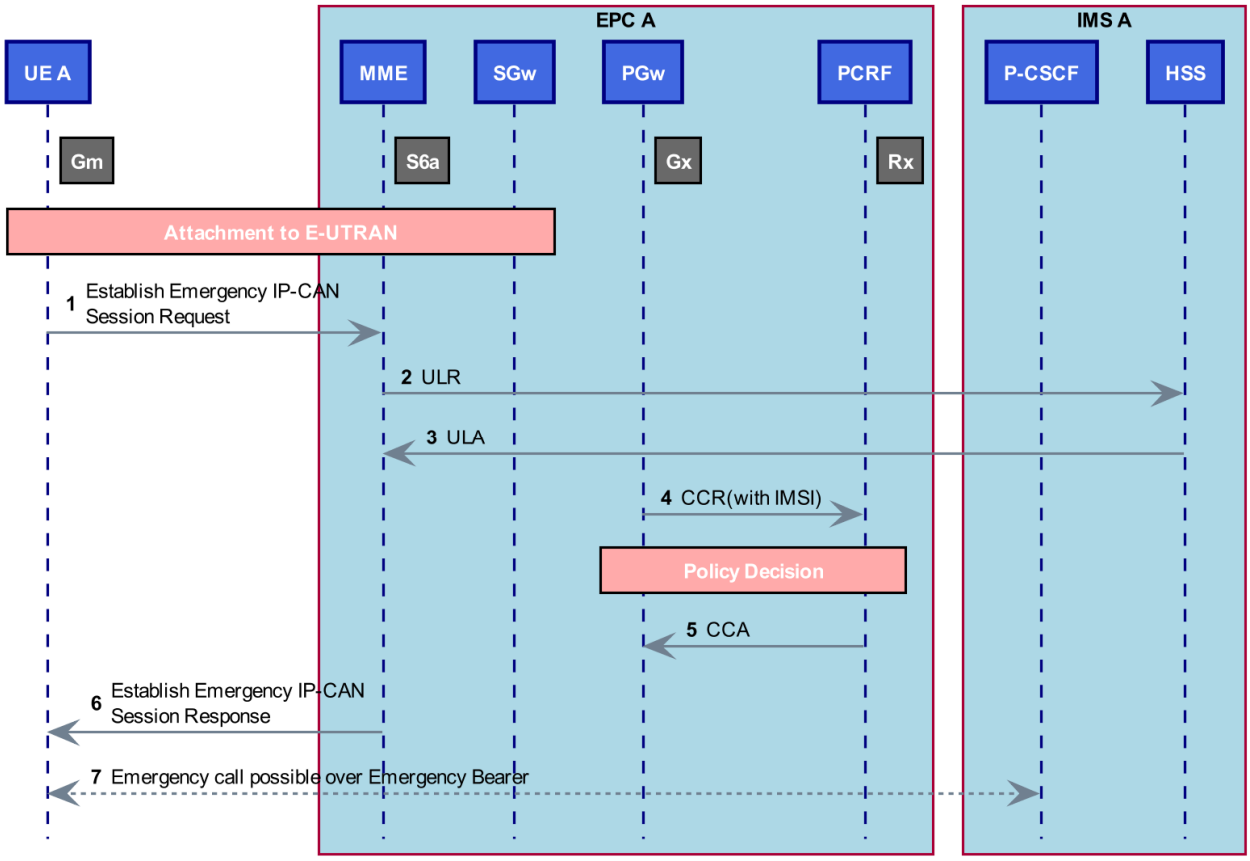


Figure 4: Emergency network attachment with USIM

1) The UE-A requests IP-CAN emergency session establishment to the EPC (MME).
2) The MME sends a ULR message to the HSS/SPR.
3) The HSS responds with ULA.
4) The PGW sends a CCR message with IMSI to the PCRF to request the emergency bearer.
5) The PCRF responds with a CCA.
6) The MME responds to the UE A, confirming that the emergency IP-CAN has been successfully set up.
7) User is informed that the emergency bearer has been successfully set up.

5.1.2 UE Emergency Network Attachment and Establishment of the Emergency Bearer without USIM

Interoperability Test Description		
Identifier:	TD_VoLTE_EMC_INT_ATT_02	
Objective:	To perform UE emergency attachment to the network without USIM (related only to emergency call) and establish an emergency bearer.	
Summary:	On successful emergency attachment, the UE/IVS should discover the P-CSCF IP address. The EPC will create the Emergency Bearers which will allow communication only between the UE and the P-CSCF and allowed forwarding towards E-CSCF.	
Configuration:	CF_VoLTE_INT_ES	
SUT:	IMS A and EPC A	
Interfaces:	Gx, S6a	
References:		ETSI TS 124 229 [2], clauses 9.2.1 and L.2.2.6
	Gx	ETSI TS 129 212 [7], clause 4.5.15
	S6a	ETSI TS 129 272 [8], clause 5.2.1.1 (MME shall proceed even if Update Location fails)
Pre-test conditions:	• Network emergency attachment credential provisioned in UE A, HSS/SPR and PCRF. • HSS/SPR and UE A provisioned with selectable emergency APN configurations for Ipv4, Ipv6 or Ipv4&Ipv6 PDN types. • P-CSCF address provisioned in the PCRF for the purpose of delivery to UE on emergency attachment. • Emergency Bearer PCRF policies set to allow UE A - P-CSCF communication. • Default EPC Gating Policy set to "Deny". • UE A does not contain USIM and is not attached to network and EPC.	
Test Sequence:	**Step**	
	1	UE A starts emergency network attachment to EPC
	2	Verify that the message sequence is correct
	3	Verify that EPC establishes Emergency Bearer for allowing UE A - P-CSCF communication, by starting at UE A an Emergency registration
	4	Verify that UE A attached successfully and received the following information: • suitable Ipv4 and/or Ipv6 address(es) • DNS configuration information P-CSCF IP address or FQDN
	5	Verify that arbitrary IP packets from UE A to arbitrary node, other than the P-CSCF, are filtered-out by EPC and not visible on PO_Sgi
	6	Verify that arbitrary IP packets from another node (e.g. PSAP sent over PO_Sgi) to UE A, are filtered-out by EPC and not visible on PO_UE A
Conformance criteria of test sequence step:	2	S6a TP_S6A_MME_ULR_01 (ULR - Event 2) S6a TP_S6A_HSS_ECO_ULA_01 (ULA - Event 3) Gx TP_GX_PCRF_EMC_CCA_01 (CCR, CCA - Events 4, 5)

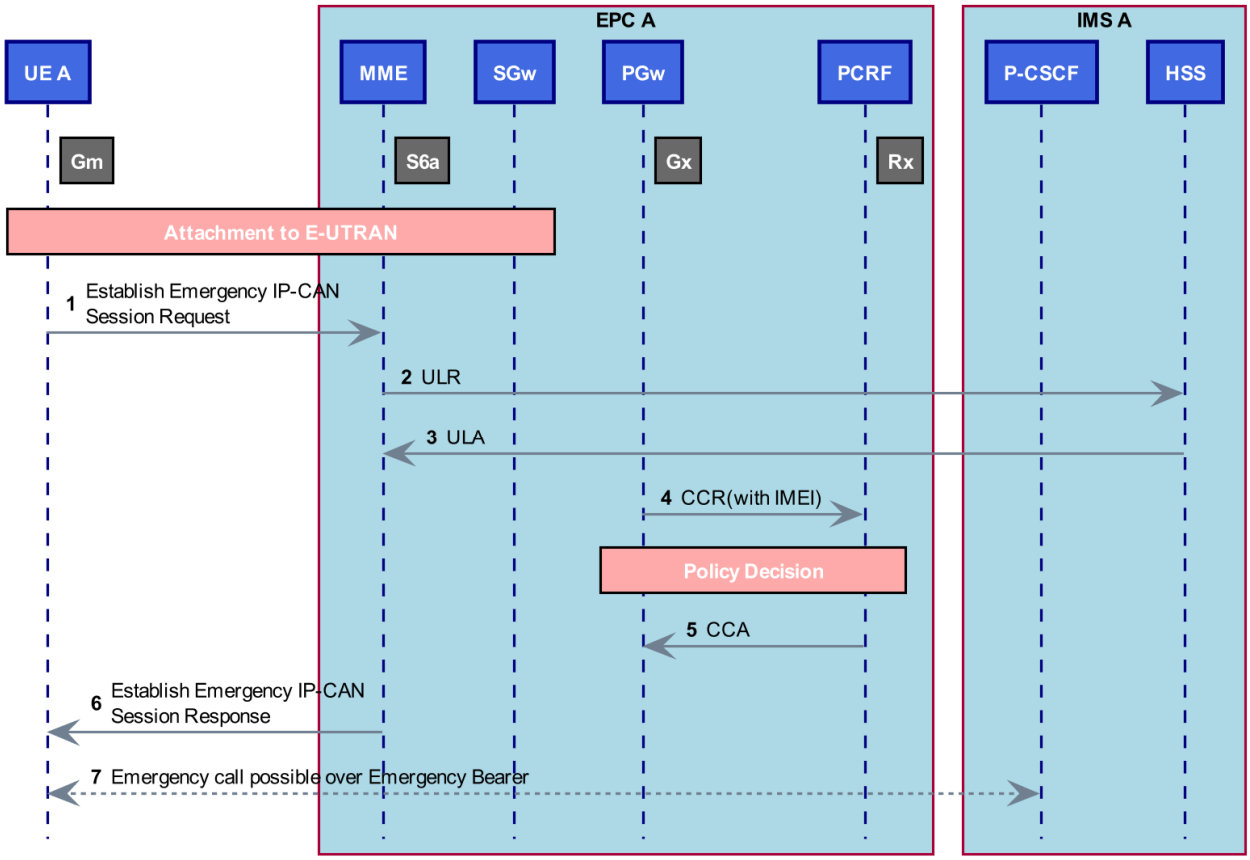


Figure 5: Emergency network attachment without USIM

1) The UE-A requests IP-CAN emergency session establishment to the EPC (MME).
2) The MME sends a ULR message to the HSS/SPR.
3) The HSS responds with ULA.
4) The PGW sends a CCR message with IMEI to the PCRF to request the emergency bearer.
5) The PCRF responds with a CCA.
6) The MME responds to the UE A, confirming that the emergency IP-CAN has been successfully set up.
7) User is informed that the emergency bearer has been successfully set up.

5.2 IMS Emergency Registration

5.2.1 IMS Emergency Registration - Successful

Interoperability Test Description	
Identifier:	TD_VoLTE_ECO_INT_REG_01
Objective:	To perform emergency registration via the established emergency bearer. Note that some Ues perform emergency registration automatically on attachment - in which case this test becomes merged with the previous ones.
Summary:	During emergency registration, the P-CSCF shall request the PCRF to perform session binding onto the underlying emergency bearer. The PCRF should act on the request and modify the bearer. Subsequent signalling should make use of the respective bearer's QoS and priority characteristics.
Configuration:	CF_VoLTE_INT_ES
SUT:	IMS A and EPC A
Interfaces:	Gm, Mw, Cx, Rx

Interoperability Test Description		
References:	Gm, Mw	ETSI TS 124 229 [2], clauses 5.1.1 and 5.1.6.1 ETSI TS 134 229-1 [13], clauses C.20 and 19.1.1.3 (items 2 and 3)
	Cx	ETSI TS 129 228 [4], clauses 6.1.1, 6.1.2 and 6.3 and Annex G ETSI TS 129 229 [5], clause 6.1.1
	Rx	ETSI TS 129 214 [6], clause A.5
Pre-test conditions:	• UE A previously attached to EPC and may be previously initially registered to IMS(see TD_VxLTE_INT_REG_01 in ETSI 103 653-2 [16], and an emergency bearer has been established. An emergency bearer allowing UE A - P-CSCF- E-CSCF IP communication. • HSS provisioned with UE A' subscription. • UE A discovered the P-CSCF address.	
Test Sequence:	**Step**	
	1	UE A triggers Emergency registration.
	2	Verify that the message sequence is correct.
	3	Verify that IMS included a Media Description for emergency signalling according to UE A.IP_Address, UE A.SIP_Port, PCSCF.IP_Address, PCSCF.SIP_Port.
	4	Verify that the PCRF successfully provisioned QOS rules to the EPC on the emergency bearer.
	5	Verify that UE A can exchange subsequent signalling with IMS.
	6	Verify that UE A subsequent signalling is transported with appropriate PCC characteristics.
Conformance criteria of test sequence step:	2	Gm TP_GM_PCSCF_ECO_REGISTER_01 (Events 1, 12) Gm TP_GM_PCSCF_ECO_REGISTER_02 (Events 13, 22) Mw TP_MW_PCSCF_ECO_REGISTER_01 (Events 4, 11) Mw TP_MW_PCSCF_ECO_REGISTER_02 (Events 14, 21) Mw TP_MW_ICSCF_ECO_REGISTER_01 (Events 7, 10) Mw TP_MW_ICSCF_ECO_REGISTER_02 (Events 17, 20) Cx TP_CX_HSS_ECO_UAA_01 (UAR, UAA - Events 5, 6) Cx TP_CX_HSS_MAA_01 (MAR, MAA - Events 8, 9) Cx TP_CX_HSS_ECO_UAA_02 (UAR, UAA - Events 15, 16) Cx TP_CX_HSS_SAA_01 (SAR, SAA - Events 18, 19)
	3	Rx TP_RX_PCSCF_ECO_AAR_01 (AAR - Event 2) Rx TP_RX_PCRF_ECO_AAA_01 (AAA - Event 3)

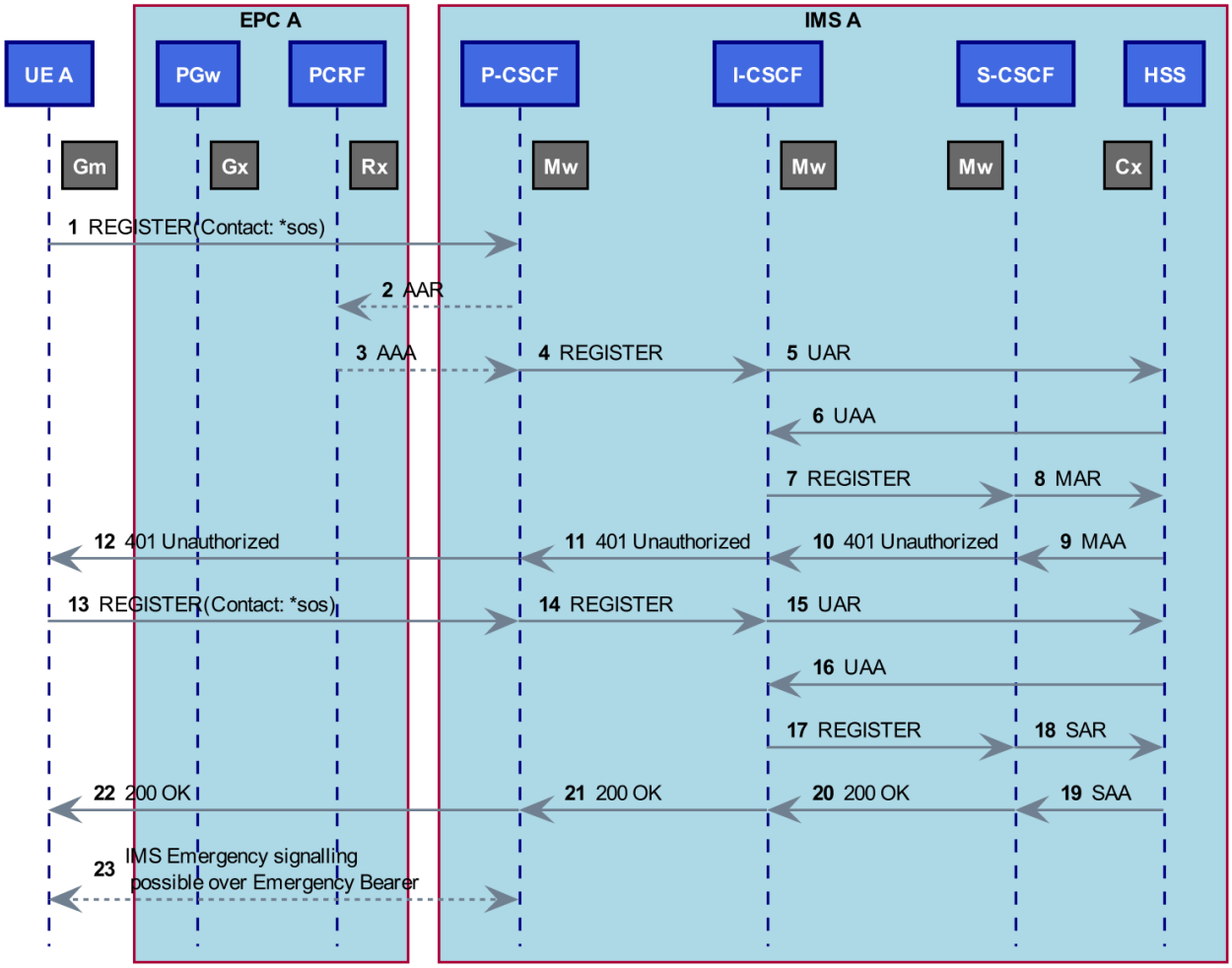


Figure 6: Emergency Registration (success)

1) The UE-A requests IMS A Registration.
2) P-CSCF optionally sent AAR to PCRF to provide EPC-level identities (MSISDN, IMSI, IMEI).
3) PSRF responds with AAA.
4) P-CSCF forwards the REGISTER to I-CSCF.
5) I-CSCF sends UAR to HSS.
6) HSS responds with UAA.
7) I-CSCF forwards the REGISTER to S-CSCF.
8) S-CSCF sends MAR to HSS.
9) HSS responds with MAA.
10) IMS A rejects the REGISTER and issues a challenge.
11) I-CSCF forwards 401 response to P-CSCF.
12) P-CSCF forwards 401 response to UE-A.
13) The REGISTER is re-sent with an Authorization header.
14) P-CSCF forwards the REGISTER to I-CSCF.
15) I-CSCF sends UAR to HSS.

16) HSS responds with UAA.

17) I-CSCF forwards the REGISTER to S-CSCF.

18) S-CSCF sends SAR to HSS.

19) HSS responds with SAA.

20) The IMS registration is successful.

21) I-CSCF forwards 200 response to P-CSCF.

22) P-CSCF forwards 200 response to UE-A.

23) IMS Emergency signalling possible over Emergency Bearer.

5.2.2 IMS Emergency Registration - Unsuccessful

Interoperability Test Description		
Identifier:	TD_VoLTE_ECO_INT_REG_02	
Objective:	To attempt initial emergency registration via the established emergency bearer. In this case, the emergency registration is not successful due to not accepted UE credentials. Emergency call can be established without emergency registration (see TD_VoLTE_ECO_INT_INI_02).	
Summary:	On failed UE emergency Registration to IMS, IMS will be able to transport emergency signalling.	
Configuration:	CF_VoLTE_INT_ES	
SUT:	IMS A and EPC A	
Interfaces:	Gm, Mw, Cx, Rx	
References:	Gm, Mw	ETSI TS 124 229 [2], clauses 5.1.6.2, 5.2.10.5 ETSI TS 134 229-1 [13], clause 19.4.5
	Rx	ETSI TS 129 214 [6], clause A.5
	Cx	ETSI TS 129 228 [4], clause 6.1.1.1
Pre-test conditions:	• UE A previously attached to EPC, but not registered to IMS. • EPC established a Default Bearer allowing UE A - P-CSCF IP communication. • HSS of IMS not provisioned with UE A's subscription. • UE A discovered the P-CSCF address.	
Test Sequence:	**Step**	
	1	UE A triggers Emergency registration with not acceptable credentials.
	2	Verify that the Emergency registration has been rejected.
	3	Verify that the PCRF is not invoked.
Conformance criteria of test sequence step:	2	Gm TP_GM_PCSCF_ECO_REGISTER_01 (Events 1, 12) Gm TP_GM_PCSCF_ECO_REGISTER_03 (Events 13, 22) Mw TP_MW_PCSCF_ECO_REGISTER_01 (Events 4, 11) Mw TP_MW_PCSCF_ECO_REGISTER_03 (Events 14, 21) Mw TP_MW_ICSCF_ECO_REGISTER_01 (Events 7, 10) Mw TP_MW_ICSCF_ECO_REGISTER_03 (Events 17, 20) Cx TP_CX_HSS_ECO_UAA_01 (UAR, UAA - Events 5, 6) Cx TP_CX_HSS_MAA_01 (MAR, MAA - Events 8, 9) Cx TP_CX_HSS_ECO_UAA_02 (UAR, UAA - Events 15, 16) Cx TP_CX_HSS_ECO_SAA_01 (SAR, SAA - Events 18, 19)
	3	Rx TP_RX_PCSCF_ECO_AAR_01 (AAR - Event 2) Rx TP_RX_PCRF_ECO_AAA_01 (AAA - Event 3)

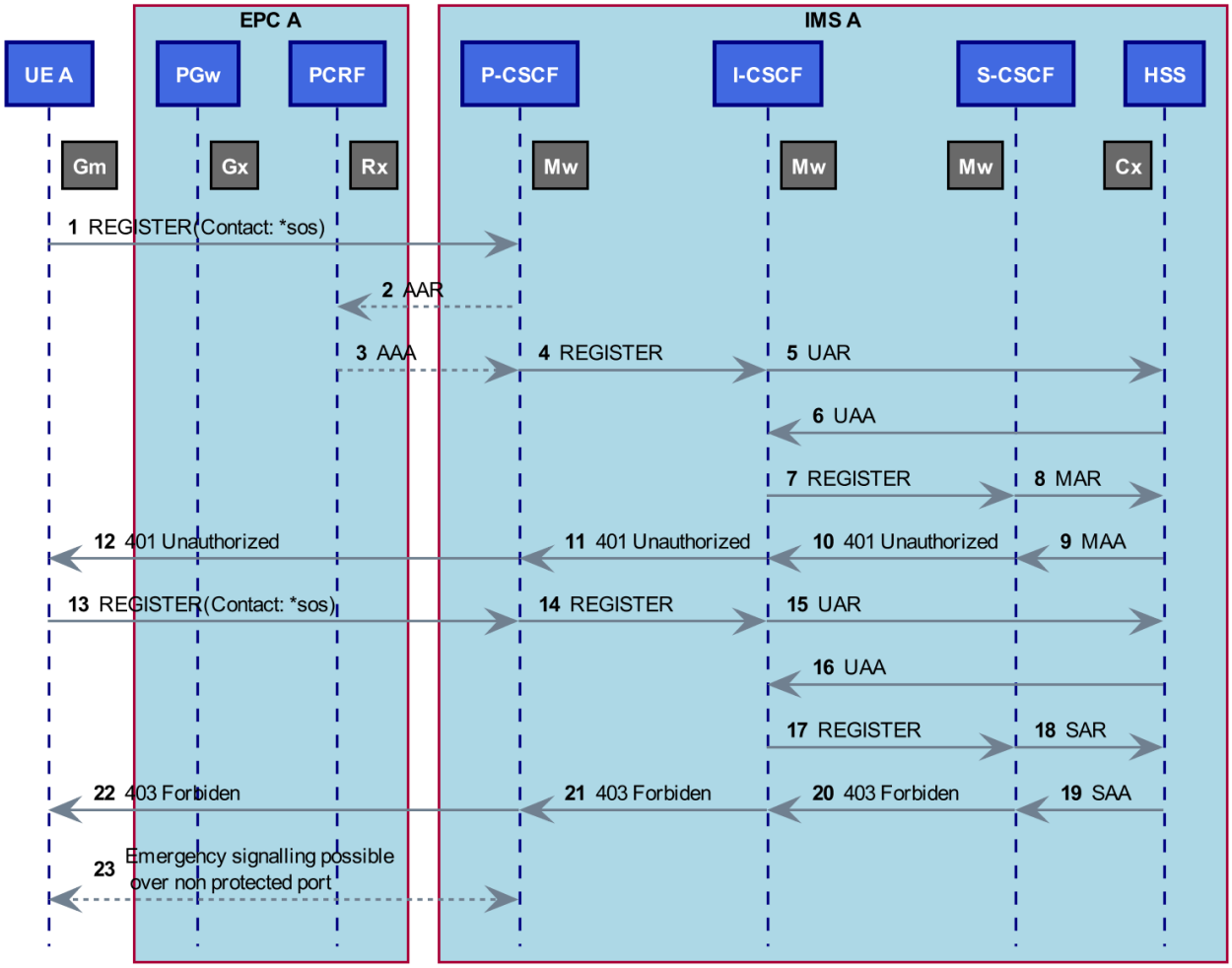


Figure 7: IMS Initial Registration (unsuccessful)

1) The UE-A requests IMS A Registration.
2) P-CSCF optionally sent AAR to PCRF to provide EPC-level identities (MSISDN, IMSI, IMEI).
3) PCRF responds with AAA.
4) P-CSCF forwards the REGISTER to I-CSCF.
5) I-CSCF sends UAR to HSS.
6) HSS responds with UAA.
7) I-CSCF forwards the REGISTER to S-CSCF.
8) S-CSCF sends MAR to HSS.
9) HSS responds with MAA.
10) IMS A rejects the REGISTER and issues a challenge.
11) I-CSCF forwards 401 response to P-CSCF.
12) P-CSCF forwards 401 response to UE-A.
13) The REGISTER is re-sent with an Authorization header.
14) P-CSCF forwards the REGISTER to I-CSCF.
15) I-CSCF sends UAR to HSS.

16) HSS responds with UAA.

17) I-CSCF forwards the REGISTER to S-CSCF.

18) S-CSCF sends SAR to HSS.

19) HSS responds with SAA.

20) The IMS registration is unsuccessful.

21) I-CSCF forwards 403 Forbidden response to P-CSCF.

22) P-CSCF forwards 403 Forbidden response to UE-A.

23) Emergency signalling possible over non protected port.

5.3 Emergency Session and Emergency Bearer Operations (Interoperability)

5.3.0 Introduction

5.3.1 Emergency Session Establishment

5.3.1.1 General

The term "initiates an emergency call" or "initiates an NG eCall" used in the test descriptions describes the use of a service URN with a top-level service type "sos", which marks the user intends to establish an emergency call.

Some examples of the services with a top-level service type "sos" and the short descriptions provided in IETF RFC 5031 [18] and IETF RFC 8147 [19] can be found in Table 1.

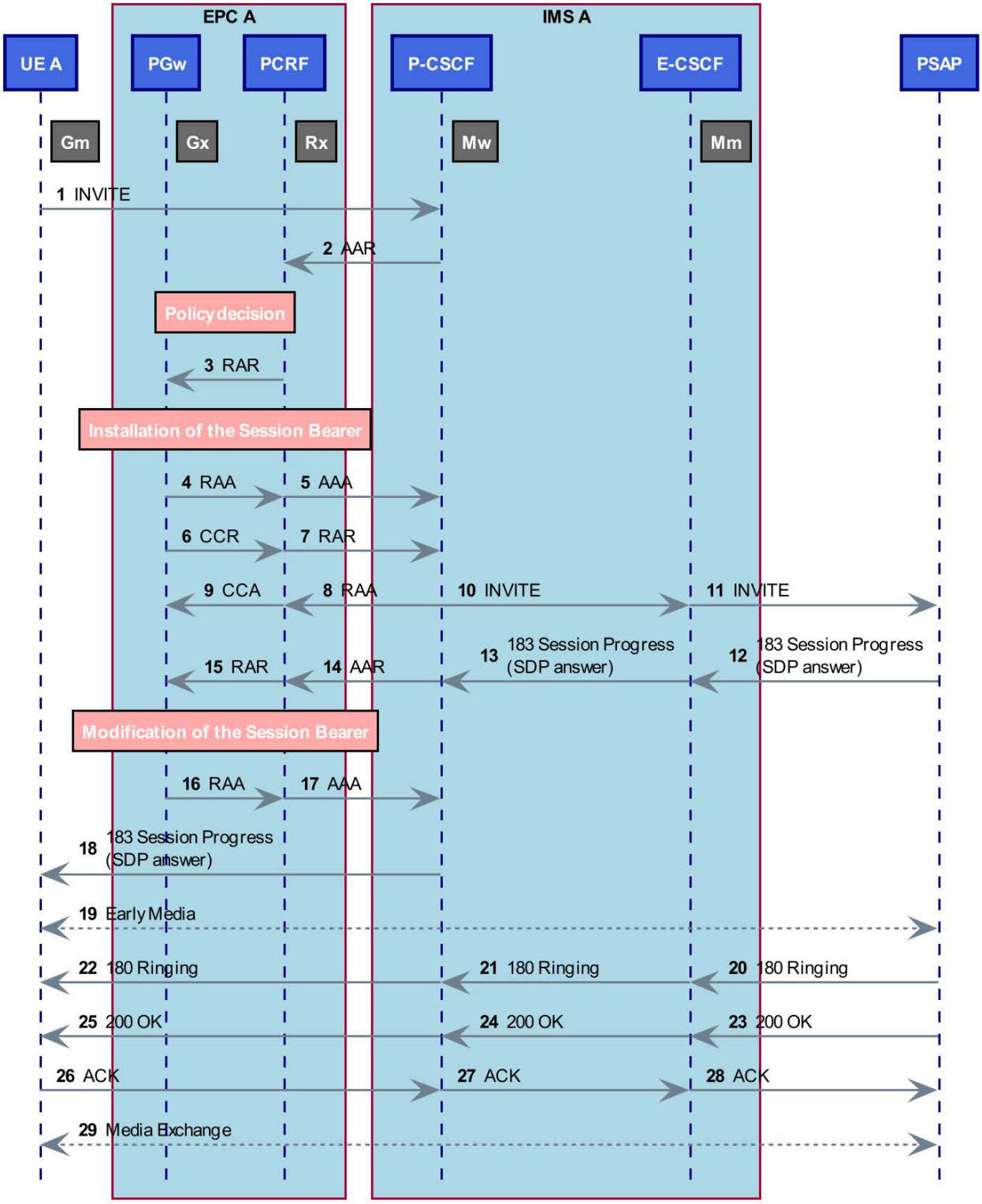
Table 1: URN services

URN-Service	Short Description (see IETF RFC 5031 [18] and IETF RFC 8147 [19])
urn:service:sos	The generic 'sos' service reaches a Public Safety Answering Point (PSAP)
urn:service:sos.ambulance	This service identifier reaches an ambulance service that provides emergency medical assistance and transportation.
urn:service:sos.fire	The 'fire' service identifier summons the fire service, also known as the fire brigade or fire department.
urn:service:sos.gas	The 'gas' service allows the reporting of natural gas leaks or other natural gas emergencies.
urn:service:sos.police	The 'police' service refers to the police department or other law enforcement authorities.
urn:service:sos.ecall.automatic	The 'ecall' service indicating automatically triggered eCall.
urn:service:sos.ecall.manual	The 'ecall' service indicating manually triggered eCall.

5.3.1.2 UE calling PSAP with emergency registration

Identifier:	TD_VoLTE_ECO_INT_INI_01	
Objective:	To demonstrate the establishment of dedicated bearers at the originating EPC due to SIP emergency session establishment within an emergency registration. PSAP is located in the IM CN subsystem of IMS A.	
Summary:	An emergency call is setup between UE A and the PSAP located in the IM CN subsystem of IMS A. UE-A is attached to EPC A and registered to IMS A, has performed the emergency registration to IMS A, and requests emergency session establishment using an emergency URN. The P-CSCF derives descriptions of the Service Data Flow from the SDP data, requests creation of adequate bearers from PCRF and EPC, and forwards the request to the E-CSCF. The E-CSCF retrieves the PSAP URI from local configuration and forwards the request to this PSAP. Media transport is possible only after the successful establishment of the session. Media negotiation happens during INVITE/200 OK (UE A sends SDP-offer, PSAP responds with SDP-answer).	
Configuration:	CF_VoLTE_INT_ES option 1	
SUT:	IMS A, EPC A and PSAP	
Interfaces:	Gm, Mw, Rx, Gx, Mm	
References:	Mm	ETSI TS 124 229 [2], clause 5.11.2 ETSI TS 123 167 [14]
	Gm, Mw	ETSI TS 124 229 [2], clauses 5.1.6.8.3, 5.1.6.11, 5.2.6.3.3, 5.2.10.3 and 5.11.2
	Rx	ETSI TS 129 214 [6], clauses 4.4.1, A.1, A.2 and annex B
	Gx	ETSI TS 129 212 [7], clause 4.5.2
Pre-test conditions:	• UE A previously attached to EPC A. • UE A previously registered to IMS A. • EPC established an emergency Bearer allowing UE A - P-CSCF IP communication. • EPC established an IMS signalling bearer. • PSAP is registered or connected to the IMS A and ready to accept the session establishment. • UE A previously performed emergency registration.	
Test Sequence:	**Step**	
	1	Verify that media between UE A and PSAP is not delivered in any direction before call establishment.
	2	UE A initiates an emergency call to establish a communication session using an emergency service URN.
	3	Verify that the UE A inserts in the INVITE request, a From header field that includes the public user identity registered via emergency registration or the tel URI associated with the public user identity registered via emergency registration and a To header indicating one of the emergency URNs defined in Table 1.
	4	Verify that IMS A (P-CSCF, E-CSCF) routes the emergency call to the PSAP in the same IM CN subsystem of the own network.
	5	Verify that the IMS produced a Media Description for the session according to SDP-offer in SIP INVITE Request and SDP-answer in SIP 183 to the PCRF.
	6	Verify that the PCRF invokes the EPC PGW with a RA-Request to create a new bearer for the requested media.
	7	Verify that PCRF requested media description was found acceptable by EPC and dedicated bearers are established and that a RA-Answer is sent to the PCRF.
	8	Verify that media between UE A and PSAP is successfully routed over the dedicated bearer.
	9	Verify that media between UE A and PSAP is transported with appropriate PCC characteristics.

Conformance criteria of test sequence step:	2	Gm	TP_GM_PCSCF_ECO_INVITE_02 (Event1)
	3	Gm	TP_GM_PCSCF_ECO_REGISTER_02 (Pre-test)
	4	Mw Mm	TP_MW_PCSCF_ECO_INVITE_02 (Event 10) TP_MM_ECSCF_ECO_INVITE_01 (Event 11)
	6/7	Rx Rx Rx Gx Rx Gx Gx	TP_RX_PCSCF_AAR_03 (AAR - Event 2) TP_RX_PCSCF_AAR_04 (AAR - Event 14) TP_RX_PCRF_AAA_02 (AAA - Events 5, 17) TP_GX_PCRF_RAR_01 (RAR - Events 3, 15) TP_RX_PCSCF_RAA_01 (RAR, RAA - Events 7, 8) TP_GX_PGW_RAA_02 (RAA - Events 4, 16) TP_GX_PCRF_CCA_06 (CCR, CCA - Events 6, 9)
	8	Rtp	TP_RTP_ECO_03 (Event 29)



NOTE 1: The interaction in above figure is the same for emergency registered and non-emergency registered UE.
NOTE 2: In the above figure, the Gx interaction may take place after completion of the Rx interaction.

Figure 8: Emergency Session Establishment with emergency registration, PSAP in same IM CN subsystem

1) UE A initiates the emergency session with an INVITE request. The From header field includes the public user identity (registered via emergency registration) or the tel URI associated with the public user identity (registered via emergency registration).

2) The IMS A P-CSCF invokes the PCRF.

3) PCRF sends RAR to EPC A PGW.
4) EPC A PGW responds with RAA.
5) PCRF responds to IMS A P-CSCF with AAA.
6) EPC A P- GW sends CCR.
7) PCRF sends RAR to P-CSCF.
8) P-CSCF responds with RAA.
9) PCRF responds with CCA to PGW.
10) P-CSCF sends the INVITE to E-CSCF.
11) E-CSCF sends the INVITE to PSAP.
12) PSAP responds with the 183 response with SDP answer to E-CSCF.
13) E-CSCF sends the 183 response to P-CSCF.
14) The IMS A P-CSCF invokes the PCRF to modify the bearer with AAR.
15) PCRF sends RAR to EPC A PGW.
16) EPC A PGW responds with RAA.
17) PCRF responds to IMS A P-CSCF with AAA.
18) P-CSCF forwards the SIP 183 (SDP) to UE A.
19) Early media may flow between the UE A and PSAP.
20) The PSAP responds with the 180 Ringing to E-CSCF.
21) E-CSCF forwards the 180 to P-CSCF.
22) P-CSCF forwards the SIP 180 to UE A.
23) PSAP sends 200 OK to E-CSCF.
24) E-CSCF forwards the 200 OK to P-CSCF.
25) P-CSCF forwards the 200 OK towards UE A.
26) UE A sends ACK to P-CSCF.
27) P-CSCF sends ACK to E-CSCF.
28) E-CSCF sends ACK to PSAP.
29) Media Exchange.

5.3.1.3 UE calling PSAP with non-emergency registration

Interoperability Test Description	
Identifier:	TD_VoLTE_ECO_INT_INI_02
Objective:	To demonstrate the establishment of dedicated bearers at the originating EPC due to SIP emergency session establishment within non-emergency registration. PSAP is located in the IM CN subsystem of IMS A.

Interoperability Test Description		
Summary:	An emergency call is setup between UE A and the PSAP located in the IM CN subsystem of IMS A. UE-A is attached to EPC A and registered to IMS A, has **NOT** performed the emergency registration to IMS A, and requests emergency session establishment using an emergency URN. The P-CSCF derives descriptions of the Service Data Flow from the SDP data, requests creation of adequate bearers from PCRF and EPC, and forwards the request to the E-CSCF. The E-CSCF retrieves the PSAP URI from local configuration and forwards the request to this PSAP. Media transport is possible only after the successful establishment of the session. Media negotiation happens during INVITE/200 OK (UE A sends SDP-offer, PSAP responds with SDP-answer).	
Configuration:	CF_VoLTE_INT_ES option 1	
SUT:	IMS A and EPC A	
Interfaces:	Gm, Mw, Rx, Gx, Mm	
References:	Mm	ETSI TS 124 229 [2], clause 5.11.2 ETSI TS 123 167 [14]
	Gm, Mw	ETSI TS 124 229 [2], clauses 5.1.6.8.4, 5.2.6.3.3, 5.2.10.4 and 5.11.2
	Rx	ETSI TS 129 214 [6], clauses 4.4.1, A.1, A.2 and annex B
	Gx	ETSI TS 129 212 [7], clause 4.5.2
Pre-test conditions:	• UE A previously attached to EPC A. • UE A previously registered to IMS A. • EPC established a non-emergency Bearer allowing UE A - P-CSCF IP communication. • UE A previously registered to IMS A. • EPC established an IMS signalling bearer. • PSAP is registered or connected to the IMS A and ready to accept the session establishment. • UE A has not performed emergency registration.	
Test Sequence:	**Step**	
	1	Verify that media between UE A and PSAP is not delivered in any direction before call establishment.
	2	UE A initiates an emergency call to establish a communication session using an emergency service URN (To header indicating one of the emergency URNs defined in Table 1).
	3	Verify that IMS A (P-CSCF, E-CSCF) routes the emergency call to the PSAP in the same IM CN subsystem of the own network.
	4	Verify that the IMS produced a Media Description for the session according to SDP-offer in SIP INVITE Request and SDP-answer in SIP 183 to the PCRF.
	5	Verify that the PCRF invokes the EPC PGW with RA-Request to create a new bearer for the requested media.
	6	Verify that PCRF requested media description was found acceptable by EPC and emergency bearers are established and that a RA-Answer is sent to the PCRF.
	7	Verify that media between UE A and PSAP is successfully routed over the dedicated bearer.
	8	Verify that media between UE A and PSAP is transported with appropriate PCC characteristics.
Conformance criteria of test sequence step:	2	Gm TP_GM_PCSCF_ECO_INVITE_03 (Event1)
	4	Mw TP_MW_PCSCF_ECO_INVITE_03 (Event 10) Mm TP_MM_ECSCF_ECO_INVITE_01 (Event 11)
	5/6	Rx TP_RX_PCSCF_AAR_03 (AAR - Event 2) Rx TP_RX_PCSCF_AAR_04 (AAR - Event 14) Rx TP_RX_PCRF_AAA_02 (AAA - Events 5, 17) Gx TP_GX_PCRF_RAR_01 (RAR - Events 3, 15) Rx TP_RX_PCSCF_RAA_01 (RAR, RAA - Events 7, 8) Gx TP_GX_PGW_RAA_02 (RAA - Events 4, 18) Gx TP_GX_PCRF_CCA_06 (CCR, CCA - Events 6, 9)
	8	Rtp TP_RTP_ECO_03 (Event 29)

The message sequence as depicted in Figure 8 applies without changes.

5.3.1.4 UE calling PSAP without any registration

Interoperability Test Description		
Identifier:	TD_VoLTE_ECO_INT_INI_03	
Objective:	To demonstrate the establishment of emergency bearers at the originating EPC due to SIP emergency session establishment without any registration. PSAP is located in the IM CN subsystem of IMS A.	
Summary:	An emergency call is setup between UE A and the PSAP located in the IM CN subsystem of IMS A. UE-A is attached to EPC A but **NOT** registered to IMS A, has **NOT** performed the emergency registration to IMS A, and requests emergency session establishment using an emergency URN. The P-CSCF derives descriptions of the Service Data Flow from the SDP data, requests creation of adequate bearers from PCRF and EPC, and forwards the request to the E-CSCF. The E-CSCF retrieves the PSAP URI from local configuration and forwards the request to this PSAP. Media transport is possible only after the successful establishment of the session. Media negotiation happens during INVITE/200 OK (UE A sends SDP-offer, PSAP responds with SDP-answer).	
Configuration:	CF_VoLTE_INT_ES option 1	
SUT:	IMS A and EPC A	
Interfaces:	Gm, Mw, Rx, Gx, Mm	
References:	Mm	ETSI TS 124 229 [2], clause 5.11.2 ETSI TS 123 167 [14]
	Gm, Mw	ETSI TS 124 229 [2], clauses 5.1.6.8.2, 5.2.6.3.3, 5.2.10.2 and 5.11.2
	Rx	ETSI TS 129 214 [6], clauses 4.4.1, A.1, A.2 and annex B
	Gx	ETSI TS 129 212 [7], clause 4.5.2
Pre-test conditions:	• UE A previously emergency attached to EPC A. • EPC established a default bearer allowing UE A - P-CSCF IP communication. • PSAP is registered or connected to the IMS A and ready to accept the session establishment. • UE A previously not registered to IMS A. • UE A has not performed emergency registration. • UE A discovered the P-CSCF address.	
Test Sequence:	**Step**	
	1	Verify that media between UE A and PSAP is not delivered in any direction before call establishment.
	2	UE A initiates an emergency call to establish a communication session using an emergency service URN.
	3	Verify that the UE A sets the From header field of the INVITE request to "Anonymous" as specified in IETF RFC 3261 [12] and a To header indicating one of the emergency URNs defined in Table 1.
	4	Verify that IMS A (P-CSCF, E-CSCF) routes the emergency call to the PSAP in the same IM CN subsystem of the own network.
	5	Verify that the IMS produced a Media Description for the session according to SDP-offer in SIP INVITE Request and SDP-answer in SIP 183 to the PCRF.
	6	Verify that the PCRF invokes the EPC PGW with RA-Request to create a new bearer for the requested media.
	7	Verify that PCRF requested media description was found acceptable by EPC and emergency bearers are established and that a RA-Answer is sent to the PCRF.
	8	Verify that media between UE A and PSAP is successfully routed over the dedicated bearer.
	9	Verify that media between UE A and PSAP is transported with appropriate PCC characteristics.

Interoperability Test Description			
Conformance criteria of test sequence step:	2/3	Gm	TP_GM_PCSCF_ECO_INVITE_01 (Event 1)
	4	Mw	TP_MW_PCSCF_ECO_INVITE_01 (Event 10)
		Mm	TP_MM_ECSCF_ECO_INVITE_01 (Event 11)
	6/7	Rx	TP_RX_PCSCF_AAR_03 (AAR - Event 2)
		Rx	TP_RX_PCSCF_AAR_04 (AAR - Event 14)
		Rx	TP_RX_PCRF_AAA_02 (AAA - Events 5, 17)
		Gx	TP_GX_PCRF_RAR_01 (RAR - Events 3, 15)
		Rx	TP_RX_PCSCF_RAA_01 (RAR, RAA - Events 7, 8)
		Gx	TP_GX_PGW_RAA_02 (RAA - Events 4, 18)
		Gx	TP_GX_PCRF_CCA_06 (CCR, CCA - Events 6, 9)
	8	Rtp	TP_RTP_ECO_03 (Event 29)

The message sequence as depicted in Figure 8 applies with the following changes:

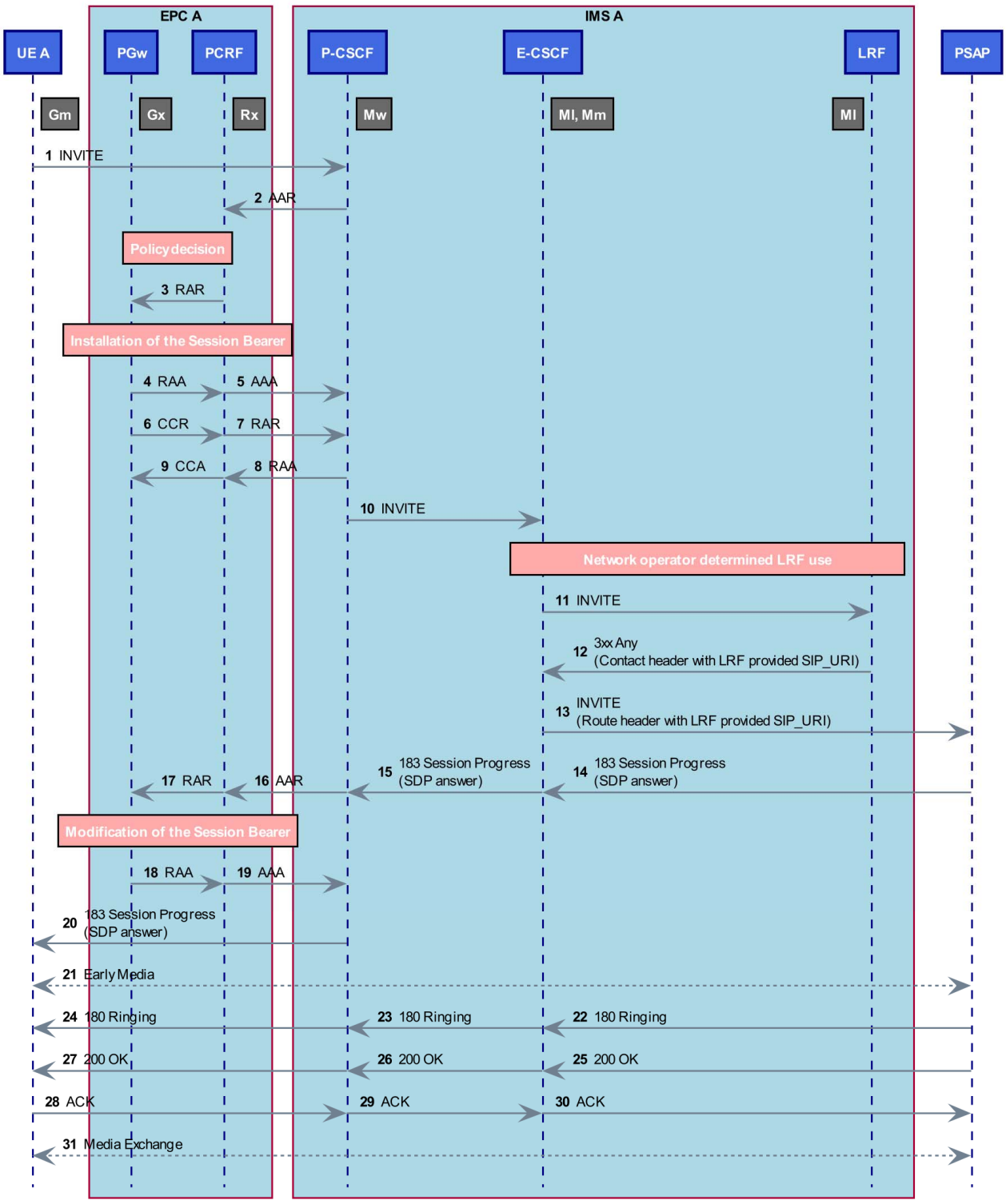
1) UE A initiates the emergency session with an INVITE request. The From header field of the INVITE request is set to "Anonymous" as specified in IETF RFC 3261 [12].

10) P-CSCF sends the INVITE to E-CSCF. The From header field of the INVITE request is set to "Anonymous".

5.3.1.5 UE calling PSAP in same network, LRF derived PSAP URI

Identifier:	TD_VoLTE_ECO_INT_INI_04	
Objective:	To demonstrate the establishment of dedicated bearers at the originating EPC due to SIP emergency session establishment within an emergency registration. PSAP is located in the IM CN subsystem of IMS A. The PSAP URI is delivered by the LRF.	
Summary:	An emergency call is setup between UE A and the PSAP located in the IM CN subsystem of IMS A. UE-A is attached to EPC A and registered to IMS A, has performed the emergency registration to IMS A, and requests emergency session establishment using an emergency URN. The P-CSCF derives descriptions of the Service Data Flow from the SDP data, requests creation of adequate bearers from PCRF and EPC, and forwards the request to the E-CSCF. The E-CSCF, where the network operator determines that an LRF is to be used, routes the emergency session establishment request to the LRF, derives the PSAP URI from the LRF response and forwards the request to this PSAP. Media transport is possible only after the successful establishment of the session. Media negotiation happens during INVITE/200 OK (UE A sends SDP-offer, PSAP responds with SDP-answer).	
Configuration:	CF_VoLTE_INT_ES option 1	
SUT:	IMS A, EPC A and PSAP	
Interfaces:	Gm, Mw, Rx, Gx, Mm, Ml	
References:	Mm	ETSI TS 124 229 [2], clause 5.11.2 ETSI TS 123 167 [14]
	Gm, Mw	ETSI TS 124 229 [2], clauses 5.1.6.8.3, 5.1.6.11, 5.2.6.3.3, 5.2.10.3 and 5.11.2
	Ml	ETSI TS 124 229 [2], clause 5.11.3
	Rx	ETSI TS 129 214 [6], clauses 4.4.1, A.1, A.2 and annex B
	Gx	ETSI TS 129 212 [7], clause 4.5.2
Pre-test conditions:	• UE A previously attached to EPC A. • UE A previously registered to IMS A. • EPC established an emergency Bearer allowing UE A - P-CSCF IP communication. • EPC established an IMS signalling bearer. • PSAP is registered or connected to the IMS A and ready to accept the session establishment. • UE A previously successful performed emergency registration. • Network operator policy determines that an LRF is to be used.	

Test Sequence:	**Step**	
	1	Verify that media between UE A and PSAP is not delivered in any direction before call establishment.
	2	UE A initiates an emergency call to establish a communication session using an emergency service URN.
	3	Verify that the UE A inserts in the INVITE request, a From header field that includes the public user identity registered via emergency registration or the tel URI associated with the public user identity registered via emergency registration and a To header indicating one of the emergency URNs defined in Table 1Table 1.
	4	Verify that IMS A (P-CSCF, E-CSCF) routes the emergency call to the LRF to retrieve PSAP URI.
	5	Verify that IMS A (E-CSCF) routes the emergency call to the PSAP in the same IM CN subsystem of the own network with the PSAP URI received from the LRF.
	6	Verify that the IMS produced a Media Description for the session according to SDP-offer in SIP INVITE Request and SDP-answer in SIP 183 to the PCRF.
	7	Verify that the PCRF invokes the EPC PGW with a RA-Request to create a new bearer for the requested media.
	8	Verify that PCRF requested media description was found acceptable by EPC and dedicated bearers are established and that a RA-Answer is sent to the PCRF.
	9	Verify that media between UE A and PSAP is successfully routed over the dedicated bearer.
	10	Verify that media between UE A and PSAP is transported with appropriate PCC characteristics.
Conformance criteria of test sequence step:	2	Gm TP_GM_PCSCF_ECO_INVITE_02 (Event1) Gm TP_GM_PCSCF_ECO_INVITE_04 for eCall (Event 1)
	3	Gm TP_GM_PCSCF_ECO_REGISTER_02 (Pre-test)
	4	Mw TP_MW_PCSCF_ECO_INVITE_02 (Event 10) Ml TP_ML_ECSCF_ECO_INVITE_01 (Event 11)
	5	Ml/Mm TP_MM_ECSCF_ECO_INVITE_02 (Events 12, 13)
	7/8	Rx TP_RX_PCSCF_AAR_03 (AAR - Event 2) Rx TP_RX_PCSCF_AAR_04 (AAR - Event 16) Rx TP_RX_PCRF_AAA_02 (AAA - Events 5, 19) Gx TP_GX_PCRF_RAR_01 (RAR - Events 3, 17) Rx TP_RX_PCSCF_RAA_01 (RAR, RAA - Events 7, 8) Gx TP_GX_PGW_RAA_02 (RAA - Events 4, 18) Gx TP_GX_PCRF_CCA_06 (CCR, CCA - Events 6, 9)
	9	Rtp TP_RTP_ECO_03 (Event 31)



NOTE 1: The interaction in above figure is the same for emergency registered and non-emergency registered UE.
NOTE 2: In the above figure, the Gx interaction may take place after completion of the Rx interaction.

Figure 9: Emergency Session Establishment with LRF, PSAP in same IM CN subsystem

1) UE A initiates the emergency session with an INVITE request. The From header field includes the public user identity (registered via emergency registration) or the tel URI associated with the public user identity (registered via emergency registration).

2) The IMS A P-CSCF invokes the PCRF.

3) PCRF sends RAR to EPC A PGW.

4) EPC A PGW responds with RAA.

5) PCRF responds to IMS A P-CSCF with AAA.

6) EPC A P- GW sends CCR.

7) PCRF sends RAR to P-CSCF.

8) P-CSCF responds with RAA.

9) PCRF responds with CCA to PGW.

10) P-CSCF sends the INVITE to E-CSCF.

11) E-CSCF forwards the INVITE to LRF.

12) LRF responds with 3xx and includes PSAP URI in the Contact header.

13) E-CSCF sends the INVITE to PSAP with LRF provided PSAP URI in Route header.

14) PSAP responds with the 183 response with SDP answer to E-CSCF.

15) E-CSCF sends the 183 response to P-CSCF.

16) The IMS A P-CSCF invokes the PCRF to modify the bearer with AAR.

17) PCRF sends RAR to EPC A PGW.

18) EPC A PGW responds with RAA.

19) PCRF responds to IMS A P-CSCF with AAA.

20) P-CSCF forwards the SIP 183 (SDP) to UE A.

21) Early media may flow between the UE A and PSAP.

22) The PSAP responds with the 180 Ringing to E-CSCF.

23) E-CSCF forwards the 180 to P-CSCF.

24) P-CSCF forwards the SIP 180 to UE A.

25) PSAP sends 200 OK to E-CSCF.

26) E-CSCF forwards the 200 OK to P-CSCF.

27) P-CSCF forwards the 200 OK towards UE A.

28) UE A sends ACK to P-CSCF.

29) P-CSCF sends ACK to E-CSCF.

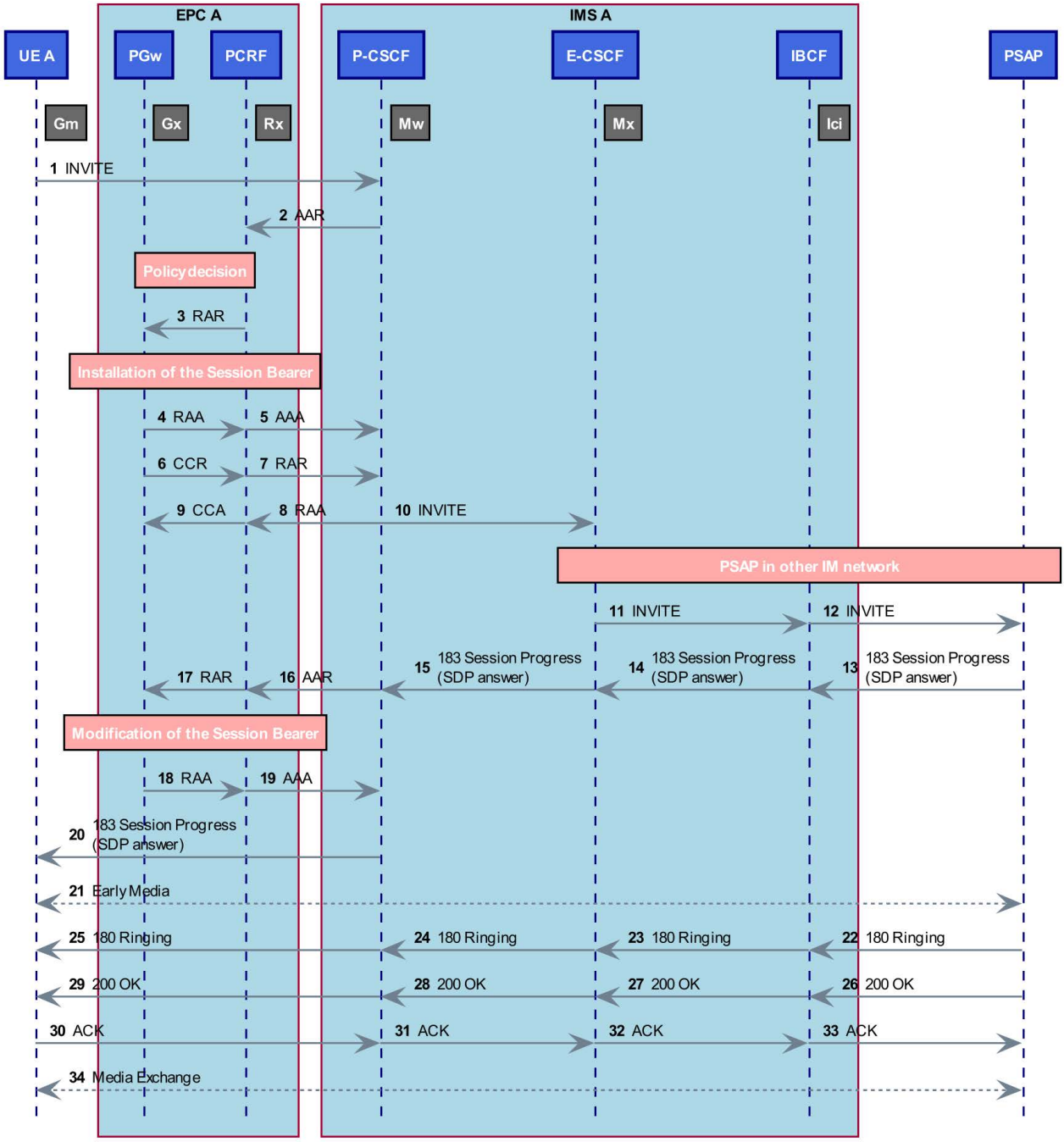
30) E-CSCF sends ACK to PSAP.

31) Media Exchange.

5.3.1.6 UE calling PSAP in another network via IBCF

Identifier:	TD_VoLTE_ECO_INT_INI_05
Objective:	To demonstrate the establishment of dedicated bearers at the originating EPC due to SIP emergency session establishment within an emergency registration. PSAP is located in the IM CN subsystem of another network connected via IBCF.

Summary:	An emergency call is setup between UE A and the PSAP located in the IM CN subsystem of another network. UE-A is attached to EPC A and registered to IMS A, has performed the emergency registration to IMS A, and requests emergency session establishment using an emergency URN. The P-CSCF derives descriptions of the Service Data Flow from the SDP data, requests creation of adequate bearers from PCRF and EPC, and forwards the request to the E-CSCF. The E-CSCF retrieves the PSAP URI from local configuration and forwards the request to this PSAP in the other network via the IBCF. Media transport is possible only after the successful establishment of the session. Media negotiation happens during INVITE/200 OK (UE A sends SDP-offer, PSAP responds with SDP-answer).	
Configuration:	CF_VoLTE_INT_ES option 2	
SUT:	IMS A, EPC A and PSAP	
Interfaces:	Gm, Mw, Rx, Gx, Mx	
	Gm, Mw	ETSI TS 124 229 [2], clauses 5.1.6.8.3, 5.1.6.11, 5.2.6.3.3, 5.2.10.3 and 5.11.2
	Mx	ETSI TS 124 229 [2], clause 5.11.2
	Rx	ETSI TS 129 214 [6], clauses 4.4.1, A.1, A.2 and annex B
	Gx	ETSI TS 129 212 [7], clause 4.5.2
Pre-test conditions:	• UE A previously attached to EPC A. • UE A previously registered to IMS A. • EPC established an emergency Bearer allowing UE A - P-CSCF IP communication. • EPC established an IMS signalling bearer. • PSAP is located outside of IMS A in another network. • UE A previously performed emergency registration.	
Test Sequence:	**Step**	
	1	Verify that media between UE A and PSAP is not delivered in any direction before call establishment.
	2	UE A initiates an emergency call to establish a communication session using an emergency service URN.
	3	Verify that the UE A inserts in the INVITE request, a From header field that includes the public user identity registered via emergency registration or the tel URI associated with the public user identity registered via emergency registration and a To header indicating one of the emergency URNs defined in Table 1.
	4	Verify that IMS A (P-CSCF, E-CSCF) routes the emergency call to the PSAP in another network via the IBCF.
	5	Verify that the IMS produced a Media Description for the session according to SDP-offer in SIP INVITE Request and SDP-answer in SIP 183 to the PCRF.
	6	Verify that the PCRF invokes the EPC PGW with a RA-Request to create a new bearer for the requested media.
	7	Verify that PCRF requested media description was found acceptable by EPC and dedicated bearers are established and that a RA-Answer is sent to the PCRF.
	8	Verify that media between UE A and PSAP is successfully routed over the dedicated bearer.
	9	Verify that media between UE A and PSAP is transported with appropriate PCC characteristics.
Conformance criteria of test sequence step:	2	Gm TP_GM_PCSCF_ECO_INVITE_02 (Event1) Gm TP_GM_PCSCF_ECO_INVITE_04 for eCall (Event 1)
	3	Gm TP_GM_PCSCF_ECO_REGISTER_02 (Pre-test)
	4	Mw TP_MW_PCSCF_ECO_INVITE_02 (Event 10) Mx TP_MX_ECSCF_ECO_INVITE_01 (Event 11)
	6/7	Rx TP_RX_PCSCF_AAR_03 (AAR - Event 2) Rx TP_RX_PCSCF_AAR_04 (AAR - Event 16) Rx TP_RX_PCRF_AAA_02 (AAA - Events 5, 19) Gx TP_GX_PCRF_RAR_01 (RAR - Events 3, 17) Rx TP_RX_PCSCF_RAA_01 (RAR, RAA - Events 7, 8) Gx TP_GX_PGW_RAA_02 (RAA - Events 4, 18) Gx TP_GX_PCRF_CCA_06 (CCR, CCA - Events 6, 9)
	8	Rtp TP_RTP_ECO_03 (Event 34)



NOTE 1: The interaction in above figure is the same for emergency registered and non-emergency registered UE.
NOTE 2: In the above figure, the Gx interaction may take place after completion of the Rx interaction.

Figure 10: Emergency Session Establishment, PSAP in another IM CN subsystem

1) UE A initiates the emergency session with an INVITE request. The From header field includes the public user identity (registered via emergency registration) or the tel URI associated with the public user identity (registered via emergency registration).

2) The IMS A P-CSCF invokes the PCRF.

3) PCRF sends RAR to EPC A PGW.

4) EPC A PGW responds with RAA.

5) PCRF responds to IMS A P-CSCF with AAA.

6) EPC A P- GW sends CCR.

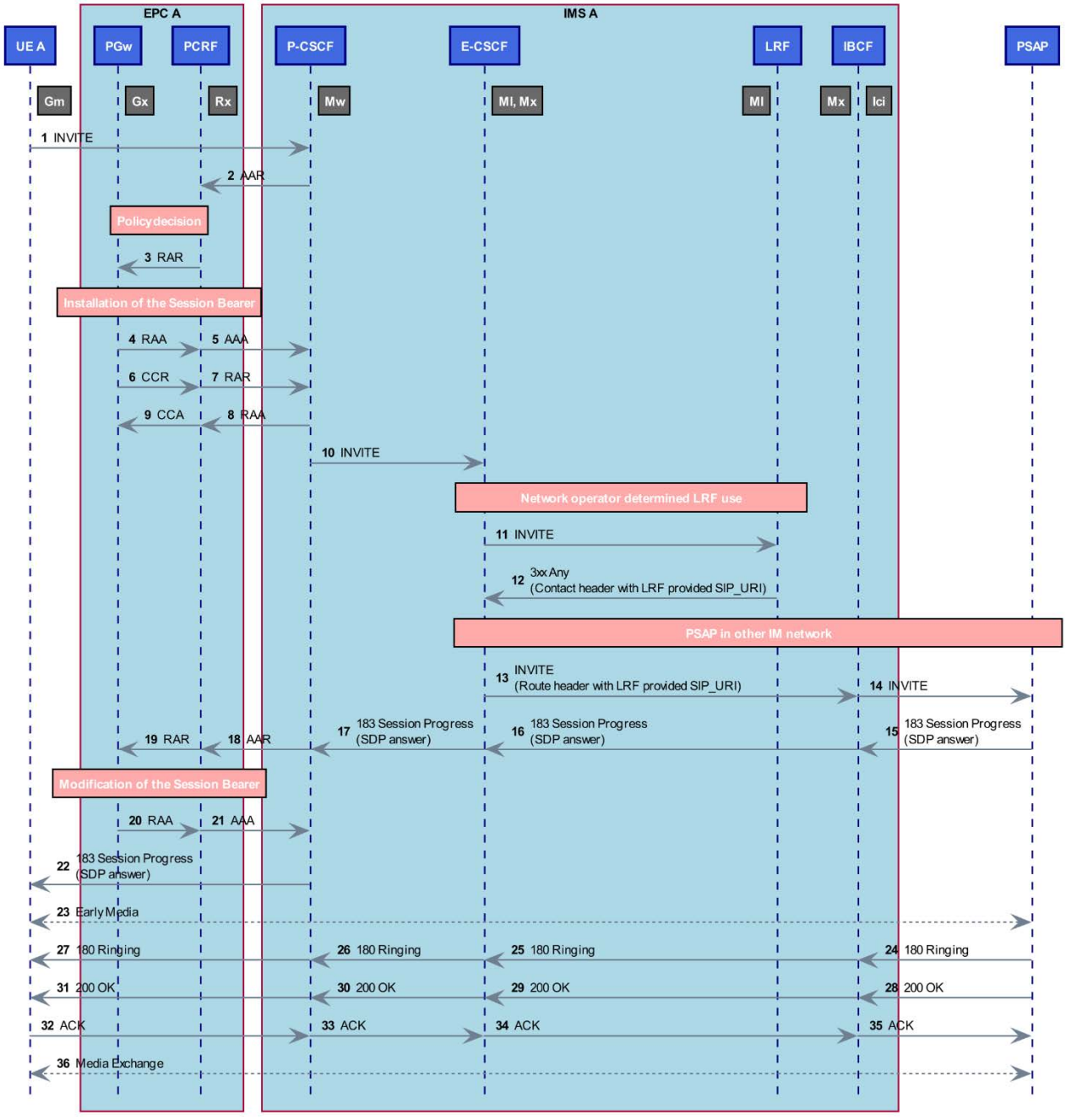
7) PCRF sends RAR to P-CSCF.
8) P-CSCF responds with RAA.
9) PCRF responds with CCA to PGW.
10) P-CSCF sends the INVITE to E-CSCF.
11) E-CSCF sends the INVITE to IBCF.
12) IBCF forwards the INVITE to PSAP.
13) PSAP responds with the 183 response with SDP answer to IBCF.
14) IBCF forwards the 183 response to E-CSCF.
15) E-CSCF sends the 183 response to P-CSCF.
16) The IMS A P-CSCF invokes the PCRF to modify the bearer with AAR.
17) PCRF sends RAR to EPC A PGW.
18) EPC A PGW responds with RAA.
19) PCRF responds to IMS A P-CSCF with AAA.
20) P-CSCF forwards the SIP 183 (SDP) to UE A.
21) Early media may flow between the UE A and PSAP.
22) The PSAP responds with the 180 Ringing to IBCF.
23) The IBCF forwards the 180 Ringing to E-CSCF.
24) E-CSCF forwards the 180 to P-CSCF.
25) P-CSCF forwards the SIP 180 to UE A.
26) The PSAP responds with the 200 OK to IBCF.
27) IBCF forwards the 200 OK to E-CSCF.
28) E-CSCF forwards the 200 OK to P-CSCF.
29) P-CSCF forwards the 200 OK towards UE A.
30) UE A sends ACK to P-CSCF.
31) P-CSCF sends ACK to E-CSCF.
32) E-CSCF sends ACK to IBCF.
33) IBCF forwards ACK to PSAP.
34) Media Exchange.

5.3.1.7 UE calling PSAP in another network via IBCF, LRF derived PSAP URI

Identifier:	TD_VoLTE_ECO_INT_INI_06
Objective:	To demonstrate the establishment of dedicated bearers at the originating EPC due to SIP emergency session establishment within an emergency registration. PSAP is located in the IM CN subsystem of another network connected via IBCF. The PSAP URI is delivered by the LRF.

Summary:	An emergency call is setup between UE A and the PSAP located in the IM CN subsystem of another network. UE-A is attached to EPC A and registered to IMS A, has performed the emergency registration to IMS A, and requests emergency session establishment using an emergency URN. The P-CSCF derives descriptions of the Service Data Flow from the SDP data, requests creation of adequate bearers from PCRF and EPC, and forwards the request to the E-CSCF. The E-CSCF retrieves the PSAP URI from local configuration and forwards the request to this PSAP in the other network via the IBCF. Media transport is possible only after the successful establishment of the session. Media negotiation happens during INVITE/200 OK (UE A sends SDP-offer, PSAP responds with SDP-answer).	
Configuration:	CF_VoLTE_INT_ES option 2	
SUT:	IMS A, EPC A and PSAP	
Interfaces:	Gm, Mw, Rx, Gx, Mx, Ml	
	Gm, Mw	ETSI TS 124 229 [2], clauses 5.1.6.8.3, 5.1.6.11, 5.2.6.3.3, 5.2.10.3 and 5.11.2
	Ml	ETSI TS 124 229 [2], clause 5.11.3
	Mx	ETSI TS 124 229 [2], clause 5.11.2
	Rx	ETSI TS 129 214 [6], clauses 4.4.1, A.1, A.2 and annex B
	Gx	ETSI TS 129 212 [7], clause 4.5.2
Pre-test conditions:	• UE A previously attached to EPC A. • UE A previously registered to IMS A. • EPC established an emergency Bearer allowing UE A - P-CSCF IP communication. • EPC established an IMS signalling bearer. • PSAP is located outside of IMS A in another network. • UE A previously performed emergency registration.	
Test Sequence:	**Step**	
	1	Verify that media between UE A and PSAP is not delivered in any direction before call establishment.
	2	UE A initiates an emergency call to establish a communication session using an emergency service URN.
	3	Verify that the UE A inserts in the INVITE request, a From header field that includes the public user identity registered via emergency registration or the tel URI associated with the public user identity registered via emergency registration and a To header indicating one of the emergency URNs defined in Table 1Table 1.
	4	Verify that IMS A (P-CSCF, E-CSCF) routes the emergency call to the LRF to retrieve PSAP URI.
	5	Verify that IMS A (E-CSCF) routes the emergency call to the PSAP in another network with the PSAP URI received from the LRF.
	6	Verify that the IMS produced a Media Description for the session according to SDP-offer in SIP INVITE Request and SDP-answer in SIP 183 to the PCRF.
	7	Verify that the PCRF invokes the EPC PGW with a RA-Request to create a new bearer for the requested media.
	8	Verify that PCRF requested media description was found acceptable by EPC and dedicated bearers are established and that a RA-Answer is sent to the PCRF.
	9	Verify that media between UE A and PSAP is successfully routed over the dedicated bearer.
	10	Verify that media between UE A and PSAP is transported with appropriate PCC characteristics.
Conformance criteria of test sequence step:	2	Gm TP_GM_PCSCF_ECO_INVITE_02 (Event1) Gm TP_GM_PCSCF_ECO_INVITE_04 for eCall (Event 1)
	3	Gm TP_GM_PCSCF_ECO_REGISTER_02 (Pre-test)
	4	Mw TP_MW_PCSCF_ECO_INVITE_02 (Event 10) Ml TP_ML_ECSCF_ECO_INVITE_01 (Event 11)
	5	Ml/Mx TP_MX_ECSCF_ECO_INVITE_02 (Events 12, 13)

	7/8	Rx	TP_RX_PCSCF_AAR_03 (AAR - Event 2)
		Rx	TP_RX_PCSCF_AAR_04 (AAR - Event 18)
		Rx	TP_RX_PCRF_AAA_02 (AAA - Events 5, 21)
		Gx	TP_GX_PCRF_RAR_01 (RAR - Events 3, 19)
		Rx	TP_RX_PCSCF_RAA_01 (RAR, RAA - Events 7, 8)
		Gx	TP_GX_PGW_RAA_02 (RAA - Events 4, 20)
		Gx	TP_GX_PCRF_CCA_06 (CCR, CCA - Events 6, 9)
	9	Rtp	TP_RTP_ECO_03 (Event 36)



NOTE 1: The interaction in above figure is the same for emergency registered and non-emergency registered UE.
NOTE 2: In the above figure, the Gx interaction may take place after completion of the Rx interaction.

Figure 11: Emergency Session Establishment with LRF, PSAP in another IM CN subsystem

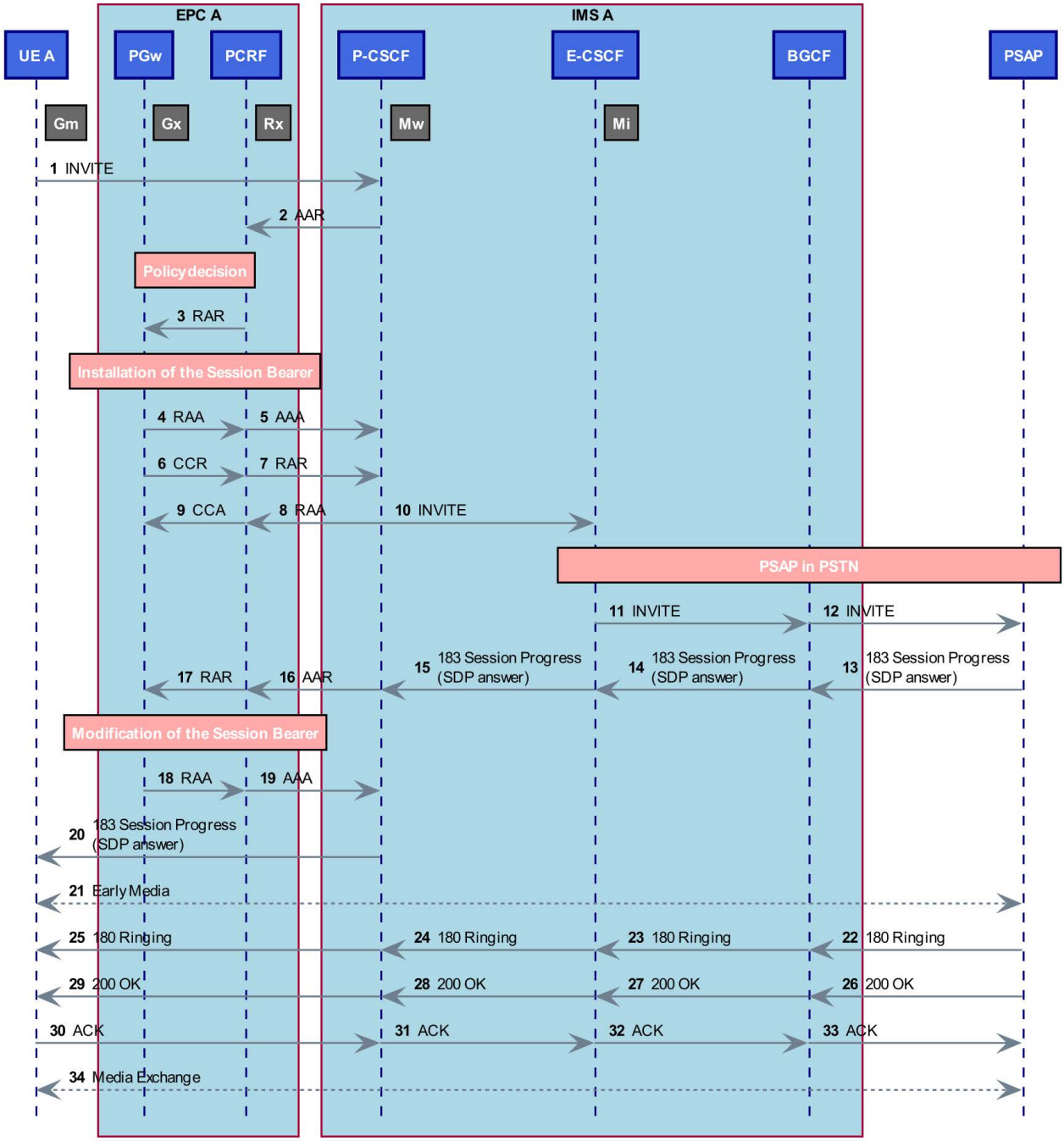
1) UE A initiates the emergency session with an INVITE request. The From header field includes the public user identity (registered via emergency registration) or the tel URI associated with the public user identity (registered via emergency registration).

2) The IMS A P-CSCF invokes the PCRF.
3) PCRF sends RAR to EPC A PGW.
4) EPC A PGW responds with RAA.
5) PCRF responds to IMS A P-CSCF with AAA.
6) EPC A P- GW sends CCR.
7) PCRF sends RAR to P-CSCF.
8) P-CSCF responds with RAA.
9) PCRF responds with CCA to PGW.
10) P-CSCF sends the INVITE to E-CSCF.
11) E-CSCF forwards the INVITE to LRF.
12) LRF responds with 3xx and includes PSAP URI in the Contact header.
13) E-CSCF sends the INVITE to IBCF with LRF provided PSAP URI in Route header.
14) IBCF forwards INVITE to PSAP.
15) PSAP responds with the 183 response with SDP answer to IBCF.
16) IBCF forwards the 183 response to E-CSCF.
17) E-CSCF sends the 183 response to P-CSCF.
18) The IMS A P-CSCF invokes the PCRF to modify the bearer with AAR.
19) PCRF sends RAR to EPC A PGW.
20) EPC A PGW responds with RAA.
21) PCRF responds to IMS A P-CSCF with AAA.
22) P-CSCF forwards the SIP 183 (SDP) to UE A.
23) Early media may flow between the UE A and PSAP.
24) The PSAP responds with the 180 Ringing to IBCF.
25) IBCF forwards the 180 to E-CSCF.
26) E-CSCF forwards the 180 to P-CSCF.
27) P-CSCF sends the SIP 180 to UE A.
28) PSAP sends 200 OK to IBCF.
29) IBCF forwards the 200 OK to E-CSCF.
30) E-CSCF forwards the 200 OK to P-CSCF.
31) P-CSCF forwards the 200 OK towards UE A.
32) UE A sends ACK to P-CSCF.
33) P-CSCF sends ACK to E-CSCF.
34) E-CSCF sends ACK to IBCF.
35) IBCF forwards ACK to PSAP.
36) Media Exchange.

5.3.1.8 UE calling PSAP in PSTN via BGCF

Identifier:	TD_VoLTE_ECO_INT_INI_07	
Objective:	To demonstrate the establishment of dedicated bearers at the originating EPC due to SIP emergency session establishment within an emergency registration. PSAP is located in the PSTN connected via BGCF.	
Summary:	An emergency call is setup between UE A and the PSAP located in the PSTN. UE-A is attached to EPC A and registered to IMS A, has performed the emergency registration to IMS A, and requests emergency session establishment using an emergency URN. The P-CSCF derives descriptions of the Service Data Flow from the SDP data, requests creation of adequate bearers from PCRF and EPC, and forwards the request to the E-CSCF. The E-CSCF retrieves the PSAP URI from local configuration and forwards the request to this PSAP in the PSTN via the BGCF. Media transport is possible only after the successful establishment of the session. Media negotiation happens during INVITE/200 OK (UE A sends SDP-offer, PSAP responds with SDP-answer).	
Configuration:	CF_VoLTE_INT_ES option 3	
SUT:	IMS A, EPC A and PSAP	
Interfaces:	Gm, Mw, Rx, Gx, Mi	
	Gm, Mw	ETSI TS 124 229 [2], clauses 5.1.6.8.3, 5.1.6.11, 5.2.6.3.3, 5.2.10.3 and 5.11.2
	Mi	ETSI TS 124 229 [2], clause 5.11.2
	Rx	ETSI TS 129 214 [6], clauses 4.4.1, A.1, A.2 and annex B
	Gx	ETSI TS 129 212 [7], clause 4.5.2
Pre-test conditions:	• UE A previously attached to EPC A. • UE A previously registered to IMS A. • EPC established an emergency Bearer allowing UE A - P-CSCF IP communication. • EPC established an IMS signalling bearer. • PSAP is located outside of IMS A in the PSTN. • UE A previously performed emergency registration.	
Test Sequence:	**Step**	
	1	Verify that media between UE A and PSAP is not delivered in any direction before call establishment.
	2	UE A initiates an emergency call to establish a communication session using an emergency service URN.
	3	Verify that the UE A inserts in the INVITE request, a From header field that includes the public user identity registered via emergency registration or the tel URI associated with the public user identity registered via emergency registration and a To header indicating one of the emergency URNs defined in Table 1.
	4	Verify that IMS A (P-CSCF, E-CSCF) routes the emergency call to the PSAP in the PSTN via the BGCF.
	5	Verify that the IMS produced a Media Description for the session according to SDP-offer in SIP INVITE Request and SDP-answer in SIP 183 to the PCRF.
	6	Verify that the PCRF invokes the EPC PGW with a RA-Request to create a new bearer for the requested media.
	7	Verify that PCRF requested media description was found acceptable by EPC and dedicated bearers are established and that a RA-Answer is sent to the PCRF.
	8	Verify that media between UE A and PSAP is successfully routed over the dedicated bearer.
	9	Verify that media between UE A and PSAP is transported with appropriate PCC characteristics.

Conformance criteria of test sequence step:	2	Gm	TP_GM_PCSCF_ECO_INVITE_02 (Event1)
		Gm	TP_GM_PCSCF_ECO_INVITE_04 for eCall (Event 1)
	3	Gm	TP_GM_PCSCF_ECO_REGISTER_02 (Pre-test)
	4	Mw	TP_MW_PCSCF_ECO_INVITE_02 (Event 10)
		Mi	TP_MI_ECSCF_ECO_INVITE_01 (Event 11)
	6/7	Rx	TP_RX_PCSCF_AAR_03 (AAR - Event 2)
		Rx	TP_RX_PCSCF_AAR_04 (AAR - Event 16)
		Rx	TP_RX_PCRF_AAA_02 (AAA - Events 5, 19)
		Gx	TP_GX_PCRF_RAR_01 (RAR - Events 3, 17)
		Rx	TP_RX_PCSCF_RAA_01 (RAR, RAA - Events 7, 8)
		Gx	TP_GX_PGW_RAA_02 (RAA - Events 4, 18)
		Gx	TP_GX_PCRF_CCA_06 (CCR, CCA - Events 6, 9)
	8	Rtp	TP_RTP_ECO_03 (Event 34)



NOTE 1: The interaction in above figure is the same for emergency registered and non-emergency registered UE.
NOTE 2: In the above figure, the Gx interaction may take place after completion of the Rx interaction.

Figure 12: Emergency Session Establishment, PSAP in the PSTN

1) UE A initiates the emergency session with an INVITE request. The From header field includes the public user identity (registered via emergency registration) or the tel URI associated with the public user identity (registered via emergency registration).

2) The IMS A P-CSCF invokes the PCRF

3) PCRF sends RAR to EPC A PGW.

4) EPC A PGW responds with RAA.

5) PCRF responds to IMS A P-CSCF with AAA.

6) EPC A P- GW sends CCR.

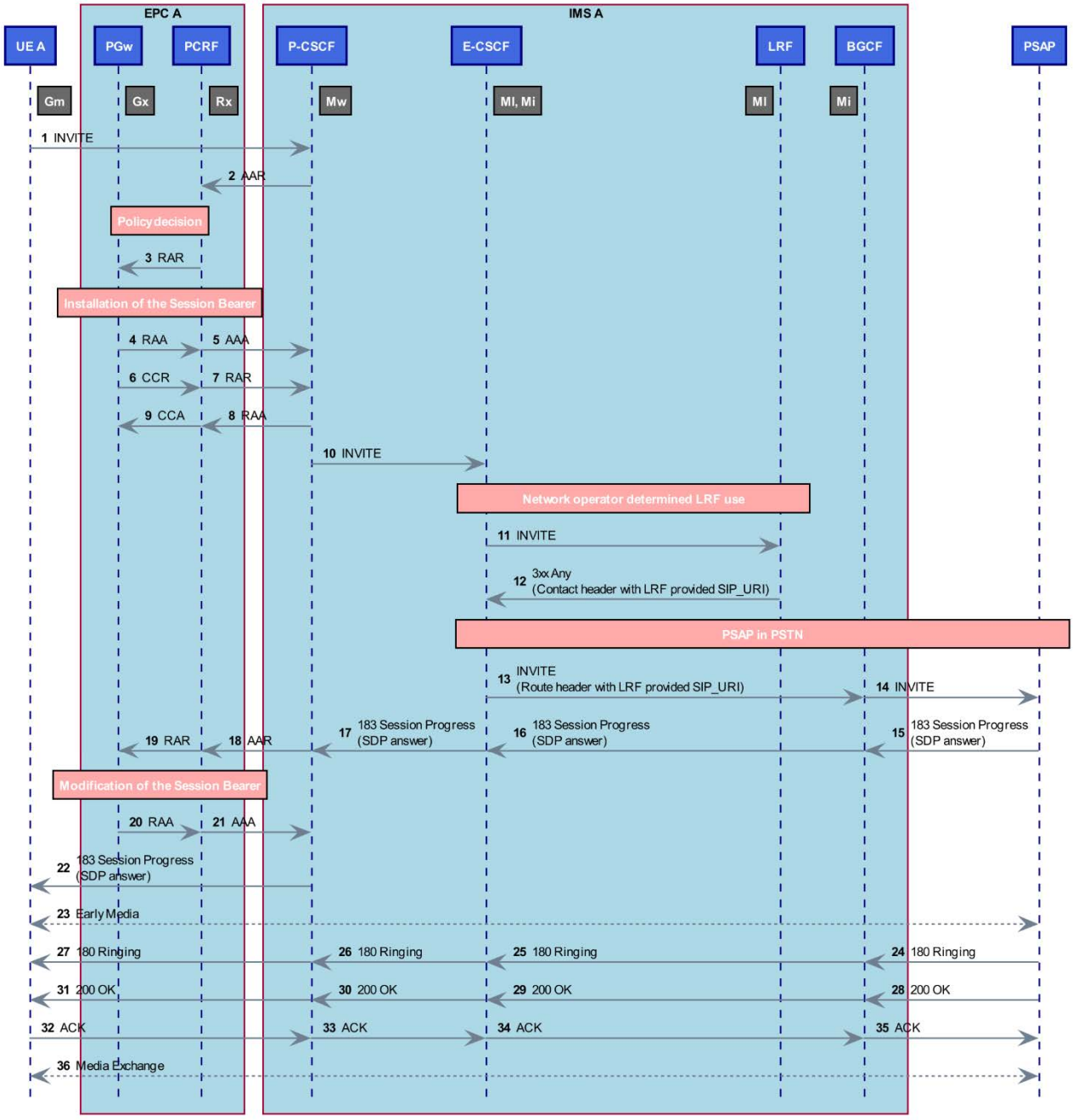
7) PCRF sends RAR to P-CSCF.
8) P-CSCF responds with RAA.
9) PCRF responds with CCA to PGW.
10) P-CSCF sends the INVITE to E-CSCF.
11) E-CSCF sends the INVITE to BGCF.
12) BGCF forwards the INVITE to PSAP.
13) PSAP responds with the 183 response with SDP answer to BGCF.
14) BGCF forwards the 183 response to E-CSCF.
15) E-CSCF sends the 183 response to P-CSCF.
16) The IMS A P-CSCF invokes the PCRF to modify the bearer with AAR.
17) PCRF sends RAR to EPC A PGW.
18) EPC A PGW responds with RAA.
19) PCRF responds to IMS A P-CSCF with AAA.
20) P-CSCF forwards the SIP 183 (SDP) to UE A.
21) Early media may flow between the UE A and PSAP.
22) The PSAP responds with the 180 Ringing to BGCF.
23) The BGCF forwards the 180 Ringing to E-CSCF.
24) E-CSCF forwards the 180 to P-CSCF.
25) P-CSCF forwards the SIP 180 to UE A.
26) The PSAP responds with the 200 OK to BGCF.
27) BGCF forwards the 200 OK to E-CSCF.
28) E-CSCF forwards the 200 OK to P-CSCF.
29) P-CSCF forwards the 200 OK towards UE A.
30) UE A sends ACK to P-CSCF.
31) P-CSCF sends ACK to E-CSCF.
32) E-CSCF sends ACK to BGCF.
33) BGCF forwards ACK to PSAP.
34) Media Exchange.

5.3.1.9 UE calling PSAP in PSTN via BGCF, LRF derived PSAP URI

Identifier:	TD_VoLTE_ECO_INT_INI_08
Objective:	To demonstrate the establishment of dedicated bearers at the originating EPC due to SIP emergency session establishment within an emergency registration. PSAP is located in the PSTN connected via BGCF. The PSAP URI is delivered by the LRF.

Summary:	An emergency call is setup between UE A and the PSAP located in the PSTN. UE-A is attached to EPC A and registered to IMS A, has performed the emergency registration to IMS A, and requests emergency session establishment using an emergency URN. The P-CSCF derives descriptions of the Service Data Flow from the SDP data, requests creation of adequate bearers from PCRF and EPC, and forwards the request to the E-CSCF. The E-CSCF retrieves the PSAP URI from local configuration and forwards the request to this PSAP in the PSTN via the BGCF. Media transport is possible only after the successful establishment of the session. Media negotiation happens during INVITE/200 OK (UE A sends SDP-offer, PSAP responds with SDP-answer).	
Configuration:	CF_VoLTE_INT_ES option 3	
SUT:	IMS A, EPC A and PSAP	
Interfaces:	Gm, Mw, Rx, Gx, Mi, Ml	
	Gm, Mw	ETSI TS 124 229 [2], clauses 5.1.6.8.3, 5.1.6.11, 5.2.6.3.3, 5.2.10.3 and 5.11.2
	Ml	ETSI TS 124 229 [2], clause 5.11.3
	Mi	ETSI TS 124 229 [2], clause 5.11.2
	Rx	ETSI TS 129 214 [6], clauses 4.4.1, A.1, A.2 and annex B
	Gx	ETSI TS 129 212 [7], clause 4.5.2
Pre-test conditions:	• UE A previously attached to EPC A. • UE A previously registered to IMS A. • EPC established an emergency Bearer allowing UE A - P-CSCF IP communication. • EPC established an IMS signalling bearer. • PSAP is located outside of IMS A in the PSTN. • UE A previously performed emergency registration.	
Test Sequence:	**Step**	
	1	Verify that media between UE A and PSAP is not delivered in any direction before call establishment.
	2	UE A initiates an emergency call to establish a communication session using an emergency service URN.
	3	Verify that the UE A inserts in the INVITE request, a From header field that includes the public user identity registered via emergency registration or the tel URI associated with the public user identity registered via emergency registration and a To header indicating one of the emergency URNs defined in Table 1.
	4	Verify that IMS A (P-CSCF, E-CSCF) routes the emergency call to the LRF to retrieve PSAP URI.
	5	Verify that IMS A (E-CSCF) routes the emergency call to the PSAP in the PSTN with the PSAP URI received from the LRF.
	6	Verify that the IMS produced a Media Description for the session according to SDP-offer in SIP INVITE Request and SDP-answer in SIP 183 to the PCRF.
	7	Verify that the PCRF invokes the EPC PGW with a RA-Request to create a new bearer for the requested media.
	8	Verify that PCRF requested media description was found acceptable by EPC and dedicated bearers are established and that a RA-Answer is sent to the PCRF.
	9	Verify that media between UE A and PSAP is successfully routed over the dedicated bearer.
	10	Verify that media between UE A and PSAP is transported with appropriate PCC characteristics.
Conformance criteria of test sequence step:	2	Gm TP_GM_PCSCF_ECO_INVITE_02 (Event1) Gm TP_GM_PCSCF_ECO_INVITE_04 for eCall (Event 1)
	3	Gm TP_GM_PCSCF_ECO_REGISTER_02 (Pre-test)
	4	Mw TP_MW_PCSCF_ECO_INVITE_02 (Event 10) Ml TP_ML_ECSCF_ECO_INVITE_01 (Event 11)
	5	Ml/Mi TP_MI_ECSCF_ECO_INVITE_02 (Events 12, 13)

	7/8	Rx	TP_RX_PCSCF_AAR_03 (AAR - Event 2)
		Rx	TP_RX_PCSCF_AAR_04 (AAR - Event 18)
		Rx	TP_RX_PCRF_AAA_02 (AAA - Events 5, 21)
		Gx	TP_GX_PCRF_RAR_01 (RAR - Events 3, 19)
		Rx	TP_RX_PCSCF_RAA_01 (RAR, RAA - Events 7, 8)
		Gx	TP_GX_PGW_RAA_02 (RAA - Events 4, 20)
		Gx	TP_GX_PCRF_CCA_06 (CCR, CCA - Events 6, 9)
	9	Rtp	TP_RTP_ECO_03 (Event 36)



NOTE 1: The interaction in above figure is the same for emergency registered and non-emergency registered UE.
NOTE 2: In the above figure, the Gx interaction may take place after completion of the Rx interaction.

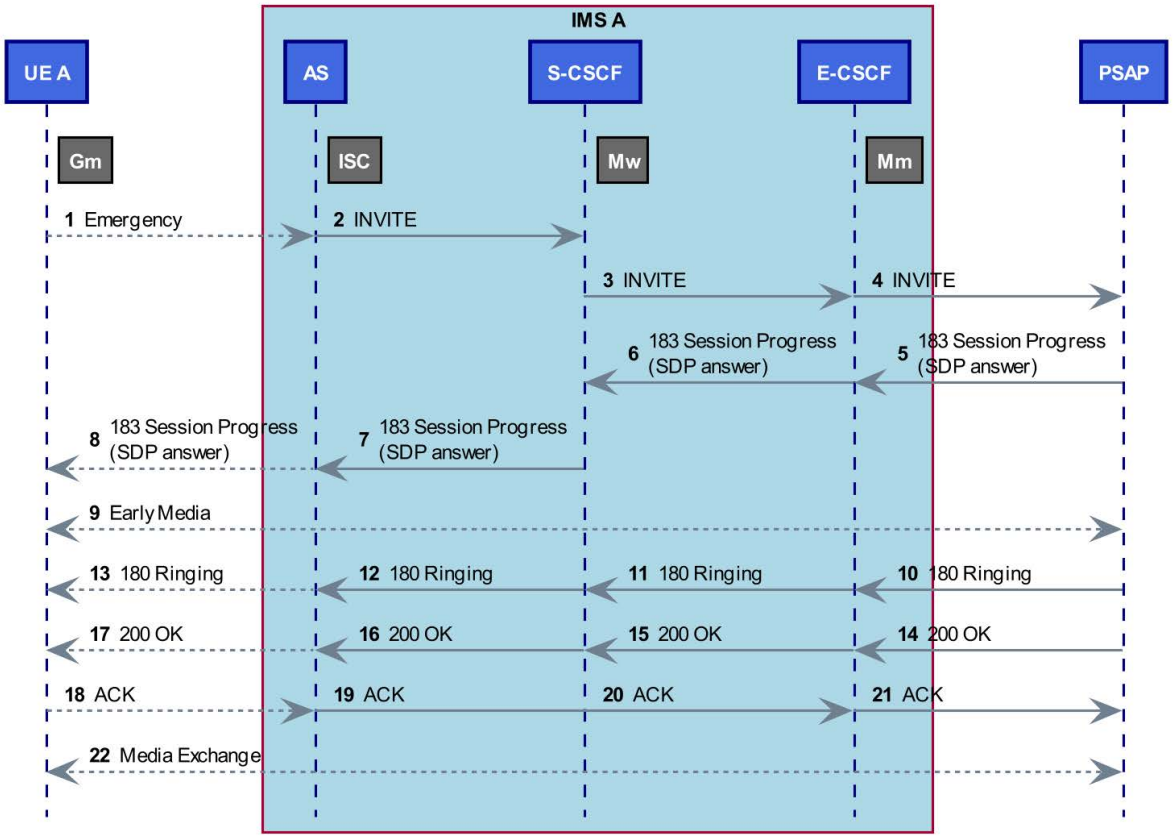
Figure 13: Emergency Session Establishment with LRF, PSAP in the PSTN

1) UE A initiates the emergency session with an INVITE request. The From header field includes the public user identity (registered via emergency registration) or the tel URI associated with the public user identity (registered via emergency registration).

2) The IMS A P-CSCF invokes the PCRF.
3) PCRF sends RAR to EPC A PGW.
4) EPC A PGW responds with RAA.
5) PCRF responds to IMS A P-CSCF with AAA.
6) EPC A P- GW sends CCR.
7) PCRF sends RAR to P-CSCF.
8) P-CSCF responds with RAA.
9) PCRF responds with CCA to PGW.
10) P-CSCF sends the INVITE to E-CSCF.
11) E-CSCF forwards the INVITE to LRF.
12) LRF responds with 3xx and includes PSAP URI in the Contact header.
13) E-CSCF sends the INVITE to BGCF with LRF provided PSAP URI in Route header.
14) BGCF forwards INVITE to PSAP.
15) PSAP responds with the 183 response with SDP answer to BGCF.
16) BGCF forwards the 183 response to E-CSCF.
17) E-CSCF sends the 183 response to P-CSCF.
18) The IMS A P-CSCF invokes the PCRF to modify the bearer with AAR.
19) PCRF sends RAR to EPC A PGW.
20) EPC A PGW responds with RAA.
21) PCRF responds to IMS A P-CSCF with AAA.
22) P-CSCF forwards the SIP 183 (SDP) to UE A.
23) Early media may flow between the UE A and PSAP.
24) The PSAP responds with the 180 Ringing to BGCF.
25) BGCF forwards the 180 to E-CSCF.
26) E-CSCF forwards the 180 to P-CSCF.
27) P-CSCF sends the SIP 180 to UE A.
28) PSAP sends 200 OK to BGCF.
29) BGCF forwards the 200 OK to E-CSCF.
30) E-CSCF forwards the 200 OK to P-CSCF.
31) P-CSCF forwards the 200 OK towards UE A.
32) UE A sends ACK to P-CSCF.
33) P-CSCF sends ACK to E-CSCF.
34) E-CSCF sends ACK to BGCF.
35) BGCF forwards ACK to PSAP.
36) Media Exchange.

5.3.1.10 UE calling PSAP over AS with non-emergency registration

Interoperability Test Description		
Identifier:	TD_VoLTE_EMC_INT_INI_09	
Objective:	To demonstrate the establishment of dedicated bearers at the originating EPC due to SIP emergency session establishment over AS with non-emergency registration. PSAP is located in the IM CN subsystem of IMS A.	
Summary:	An emergency call is setup between UE A and the PSAP located in the IM CN subsystem of IMS A over AS. UE-A is attached to EPC A and registered to IMS A, has **NOT** performed the emergency registration to IMS A, and requests emergency session by requesting the AS. The AS generates an emergency session establishment request. The S-CSCF derives descriptions of the Service Data Flow from the SDP data, requests creation of adequate bearers from PCRF and EPC, and forwards the request to the E-CSCF. The E-CSCF retrieves the PSAP URI from local configuration and forwards the request to this PSAP. Media transport is possible only after the successful establishment of the session. Media negotiation happens during INVITE/200 OK.	
Configuration:	CF_VoLTE_INT_ES option 1	
SUT:	IMS A	
Interfaces:	ISC, Gm, Mw, Rx, Gx, Mm	
References:	Mm	ETSI TS 124 229 [2], clause 5.11.2 ETSI TS 123 167 [14]
	ISC	ETSI TS 124 229 [2], clauses 4.7.3, 5.7.1.14 ETSI TS 123 167 [14], clause 6.2.8
	Gm, Mw	ETSI TS 124 229 [2], clauses 5.1.6.8.4, 5.2.6.3.3, 5.2.10.4 and 5.11.2
	Rx	ETSI TS 129 214 [6], clauses 4.4.1, A.1, A.2 and annex B
	Gx	ETSI TS 129 212 [7], clause 4.5.2
Pre-test conditions:	• UE A previously attached to EPC A. • UE A previously registered to IMS A. • UE A has not performed emergency registration. • UE A is in the same network as the S-CSCF (UE A is not roaming). • AS is part of the trust domain of the network. • EPC established a non-emergency Bearer allowing UE A - P-CSCF IP communication. • EPC established an IMS signalling bearer. • PSAP is registered or connected to the IMS A and ready to accept the session establishment.	
Test Sequence:	**Step**	
	1	The AS detect an emergency session establishment request from UE A.
	2	AS initiates an emergency session to establish a communication session using an emergency service URN with a top-level service type of "sos" and a Route header field with the topmost Route header field set to the URI associated with an E-CSCF
	3	Verify that the P-Asserted-Identity header field containing the identity of the UE A
	4	Verify that IMS A (E-CSCF) routes the emergency call to the PSAP in the same IM CN subsystem of the own network.
	5	Verify that the IMS produced a Media Description for the session according to SDP-offer in SIP INVITE Request and SDP-answer in SIP 183 to the PCRF.
	6	Verify that the PCRF invokes the EPC PGW with RA-Request to create a new bearer for the requested media.
	7	Verify that PCRF requested media description was found acceptable by EPC and emergency bearers are established and that a RA-Answer is sent to the PCRF.
Conformance criteria of test sequence step:	2	ISC TP_ISC_SCSCF_EMC_INVITE_01 (Event 2)
	3	MwTP_MW_PCSCF_ECO_INVITE_02 (Event 3)
	4	Mm TP_MM_ECSCF_ECO_INVITE_02 (Event 4)



NOTE: How the interaction between UE A and AS proceeds in detail is beyond the scope of this test description and depends on the supported application.

Figure 14: Emergency Session Establishment without emergency registration over AS

1) UE A initiates an emergency session establishment request (see note of Figure 14).

2) AS detect an emergency session establishment request and generates an INVITE request to S-CSCF include in the Request-URI an emergency service URN, i.e. a service URN with a top-level service type of "sos" as specified in IETF RFC 5031 and a Route header field with the topmost Route header field set to the URI associated with an E-CSCF.

3) S-CSCF sends the INVITE to E-CSCF.

4) E-CSCF sends the INVITE to PSAP.

5) PSAP responds with the 183 response with SDP answer to E-CSCF.

6) E-CSCF sends the 183 response to S-CSCF.

7) S-CSCF forwards the SIP 183 (SDP answer) to AS.

8) AS forwards the SIP 183 to UE A.

9) Early media may flow between the UE A and PSAP.

10) The PSAP responds with the 180 Ringing to E-CSCF.

11) E-CSCF forwards the 180 to S-CSCF.

12) S-CSCF forwards the SIP 180 to AS.

13) AS forwards the SIP 180 to UE A.

14) PSAP sends 200 OK to E-CSCF.

15) E-CSCF forwards the 200 OK to S-CSCF.

16) S-CSCF forwards the 200 OK towards AS.

17) AS forwards the 200 OK towards UE A.

18) UE A sends ACK to AS.

19) AS sends ACK to E-CSCF.

20) S-CSCF sends ACK to E-CSCF.

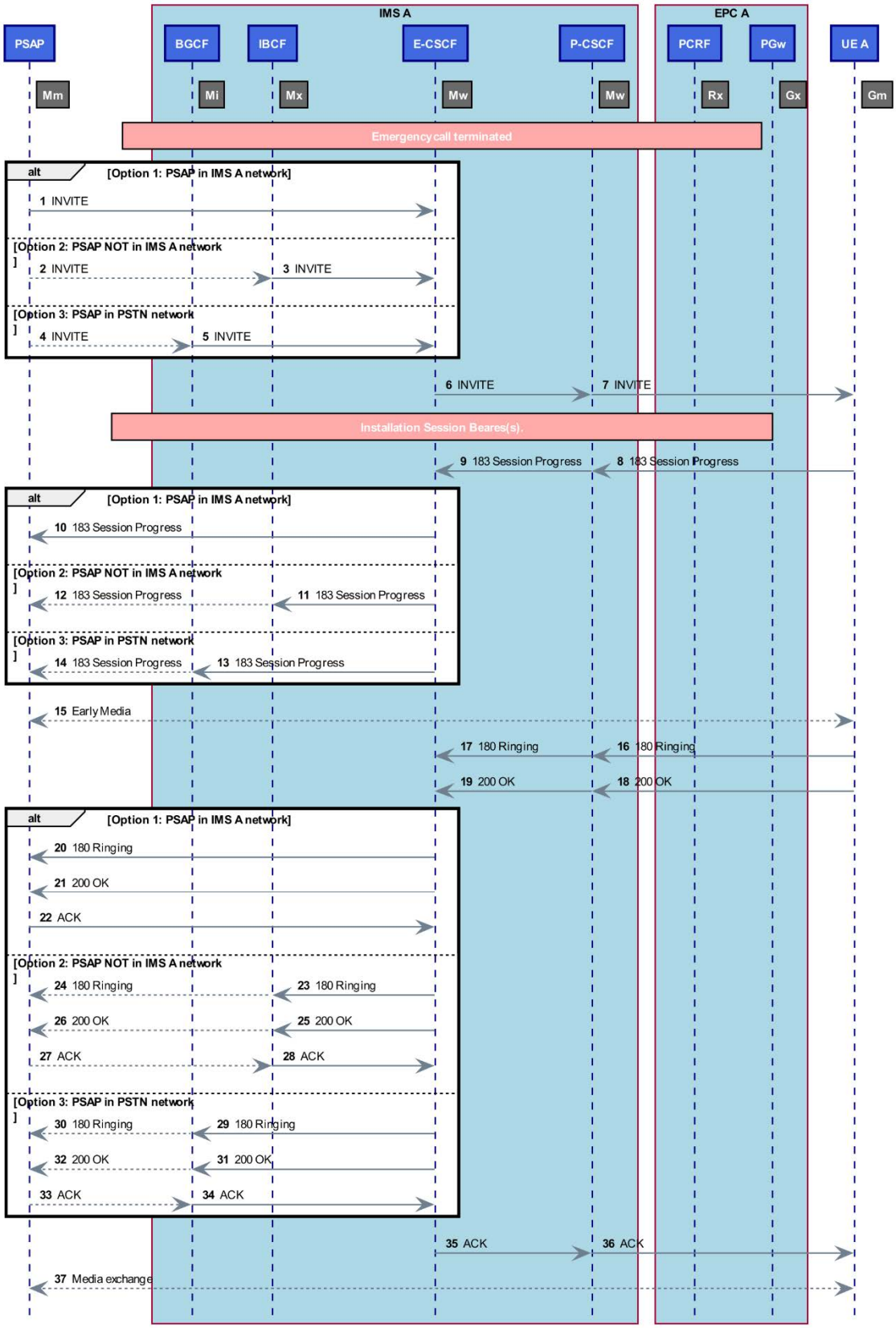
21) E-CSCF sends ACK to PSAP.

22) Media Exchange.

5.3.1.11 Callback from PSAP

Interoperability Test Description		
Identifier:	TD_VoLTE_ECO_INT_INI_010	
Objective:	To demonstrate that if an emergency call has been terminated, the attempt by the PSAP call taker to communicate back to the emergency caller shall be answered.	
Summary:	Verifying the functionality of the PSAP callback feature, ensuring that the callback is successfully initiated, routed and that media is correctly transmitted over the dedicated bearer. The callback shall use the same media as the original emergency call.	
Configuration:	CF_VoLTE_INT_ES (Option 1, Option 2 and Option 3)	
SUT:	IMS A and EPC A	
Interfaces:	Gm, Mw, Rx, Gx, Mm, Mx, Mi	
	Mm, Mx, Mi,	ETSI TS 123 167 [14], clause 5.2 ETSI TS 124 229 [2], clause 5.10.1 IETF RFC 7090 [17], clause 5.3
	Gm, Mw	ETSI TS 124 229 [2], clauses 5.2.7.2, 5.3.2.1, 5.3.2.1A, 5.4.4.1 and 5.4.4.2 ETSI TS 134 229-1 [13], clause C.11
	Rx	ETSI TS 129 214 [6], clauses 4.4.1, A.1, A.2 and annex B
	Gx	ETSI TS 129 212 [7], clause 4.5.2
Pre-test conditions:	• UE A previously attached to EPC and shall be previously initially registered to IMS and an emergency call has been established with emergency bearer allowing UE A - P-CSCF- E-CSCF IP communication. One of tests from clauses 5.3.1.2 to 5.3.1.10 need to be executed as precondition. • HSS provisioned with UE A subscription. • UE A discovered the P-CSCF address. • PSAP release the call. Release the call with test from 5.3.2.2 after emergency call establishment.	
Test Sequence:	**Step**	
	1	UE A initiates an emergency session.
	2	Verify that the emergency session between UE A and PSAP is successfully established.
	3	Verify that media between UE A and PSAP is successfully routed over the dedicated bearer.
	4	PSAP initiates a Call-Release (BYE) operation to UE A, ending the session.
	5	Verify that media between UE A and PSAP is not delivered in any direction.
	6	PSAP initiates a callback using UE A callback number, SIP identifier or IP address.
	7	Verify that the SIP Priority header field value "psap-callback" may be set, which allows blacklists to be bypass and ignore call-forwarding procedures and other similar features.
	8	Verify that the IMS produces the same Media Description as the original emergency call.
	9	Verify that the PSAP callback is successfully routed to the UE A.
	10	Verify that media between UE A and PSAP is successfully routed.

Interoperability Test Description			
Conformance criteria of test sequence step:	6	Mm	TP_MM_ECSCF_ECO_INVITE_03 (Event 1)
		Mx	TP_MX_ECSCF_ECO_INVITE_03 (Event 3)
		Mi	TP_MI_ECSCF_ECO_INVITE_03 (Event 5)
		Mw	TP_MW_PCSCF_ECO_INVITE_05 (Event 6)
	10	Rtp	TP_RTP_ECO_03 (Event 37)



NOTE: For reasons of readability, only the SIP messages are shown in the figure. The message exchange between PGW, PCRF and P-CSCF remains the same as in Figure 8.

Figure 15: Callback from PSAP

1) (Option 1) PSAP initiates a callback using UE A callback number, SIP identifier or IP address. PSAP sends the INVITE to E-CSCF.

2) (Option 2) PSAP initiates a callback using UE A callback number, SIP identifier or IP address. PSAP sends the INVITE towards IBCF.

3) (Option 2) IBCF forwards the INVITE to E-CSCF.

4) (Option 3) PSAP initiates a callback using UE A callback number, SIP identifier or IP address. PSAP sends the INVITE towards BGCF.

5) (Option 2) BGCF forwards the INVITE to E-CSCF.

6) E-CSCF forwards the INVITE to P-CSCF.

7) P-CSCF forwards the INVITE to UE A.

8) UE A responds with the 183 response with SDP answer to P-CSCF.

9) P-CSCF sends the 183 response to E-CSCF.

10) (Option 1) E-CSCF forwards the 183 Session Progress to PSAP.

11) (Option 2) E-CSCF forwards the 183 Session Progress to IBCF.

12) (Option 2) IBCF forwards the 183 Session Progress towards PSAP.

13) (Option 3) E-CSCF forwards the 183 Session Progress to BGCF.

14) (Option 3) BGCF forwards the 183 Session Progress towards PSAP over PSTN (may not be a SIP message).

15) Early media may flow between the UE A and PSAP.

16) The UE A responds with the 180 Ringing to E-CSCF.

17) P-CSCF forwards the 180 to E-CSCF.

18) UE A sends 200 OK to P-CSCF.

19) P-CSCF forwards the 200 OK to E-CSCF.

20) (Option 1) E-CSCF forwards the 180 Ringing to PSAP.

21) (Option 1) E-CSCF forwards the 200 OK to PSAP.

22) (Option 1) PSAP sends ACK to E-CSCF

23) (Option 2) E-CSCF forwards the 180 Ringing to IBCF.

24) (Option 2) IBCF forwards 180 Ringing towards PSAP.

25) (Option 2) E-CSCF forwards the 200 OK to IBCF.

26) (Option 2) IBCF forwards 200 OK towards PSAP.

27) (Option 2) PSAP sends ACK to IBCF

28) (Option 2) IBCF sends ACK to E-CSCF

29) (Option 3) E-CSCF forwards 180 Ringing to BGCF.

30) (Option 3) BGCF forwards the 180 Ringing towards PSAP over PSTN (may not be a SIP message).

31) (Option 3) E-CSCF forwards the 200 OK to BGCF.

32) (Option 3) BGCF forwards 200 OK towards PSAP.

33) (Option 3) PSAP sends ACK to BGCF.

34) (Option 3) BGCF sends ACK to E-CSCF.

35) E-CSCF forwards the ACK P-CSCF.

36) P-CSCF forwards the ACK towards UE A.

37) Media Exchange.

5.3.2 Emergency Session Release

5.3.2.0 General

These tests show the removal of the session bearers during the normal release procedures of an already established emergency session.

The test assumes that the UE A has been previously attached to EPC and registered to IMS. An emergency call is assumed to have been successfully established.

The test procedure will follow the Call Release procedures, terminating any bearers that have been previously created as part of the call.

These tests will verify that:

1) The P-CSCF will act on call release and trigger release of call bearers.

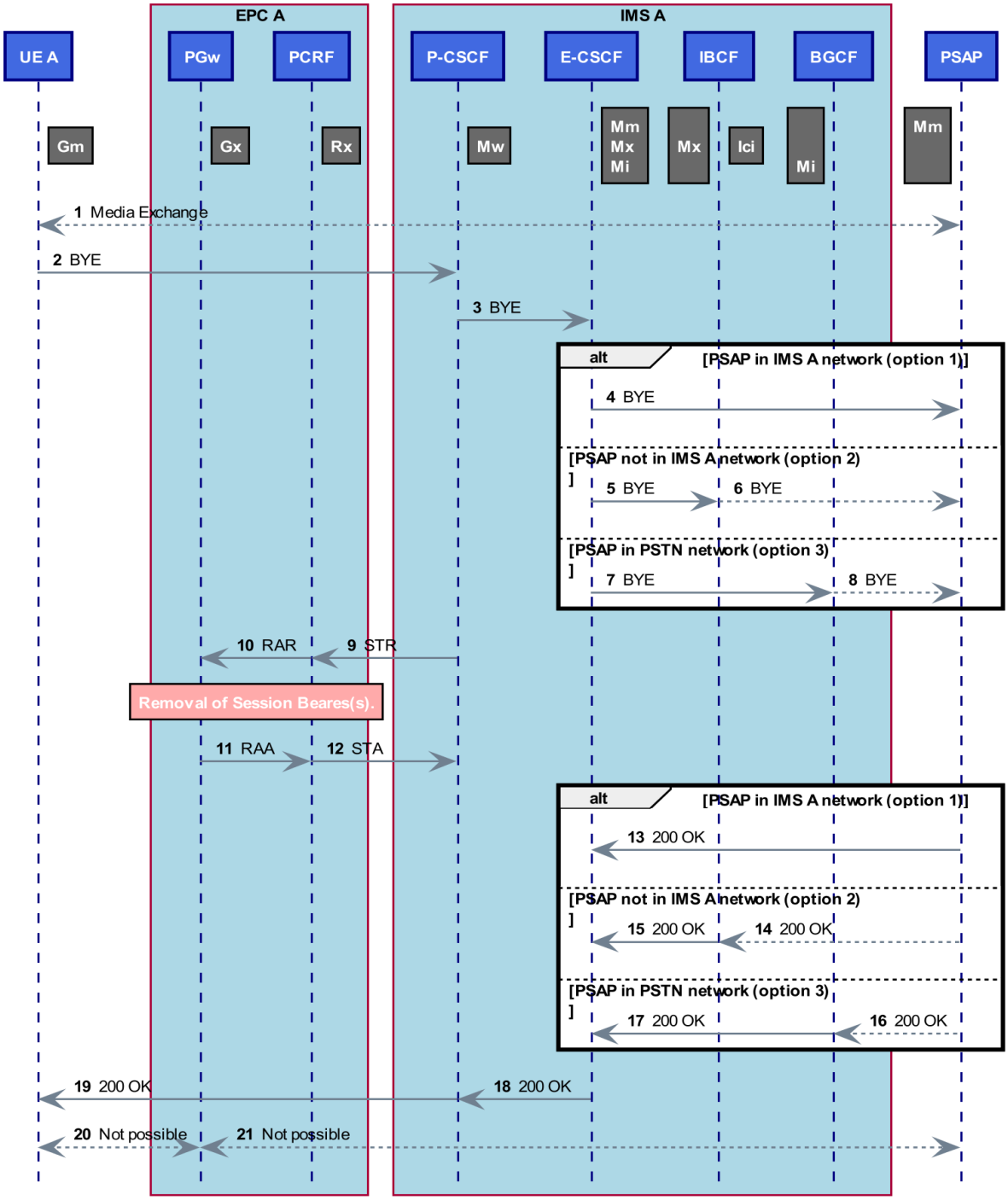
2) The PCRF/EPC will remove the call's media bearers accordingly.

3) Media will not be transported after the session termination. Tests will continue transmitting media after the session release and verify that the default EPC gating policy of "Deny" will stop all media.

5.3.2.1 UE Initiated Emergency Session Release

Interoperability Test Description		
Identifier:	TD_VoLTE_EMC_INT_REL_01	
Objective:	To perform originating UE session release and the tear down of related dedicated bearers.	
Summary:	On call release, the P-CSCF A should trigger the removal of all relevant previously created bearers. EPC A removes the bearers for media. Media transport is no longer possible, after the session release.	
Configuration:	CF_VoLTE_INT_ES (Option 1, Option 2 and Option 3)	
SUT:	IMS A and EPC A	
Interfaces:	Gm, Mw, Gx, Rx, Mm, Mx, Mi	
References:	Gm, Mw	ETSI TS 124 229 [2], clauses 5.1.5 (1st paragraph), 5.1.6.9, 5.2.7, 5.2.8.1.2, 5.4.5.2 and 6.2
	Mm Mx Mi	ETSI TS 123 167 [14], clause 5.2 ETSI TS 124 229 [2], clause 5.11.2
	Gx	ETSI TS 129 212 [7], clause 4.5.2
	Rx	ETSI TS 129 214 [6], clauses 4.4.4, 4.4.5 and A.8
Pre-test conditions:	• UE A previously attached to EPC A. • EPC A established an emergency Bearer allowing UE A to P-CSCF IP communication and PSAP to P-CSCF IP communication. • UE A previously registered to IMS and IMS signalling bearers provisioned. • UE A previously established an emergency session with PSAP.	
Test Sequence:	**Step**	
	1	Verify that media between UE A and PSAP is delivered in both directions and for all negotiated media stream types after the call establishment.
	2	UE A initiates a Call-Release (BYE) operation, ending the session.
	3	Verify that P-CSCF terminates the Rx session, triggering removal of all session related bearers.
	4	Verify that EPC A removes all session related bearers.
	5	Verify that media between UE A and PSAP can no longer be exchanged and is filtered out by EPC A.

Interoperability Test Description			
Conformance criteria of test sequence step:	1	Rtp	TP_RTP_ECO_03 (Event 1)
	2	Gm	TP_GM_PCSCF_ECO_BYE_01 (Event 2)
		Mw	TP_MW_PCSCF_ECO_BYE_01 (Event 3)
		Mm	TP_MM_ECSCF_ECO_BYE_01 (Event 4)
		Mx	TP_MX_ECSCF_ECO_BYE_01 (Events 5 and 6)
		Mi	TP_MI_ECSCF_ECO_BYE_01 (Event 7 and 8)
	3	Gm	TP_GM_PCSCF_ECO_200OK_BYE_01 (Event 19)
		Mw	TP_MW_PCSCF_ECO_200OK_BYE_01 (Event 18)
		Rx	TP_RX_PCSCF_STR_01 (STR - Event 9)
		Gx	TP_GX_PCRF_RAR_02 (RAR - Event 10)
	4	Gx	TP_GX_PGW_RAA_03 (RAA - Event 11)
		Rx	TP_RX_PCRF_STA_01 (STA - Event 12)
	5	Rtp	TP_RTP_ECO_01 (Events 20, 21)



NOTE 1: In the above figure, the Gx interaction may take place after completion of the Rx interaction.
NOTE 2: Emergency Session Release from UE side is not possible for eCall.

Figure 16: Emergency Session Tear-down - UE Initiated Emergency Session Release

1) Media can be exchanged between UE A and PSAP.

2) UE A initiates the emergency session release with a BYE.

3) P-CSCF forwards the BYE to E-CSCF.

4) (Option 1) E-CSCF forwards the BYE to PSAP.

5) (Option 2) E-CSCF forwards the BYE to IBCF.

6) (Option 2) IBCF forwards the BYE towards PSAP.

7) (Option 3) E-CSCF forwards the BYE to BGCF.

8) (Option 3) BGCF forwards the BYE towards PSAP over PSTN (may not be a SIP message).

9) P-CSCF sends a ST-Request to the PCRF (Session-Termination request).

10) PCRF sends a RA-Request to the PGW (Re-Auth request).

11) PGW responds P-CSCF.

12) PCRF responds to P-CSCF.

13) (Option 1) PSAP sends 200 OK (BYE) to E-CSCF.

14) (Option 2) PSAP sends 200 OK (BYE) towards IBCF.

15) (Option 2) IBCF sends 200 OK (BYE) to E-CSCF.

16) (Option 3) PSAP sends 200 OK (BYE) to BGCF over PSTN (may not be a SIP message).

17) (Option 3) BGCF sends 200 OK (BYE) to E-CSCF.

18) E-CSCF forwards the 200 OK (BYE) to P-CSCF.

19) P-CSCF forwards the 200 OK (BYE) towards UE A.

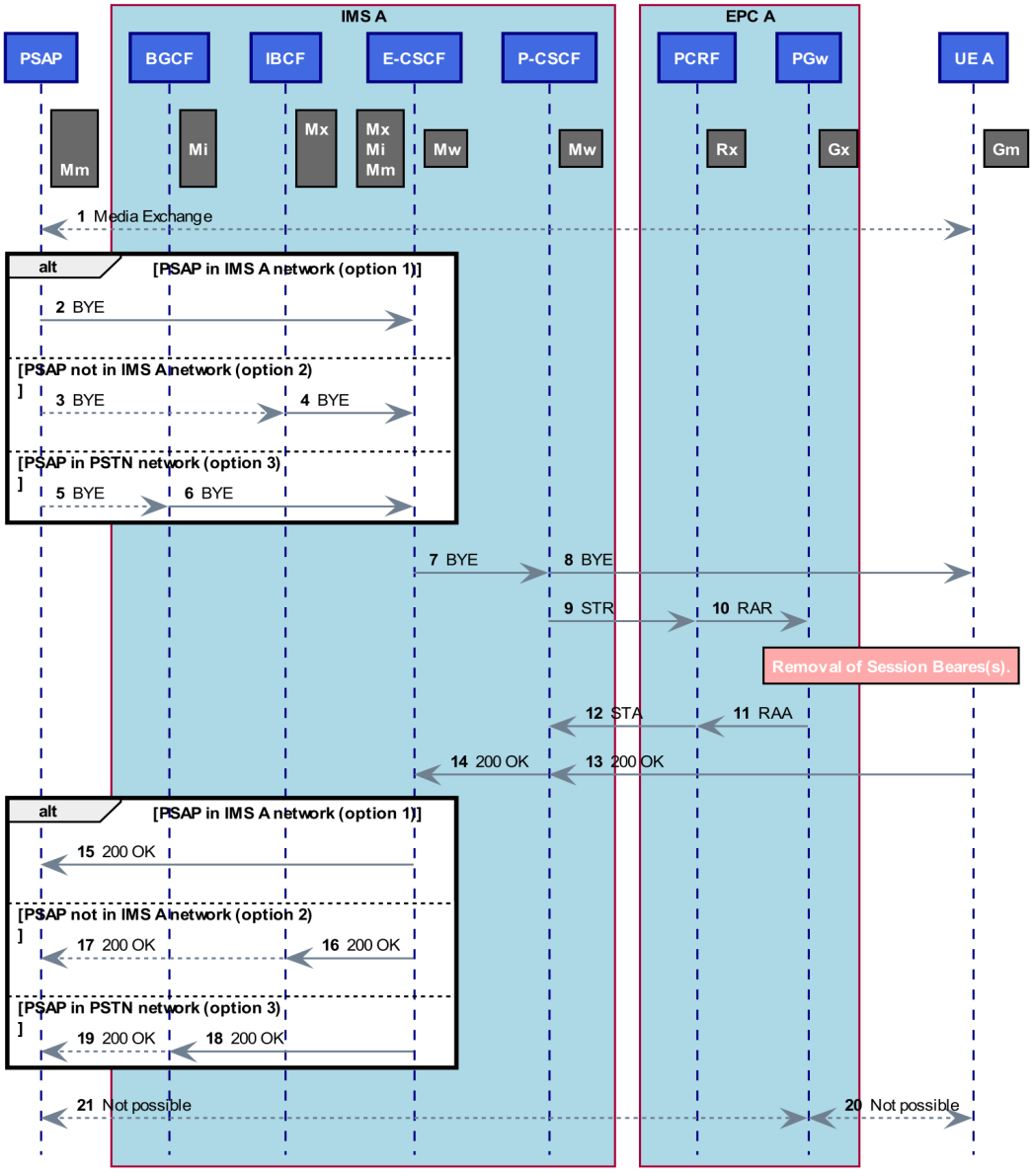
20) The dedicated bearer(s) is/are down.

21) No media can flow between the Ues.

5.3.2.2 PSAP Initiated Emergency Session Release

Identifier:	TD_VoLTE_ECO_INT_REL_02	
Objective:	To perform originating PSAP session release and the tear down of related dedicated bearers.	
Summary:	On call release initiated bye PSAP, the P-CSCF A should trigger the removal of all relevant previously created bearers. EPC A removes the bearers for media. Media transport is no longer possible, after the session release.	
Configuration:	CF_VoLTE_INT_ES (Option 1, Option 2 and Option 3)	
SUT:	IMS A and EPC A	
Interfaces:	Gm, Mw, Gx, Rx, Mm, Mx, Mi	
References:	Gm, Mw	ETSI TS 124 229 [2], clauses 5.1.5, 5.2.7, 6.1 and 6.2
	Mm, Mx, Mi,	ETSI TS 123 167 [14], clause 5.2
	Gx	ETSI TS 129 212 [7], clause 4.5.2
	Rx	ETSI TS 129 214 [6], clause 4.4.4
Pre-test conditions:	• UE A and PSAP previously attached to EPC A. • EPC A established an emergency Bearer allowing UE A to P-CSCF IP communication. • UE A previously registered to IMS and IMS signalling bearers provisioned. • UE A previously established an emergency session with PSAP.	
Test Sequence:	**Step**	
	1	Verify that media between UE A and PSAP is delivered in both directions and for all negotiated media stream types after the call establishment.
	2	PSAP initiates a Call-Release (BYE) operation, ending the session.
	3	Verify that P-CSCF terminates the Rx session, triggering removal of all session related bearers.
	4	Verify that EPC A removes all session related bearers.
	5	Verify that media between UE A and PSAP can no longer be exchanged and is filtered out by EPC A.

Conformance criteria of test sequence step:	1	Rtp	TP_RTP_ECO_03 (Event 1)
	2	Mm Mx Mi	TP_MM_ECSCF_ECO_BYE_02 (Events 2, 7) TP_MX_ECSCF_ECO_BYE_02 (Events 4, 7) TP_MI_ECSCF_ECO_BYE_02 (Events 6, 7)
	3	Gm Mw Rx Gx	TP_GM_PCSCF_ECO_200OK_BYE_02 (Event 13) TP_MW_PCSCF_ECO_200OK_BYE_02 (Event 14) TP_RX_PCSCF_STR_01 (STR - Event 9) TP_GX_PCRF_RAR_02 (RAR - Event 10)
	4	Gx Rx	TP_GX_PGW_RAA_03 (RAA - Event 11) TP_RX_PCRF_STA_01 (STA - Event 12)
	5	Rtp	TP_RTP_ECO_01 (Events 20, 21)



NOTE: In the above figure, the Gx interaction may take place after completion of the Rx interaction.

Figure 17: Emergency Session Tear-down - PSAP Initiated Emergency Session Release

1) Media can be exchanged between UE A and PSAP.

2) (Option 1) PSAP initiates the emergency session release with sending BYE to E-CSCF.

3) (Option 2) PSAP initiates the emergency session release with sending BYE to IBCF.

4) (Option 2) IBCF forwards the BYE towards E-CSCF.

5) (Option 3) PSAP initiates the session release with sending BYE to BGCF over PSTN (may not be a SIP message).

6) (Option 3) BGCF forwards the E-CSCF.

7) E-CSCF forwards the BYE to P-CSCF.

8) P-CSCF forwards the BYE to UE A.

9) P-CSCF sends a ST-Request to the PCRF (Session-Termination request).

10) PCRF sends a RA-Request to the PGW (Re-Auth request).

11) PGW responds with RAA.

12) PCRF responds to P-CSCF with STA.

13) UE A sends 200 OK (BYE) to P-CSCF.

14) P-CSCF forwards 200 OK (BYE) to E-CSCF.

15) (Option 1) E-CSCF forwards 200 OK (BYE) to.

16) (Option 2) E-CSCF forwards 200 OK (BYE) to IBCF.

17) (Option 2) IBCF forwards the 200 OK (BYE) towards PSAP.

18) (Option 3) E-CSCF forwards 200 OK (BYE) to BGCF.

19) (Option 3) BGCF forwards the 200 OK (BYE) towards PSAP over PSTN (may not be a SIP message).

20) The dedicated bearer(s) is/are down.

21) No media can flow between the Ues.

5.3.3 Emergency Session Abort/Reject

5.3.3.0 General

These test cases cover unsuccessful emergency session setup. Either the emergency call is aborted in the UE side or rejected on the PSAP side. The test assumes that the UE A has been previously attached to EPC and registered to IMS.

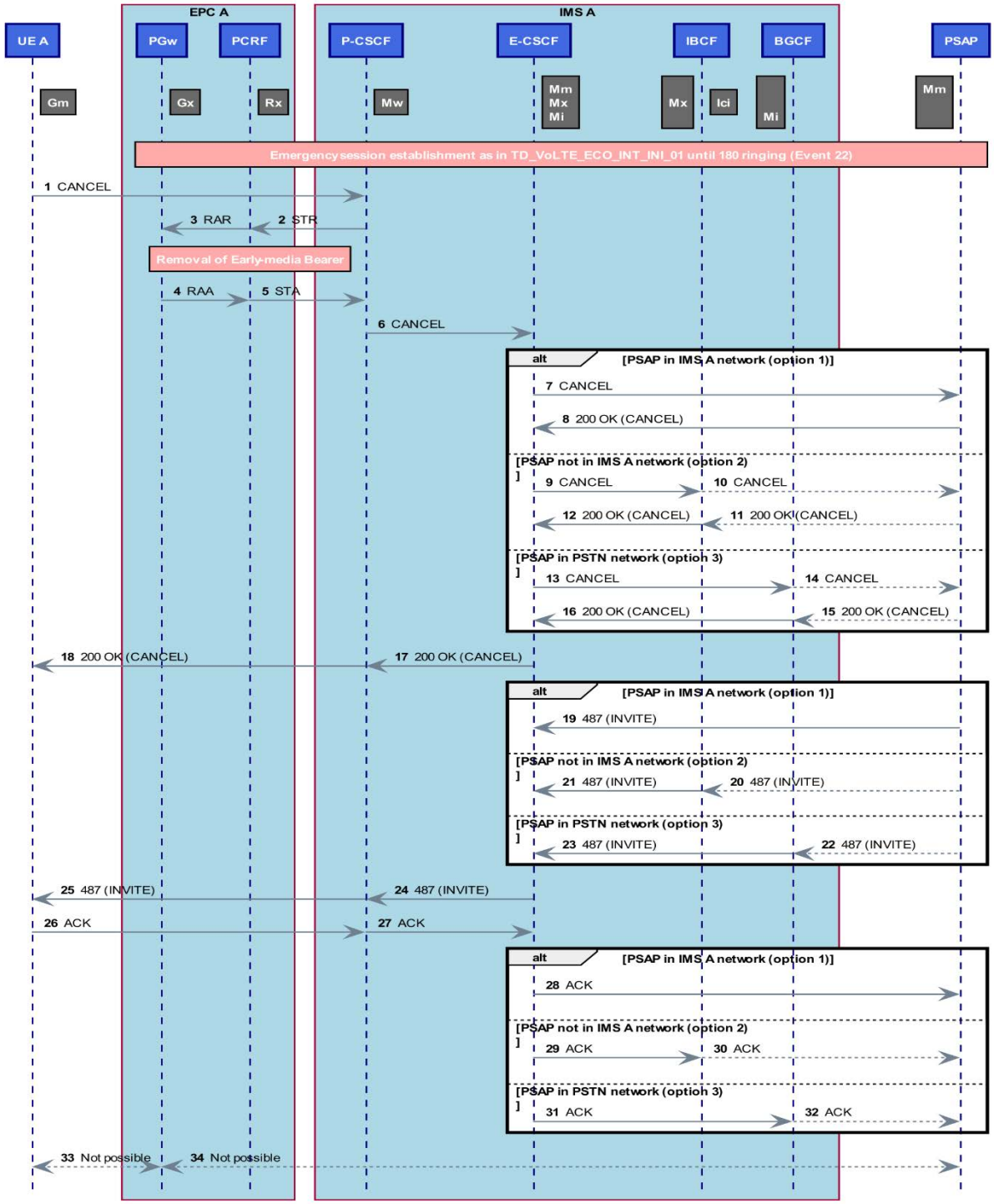
For emergency session abort, it is assumed that a call is established to the ringing phase prior to the originating UE initiating session release. Early media is possible in the backward direction prior to session abort.

For emergency session reject, the INVITE is delivered to the P-CSCF but is rejected (e.g. PSAP is busy). In both cases, dedicated media bearers are established prior to being turn down after session abort/reject.

5.3.3.1 Emergency Session Abort

Interoperability Test Description		
Identifier:	TD_VoLTE_EMC_INT_ABT_01	
Objective:	To perform SIP session abort (originating side) and the related interactions with PCRF A and EPC A.	
Summary:	On session abort, the P-CSCF A should trigger the removal of all relevant previously created early media bearers. EPC A removes the bearers for early media. Media transport is no longer possible, after the session abort.	
Configuration:	CF_VoLTE_INT_ES (Option 1, Option 2 and Option 3)	
SUT:	IMS A and EPC A	
Interfaces:	Gm, Mw, Gx, Rx, Mm	
References:	Gm, Mw	ETSI TS 124 229 [2], clauses 5.1.3, 5.2.7, 5.11.2, 6.1 and 6.2

Interoperability Test Description		
	Mm Mx Mi	ETSI TS 123 167 [14], clause 5.2 ETSI TS 124 229 [2], clause 5.11.2
	Gx	ETSI TS 129 212 [7], clause 4.5.2
	Rx	ETSI TS 129 214 [6], clause 4.4.4
Pre-test conditions:	• UE A previously attached to EPC A. • EPC A established an emergency Bearer allowing UE A to P-CSCF IP communication. • UE A & PSAP previously registered to IMS and IMS signalling bearers provisioned.	
Test Sequence:	**Step**	
	1	Verify that media between UE A and PSAP is not delivered in any direction.
	2	UE A initiates an emergency session establishment operation.
	3	PSAP answers with SIP 183 Session Progress INVITE Response and starts sending early media.
	4	Verify that early media is delivered from PSAP to UE A.
	5	UE A cancels the session establishment.
	6	Verify that P-CSCF A terminates the Rx session, triggering removal of all early media related bearers.
	7	Verify that EPC A removes all early media related bearers.
	8	Verify that media between UE A and PSAP can no longer be exchanged and is filtered out by EPC A.
Conformance criteria of test sequence step:	5	Gm TP_GM_PCSCF_EMC_CANCEL_01 (Event 1) Mw TP_MW_PCSCF_EMC_CANCEL_01 (Event 6) Mm TP_MM_ECSCF_EMC_CANCEL_01 (Events 7, 8) Mx TP_MX_ECSCF_EMC_CANCEL_01 (Events 9, 12) Mi TP_MI_ECSCF_EMC_CANCEL_01 (Events 13, 16)
	6	Rx TP_RX_PCSCF_STR_03 (STR - Event 2) Gx TP_GX_PCRF_RAR_02 (RAR - Event 3)
	7	Gx TP_GX_PGW_RAA_03 (RAA - Event 4) Rx TP_RX_PCRF_STA_01 (STA - Event 5) Gm TP_GM_PCSCF_EMC_200OK_CANCEL_01 (Event 18) Mw TP_MW_PCSCF_EMC_200OK_CANCEL_01 (Event 17) Mm TP_MM_ECSCF_EMC_487INVITE_01 (Events 19) Mx TP_MX_ECSCF_EMC_487INVITE_01 (Events 21) Mi TP_MI_ECSCF_EMC_487INVITE_01 (Events 23) Gm TP_GM_PCSCF_EMC_487INVITE_01 (Event 25) Mw TP_MW_PCSCF_EMC_487INVITE_01 (Event 24)
	8	Rtp TP_RTP_ECO_01 (Events 33, 34)



NOTE 1: In the above figure, the Gx interaction may take place after completion of the Rx interaction.
NOTE 2: Emergency Session Abort is not possible for eCall.

Figure 18: Emergency Session Abort

1) The UE A responds 180 Ringing with CANCEL.

2) P-CSCF sends a ST-Request to the PCRF (Session-Termination request).

3) PCRF sends a RA-Request to the PGW (Re-Auth request).

4) PGW responds with RA-Answer to PCRF.

5) PCRF responds with ST-Answer to P-CSCF.

6) P-CSCF sends CANCEL to E-CSCF.

7) (Option 1) E-CSCF sends CANCEL to PSAP.

8) (Option 1) PSAP sends 200 OK (CANCEL) to E-CSCF.

9) (Option 2) E-CSCF sends CANCEL to IBCF.

10) (Option 2) IBCF forwards the CANCLE towards PSAP.

11) (Option 2) PSAP sends 200 OK (CANCEL) to IBCF.

12) (Option 2) IBCF sends 200 OK (CANCEL) to E-CSCF.

13) (Option 3) E-CSCF sends CANCEL to BGCF.

14) (Option 3) BGCF forwards CANCLE towards PSAP over PSTN (may not be a SIP message).

15) (Option 3) PSAP sends 200 OK (CANCEL) to BGCF over PSTN.

16) (Option 3) BGCF forwards 200 OK (CANCEL) to E-CSCF.

17) E-CSCF sends 200 OK (CANCEL) to P-CSCF.

18) P-CSCF forwards 200 OK (CANCEL) to UE A.

19) (Option 1) PSAP sends 487 (INVITE) to E-CSCF.

20) (Option 2) PSAP sends 487 (INVITE)) to IBCF.

21) (Option 2) IBCF sends 487 (INVITE) to E-CSCF.

22) (Option 3) PSAP sends 487 (INVITE) to BGCF over PSTN (may not be a SIP message).

23) (Option 3) BGCF forwards 487 (INVITE) to E-CSCF.

24) E-CSCF sends 487 (INVITE) to P-CSCF.

25) P-CSCF forwards 487 (INVITE) to UE A.

26) UE A sends ACK to IMS A P-CSCF.

27) P-CSCF sends ACK to E-CSCF.

28) (Option 1) E-CSCF forwards ACK to PSAP.

29) (Option 2) E-CSCF forwards ACK to IBCF.

30) (Option 2) IBCF forwards the ACK towards PSAP.

31) (Option 3) E-CSCF forwards ACK to BGCF.

32) (Option 3) BGCF forwards the ACK towards PSAP over PSTN (may not be a SIP message).

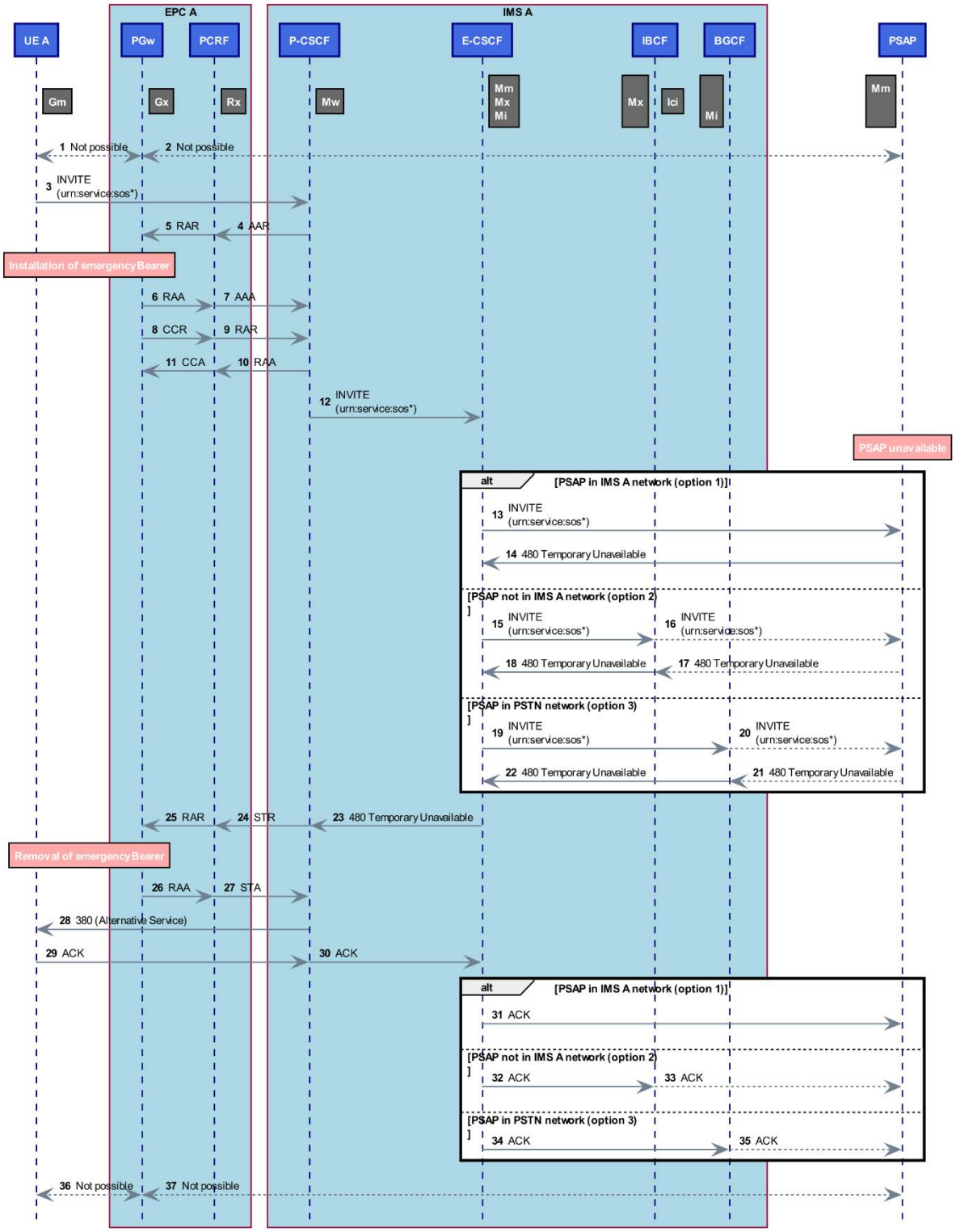
33) The dedicated bearer(s) is/are down.

34) No media can flow between the UEs.

5.3.3.2 Emergency Session Reject from PSAP

Interoperability Test Description	
Identifier:	TD_VoLTE_ECO_INT_REJ_01
Objective:	To demonstrate interaction between UE A and PSAP when an emergency session is rejected.
Summary:	On session reject, the P-CSCF A should trigger the removal of all relevant previously created early media bearers. EPC A removes the bearers for early media. Media transport is no longer possible, after the rejected session.

Interoperability Test Description			
Configuration:	CF_VoLTE_INT_ES (Option 1, Option 2 and Option 3)		
SUT:	IMS A and EPC A		
Interfaces:	Gm, Mw, Gx, Rx, Mm		
References:	Gm, Mw	ETSI TS 124 229 [2], clauses 5.1.3, 5.2.10.5, 5.10.3.2, 5.11.2, 6.1 and 6.2	
	Mm, Mx, Mi,	ETSI TS 123 167 [14], clause 5.2	
	Gx	ETSI TS 129 212 [7], clause 4.5.2	
	Rx	ETSI TS 129 214 [6], clause 4.4.4	
Pre-test conditions:	• UE A previously attached to EPC A. • EPC A established an emergency Bearer allowing UE A to P-CSCF IP communication. • UE A & PSAP previously registered to IMS and IMS signalling bearers provisioned. • PSAP not available (turn off)		
Test Sequence:	**Step**		
	1	Verify that media between UE A and PSAP is not delivered in any direction.	
	2	UE A initiates an emergency session establishment operation.	
	3	PSAP rejects session establishment with 480 "Temporary Unavailable"	
	4	Verify that P-CSCF reject the request by returning a 380 (Alternative Service) response	
	5	Verify that P-CSCF A terminates the Rx session, triggering removal of all early media related bearers.	
	6	Verify that EPC A removes all early media related bearers.	
	7	Verify that media between UE A and PSAP can not be exchanged and is filtered out by EPC A.	
Conformance criteria of test sequence step:	1	Rtp	TP_RTP_ECO_01 (Events 1, 2)
	2	Gm	TP_GM_PCSCF_ECO_INVITE_01 (Event 3)
		Gm	TP_GM_PCSCF_ECO_INVITE_02 (Event 3)
		Gm	TP_GM_PCSCF_ECO_INVITE_03 (Event 3)
		Gm	TP_GM_PCSCF_ECO_INVITE_04 (Event 3)
		Gm	TP_GM_PCSCF_ECO_INVITE_05 (Event 3)
		Gm	TP_GM_PCSCF_ECO_INVITE_06 (Event 3)
		Gm	TP_GM_PCSCF_ECO_INVITE_07 (Event 3)
		Gm	TP_GM_PCSCF_ECO_INVITE_08 (Event 3)
	3	Ic	TP_IC_IBCF_ECO_480INVITE_01 (Event 16)
		Mm	TP_MM_ECSCF_ECO_480INVITE_01 (Events 14, 23)
		Mx	TP_MX_ECSCF_ECO_480INVITE_01 (Events 18, 23)
		Mi	TP_MI_ECSCF_ECO_480INVITE_01 (Events 22, 23)
	4	Mw	TP_MW_PCSCF_ECO_480INVITE_01 (Events 23, 28)
	5, 6, 7	Rx	TP_RX_PCSCF_STR_05 (STR - Event 24)
		Gx	TP_GX_PCRF_RAR_02 (RAR - Event 25)
		Gx	TP_GX_PGW_RAA_03 (RAA - Event 26)
		Rx	TP_RX_PCRF_STA_01 (STA - Event 27)
		Rtp	TP_RTP_ECO_01 (Events 36, 37)



NOTE: In the above figure, the Gx interaction may take place after completion of the Rx interaction.

Figure 19: Emergency Session Reject - PSAP unavailable

1) The dedicated bearer(s) is/are down.

2) No media can flow between the Ues.

3) UE A initiates the SIP session with an INVITE containing the service URN "sos".

4) The IMS A P-CSCF invokes the PCRF.

5) PCRF sends RAR to EPC A PGW.
6) EPC A PGW responds with RAA.
7) PCRF responds to IMS A P-CSCF with AAA.
8) EPC A PGW sends CCR to PCRF.
9) PCRF sends RAR to P-CSCF.
10) P-CSCF responds with RAA.
11) PCRF responds with CCA to PGW.
12) P-CSCF sends the INVITE to E-CSCF.
13) (Option 1) E-CSCF forwards the INVITE to PSAP.
14) (Option 1) PSAP response with 480 Temporary Unavailable to E-CSCF.
15) (Option 2) E-CSCF forwards the INVITE to IBCF.
16) (Option 2) IBCF forwards the INVITE towards PSAP.
17) (Option 2) PSAP response with 480 Temporary Unavailable to IBCF.
18) (Option 2) IBCF forwards the response with 480 Temporary Unavailable to E-CSCF.
19) (Option 3) E-CSCF forwards the INVITE to BGCF.
20) (Option 3) BGCF forwards the INVITE towards PSAP over PSTN (may not be a SIP message).
21) (Option 3) PSAP response with 480 Temporary Unavailable to BGCF over PSTN (may not be a SIP message).
22) (Option 3) BGCF forwards the response with 480 Temporary Unavailable to E-CSCF
23) E-CSCF sends the 480 Temporary Unavailable to P-CSCF.
24) The IMS A P-CSCF invokes the PCRF to remove the bearer.
25) PCRF sends RAR to EPC A PGW.
26) EPC A PGW responds with RAA.
27) PCRF responds to IMS A P-CSCF with STA.
28) P-CSCF 64ends the 380 (Alternative Service) to UE A.
29) UE A sends ACK to IMS A P-CSCF.
30) P-CSCF sends ACK to E-CSCF.
31) (Option 1) E-CSCF forwards ACK to PSAP.
32) (Option 2) E-CSCF forwards ACK to IBCF.
33) (Option 2) IBCF forwards the ACK towards PSAP.
34) (Option 3) E-CSCF forwards ACK to BGCF.
35) (Option 3) BGCF forwards the ACK towards PSAP over PSTN (may not be a SIP message).
36) The dedicated bearer(s) is/are down.
37) No media can flow between the UE and PSAP.

5.3.3.3 Emergency Session Reject - IMS not able to handle emergency sessions

Interoperability Test Description		
Identifier:	TD_VoLTE_ECO_INT_REJ_02	
Objective:	To demonstrate interaction between UE A and P-CSCF when an emergency session is rejected.	
Summary:	On session reject, the P-CSCF A should trigger the removal of all relevant previously created early media bearers. EPC A removes the bearers for early media. Media transport is no longer possible, after the rejected session.	
Configuration:	CF_VoLTE_INT_ES	
SUT:	IMS A and EPC A	
Interfaces:	Gm	
References:	Gm	ETSI TS 124 229 [2], clause 5.2.10.5
Pre-test conditions:	• UE A previously attached to EPC A. • EPC A established default Bearer allowing UE A to P-CSCF IP communication. • UE A & PSAP previously registered to IMS and IMS signalling bearers provisioned. • The IMS A is not capable or does not handle emergency sessions	
Test Sequence:	**Step**	
	1	UE A initiates an emergency session establishment operation.
	2	Verify that P-CSCF reject the request by returning a 380 (Alternative Service) response.
Conformance criteria of test sequence step:	1	Gm TP_GM_PCSCF_ECO_INVITE_01 (Event 1)
	2	Mw TP_MW_PCSCF_ECO_380INVITE_01 (Events 2)

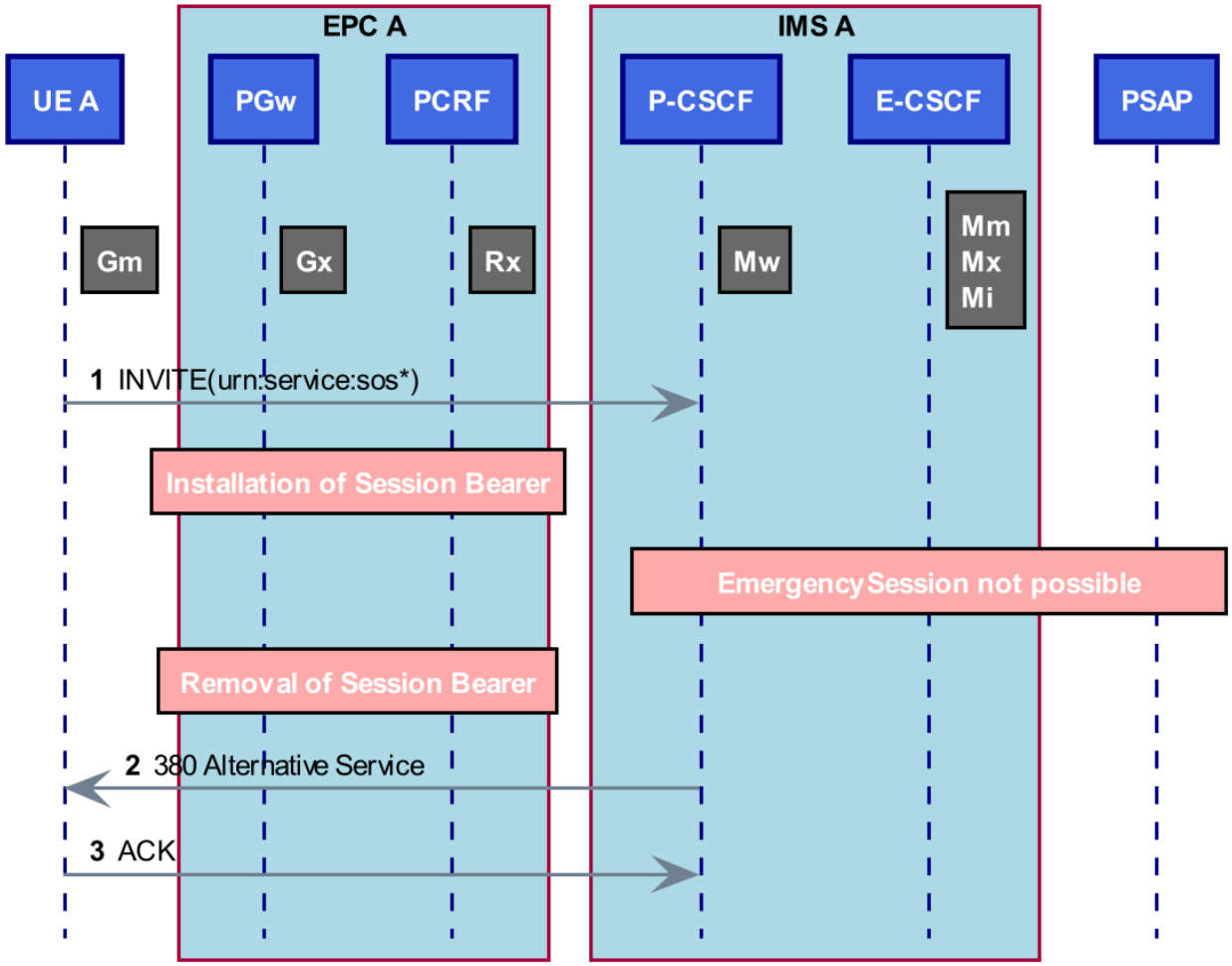


Figure 20: Emergency Session Reject - Network Rejection

1) UE A initiates the emergency session with an INVITE containing the service URN "sos".

2) P-CSCF sends 380 (Alternative Service) to UE-A.

3) UE A sends ACK to P-CSCF.

5.3.3.4 Emergency Session Reject - due to wrong urn

Interoperability Test Description		
Identifier:	TD_VoLTE_ECO_INT_REJ_03	
Objective:	To demonstrate interaction between UE A and P-CSCF when an emergency session is rejected due to wrong urn.	
Summary:	On session reject, the P-CSCF A should trigger the removal of all relevant previously created early media bearers. EPC A removes the bearers for early media. Media transport is no longer possible, after the rejected session.	
Configuration:	CF_VoLTE_INT_ES	
SUT:	IMS A and EPC A	
Interfaces:	Gm	
References:	Gm	ETSI TS 124 229 [2], clauses 5.2.10.4 and 5.2.10.5
Pre-test conditions:	• UE A previously attached to EPC A. • EPC A established default Bearer allowing UE A to P-CSCF IP communication. • UE A & PSAP previously registered to IMS and IMS signalling bearers provisioned. • The IMS A rejects emergency session due to wrong urn.	

Interoperability Test Description		
Test Sequence:	**Step**	
	1	UE A initiates an emergency session establishment operation with wrong urn
	2	Verify that P-CSCF reject the request by returning a 380 (Alternative Service) response due to wrong urn
Conformance criteria of test sequence step:	2	Mw TP_MW_PCSCF_ECO_380INVITE_02 (Events 2)

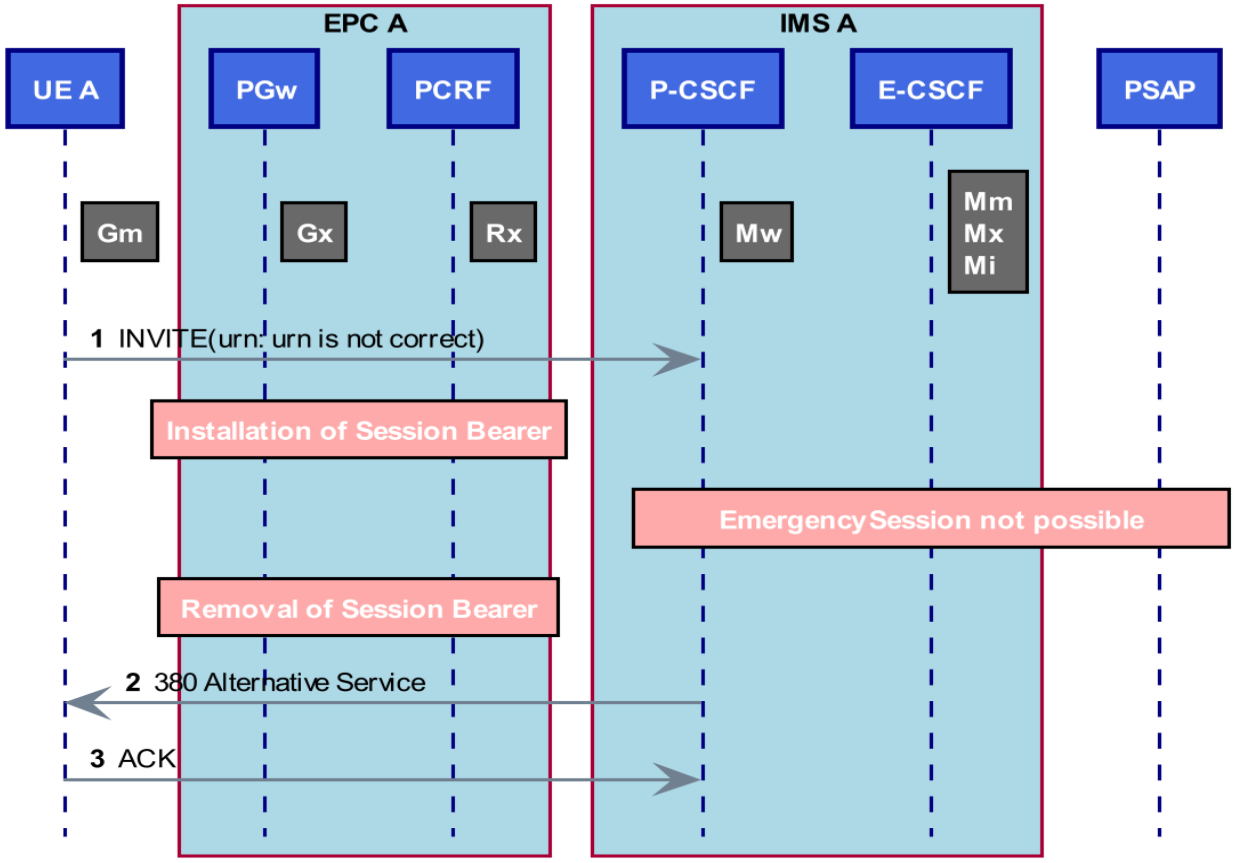


Figure 21: Emergency Session Reject - Wrong urn

1) UE A initiates the emergency session with an INVITE containing wrong service URN.

2) P-CSCF sends 380 (Alternative Service) to UE-A.

3) UE A sends ACK to P-CSCF.

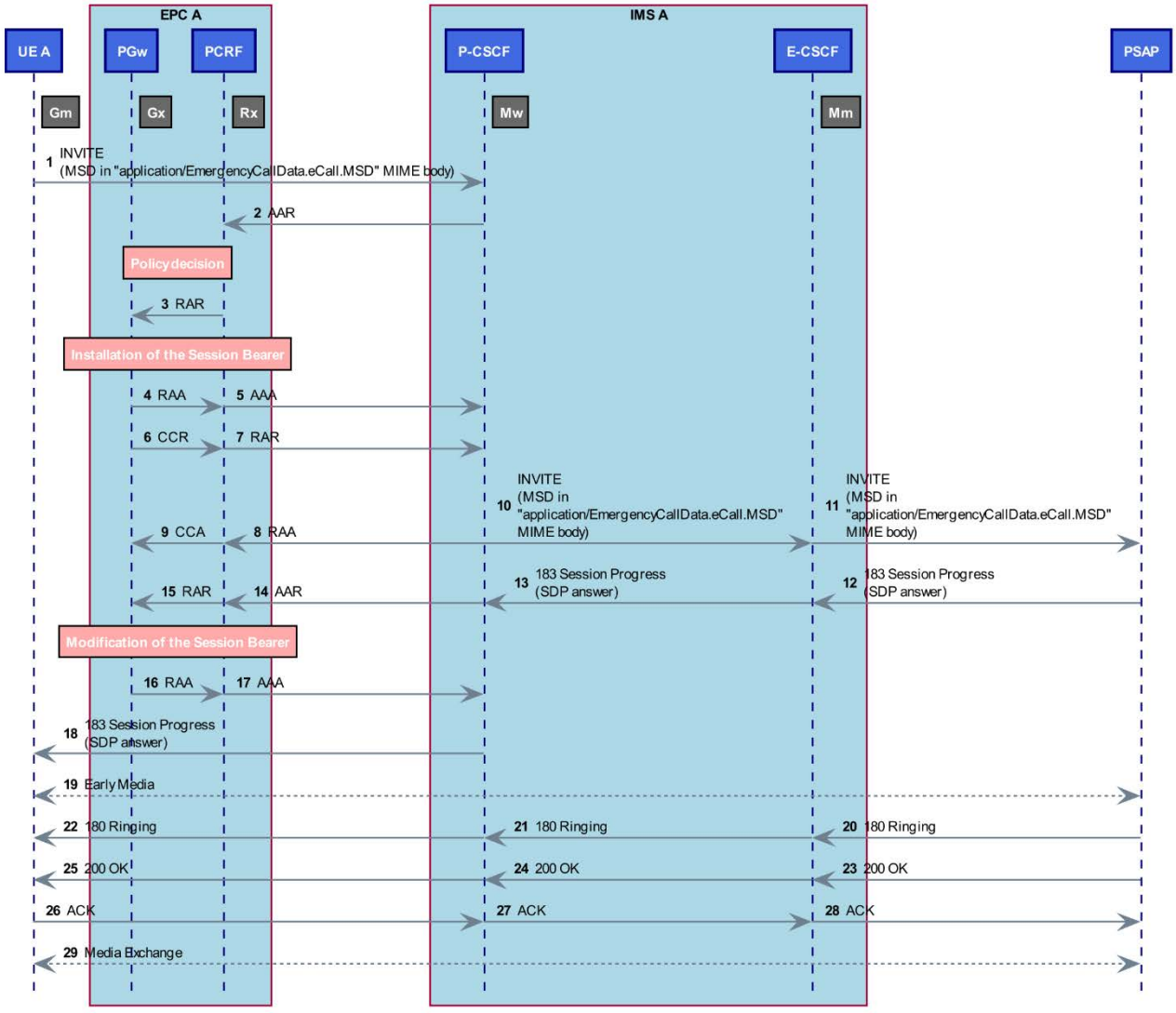
5.3.4 NG eCall tests

5.3.4.1 MSD sent during NG eCall establishment

Identifier:	TD_VoLTE_NGC_INT_INI_01
Objective:	To demonstrate the establishment of IMS emergency call of the (automatically or manually) initiated eCall type of emergency service within an emergency registration. PSAP is located in the IM CN subsystem of IMS A.

Summary:	An eCall type of emergency service is setup between UE A and the PSAP located in the IM CN subsystem of IMS A. UE-A is attached to EPC A and registered to IMS A, has performed the emergency registration to IMS A, and requests emergency session establishment using an emergency URN. The P-CSCF derives descriptions of the Service Data Flow from the SDP data, requests creation of adequate bearers from PCRF and EPC, and forwards the request to the E-CSCF. The E-CSCF retrieves the PSAP URI from local configuration and forwards the request to this PSAP. Media transport is possible only after the successful establishment of the session. Media negotiation happens during INVITE/200 OK (UE A sends SDP-offer, PSAP responds with SDP-answer).	
Configuration:	CF_VoLTE_INT_ES option 1	
SUT:	IMS A, EPC A and PSAP	
Interfaces:	Gm, Mw, Rx, Gx, Mm	
References:	Mm	ETSI TS 124 229 [2], clause 5.11.2 ETSI TS 123 167 [14]
	Gm, Mw	ETSI TS 124 229 [2], clauses 5.1.6.8.3, 5.1.6.11, 5.2.6.3.3, 5.2.10.3 and 5.11.2
	Rx	ETSI TS 129 214 [6], clauses 4.4.1, A.1, A.2 and annex B
	Gx	ETSI TS 129 212 [7], clause 4.5.2
Pre-test conditions:	• UE A previously attached to EPC A. • UE A previously registered to IMS A. • EPC established an emergency Bearer allowing UE A - P-CSCF IP communication. • EPC established an IMS signalling bearer. • PSAP is registered or connected to the IMS A and ready to accept the session establishment. • UE A previously performed emergency registration.	
Test Sequence:	**Step**	
	1	Verify that media between UE A and PSAP is not delivered in any direction before call establishment.
	2	UE A initiates an eCall type of emergency call to establish a communication session using an emergency service URN.
	3	Verify that the UE A inserts in the INVITE request, a From header field that includes the public user identity registered via emergency registration or the tel URI associated with the public user identity registered via emergency registration and a To header indicating one of the NG eCall URNs defined in Table 1. Verify also that the UE A inserts a multipart/mixed body containing an "application/EmergencyCallData.eCall.MSD" MIME body part containing the MSD not exceeding 140 bytes and encoded in binary ASN.1 PER, a Content-Disposition header field with the handling parameter set to optional, an Accept header field indicating "application/EmergencyCallData.Control+xml"is acceptable, and a Recv-Info header field set to "EmergencyCallData.eCall.MSD".
	4	Verify that IMS A (P-CSCF, E-CSCF) routes the emergency call to the PSAP in the same IM CN subsystem of the own network.
	5	Verify that the IMS produced a Media Description for the session according to SDP-offer in SIP INVITE Request and SDP-answer in SIP 183 to the PCRF.
	6	Verify that the PCRF invokes the EPC PGW with a RA-Request to create a new bearer for the requested media.
	7	Verify that PCRF requested media description was found acceptable by EPC and dedicated bearers are established and that a RA-Answer is sent to the PCRF.
	8	Verify that media between UE A and PSAP is successfully routed over the dedicated bearer.
	9	Verify that media between UE A and PSAP is transported with appropriate PCC characteristics.

Conformance criteria of test sequence step:	2	Gm	TP_GM_PCSCF_NGC_INVITE_01 (Event 1)
	3	Gm	TP_GM_PCSCF_ECO_REGISTER_02 (Pre-test)
	4	Mw Mm	TP_MW_PCSCF_ECO_INVITE_02 (Event 10) TP_MM_ECSCF_ECO_INVITE_01 (Event 11)
	6/7	Rx Rx Rx Gx Rx Gx Gx	TP_RX_PCSCF_AAR_03 (AAR - Event 2) TP_RX_PCSCF_AAR_04 (AAR - Event 14) TP_RX_PCRF_AAA_02 (AAA - Events 5, 17) TP_GX_PCRF_RAR_01 (RAR - Events 3, 15) TP_RX_PCSCF_RAA_01 (RAR, RAA - Events 7, 8) TP_GX_PGW_RAA_02 (RAA - Events 4, 16) TP_GX_PCRF_CCA_06 (CCR, CCA - Events 6, 9)
	8	Rtp	TP_RTP_ECO_03 (Event 29)



NOTE 1: The interaction in above figure is the same for emergency registered and non-emergency registered UE.
NOTE 2: In the above figure, the Gx interaction may take place after completion of the Rx interaction.

Figure 22: NG eCall establishment with emergency registration, PSAP in same IM CN subsystem

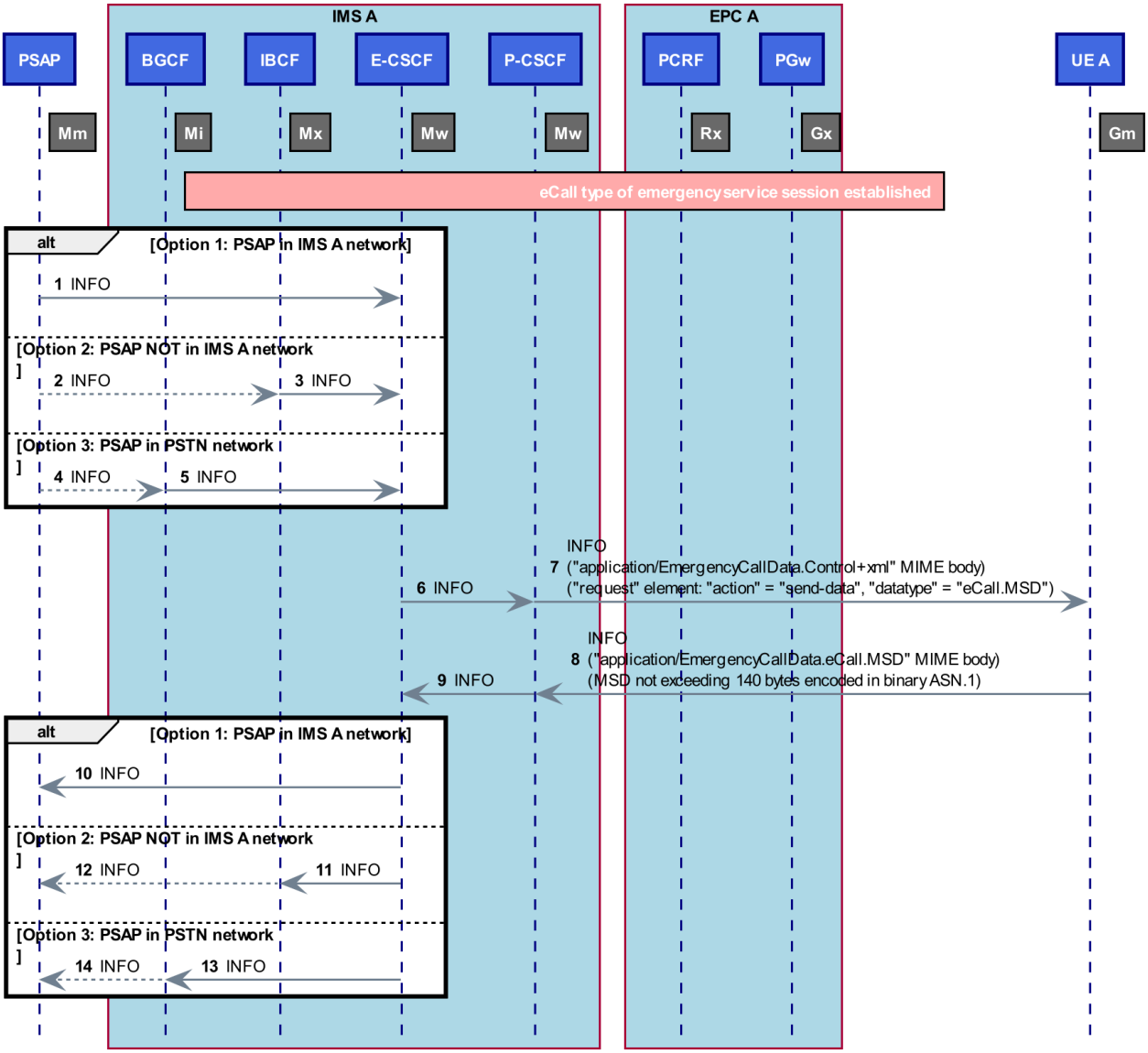
1) UE A initiates the emergency session with an INVITE request. The From header field includes the public user identity (registered via emergency registration) or the tel URI associated with the public user identity (registered via emergency registration). The multipart/mixed body contains an "application/EmergencyCallData.eCall.MSD" MIME body part containing the MSD not exceeding 140 bytes and encoded in binary ASN.1 PER.

2) The IMS A P-CSCF invokes the PCRF.
3) PCRF sends RAR to EPC A PGW.
4) EPC A PGW responds with RAA.
5) PCRF responds to IMS A P-CSCF with AAA.
6) EPC A P- GW sends CCR.
7) PCRF sends RAR to P-CSCF.
8) P-CSCF responds with RAA.
9) PCRF responds with CCA to PGW.
10) P-CSCF sends the INVITE including the MSD MIME body to E-CSCF.
11) E-CSCF sends the INVITE including the MSD MIME body to PSAP.
12) PSAP responds with the 183 response with SDP answer to E-CSCF.
13) E-CSCF sends the 183 response to P-CSCF.
14) The IMS A P-CSCF invokes the PCRF to modify the bearer with AAR.
15) PCRF sends RAR to EPC A PGW.
16) EPC A PGW responds with RAA.
17) PCRF responds to IMS A P-CSCF with AAA.
18) P-CSCF forwards the SIP 183 (SDP) to UE A.
19) Early media may flow between the UE A and PSAP.
20) The PSAP responds with the 180 Ringing to E-CSCF.
21) E-CSCF forwards the 180 to P-CSCF.
22) P-CSCF forwards the SIP 180 to UE A.
23) PSAP sends 200 OK to E-CSCF.
24) E-CSCF forwards the 200 OK to P-CSCF.
25) P-CSCF forwards the 200 OK towards UE A.
26) UE A sends ACK to P-CSCF.
27) P-CSCF sends ACK to E-CSCF.
28) E-CSCF sends ACK to PSAP.
29) Media Exchange.

5.3.4.2 MSD update during NG eCall

Interoperability Test Description	
Identifier:	TD_VoLTE_NGC_INT_INF_01
Objective:	To demonstrate that if an IMS emergency call of the (automatically or manually) initiated eCall type of emergency service has been established, the attempt by the PSAP to request transfer of an updated MSD shall be answered.
Summary:	Verifying the complete message stream related to the transfer of an updated MSD requested by the PSAP and answered by the UE having established the eCall session. The updated MSD is transferred in the "application/EmergencyCallData.eCall.MSD" MIME body of an INFO request message.
Configuration:	CF_VoLTE_INT_ES (Option 1, Option 2 and Option 3)

Interoperability Test Description		
SUT:	IMS A and EPC A	
Interfaces:	Gm, Mw, Mm, Mx, Mi	
	Mm, Mx, Mi	ETSI TS 124 229 [2], clause 5.11.2 ETSI TS 123 167 [14]
	Gm, Mw	ETSI TS 124 229 [2], clauses 5.1.6.8, 5.1.6.11.3, 5.2.6.3, 5.2.6.4, 5.2.10.3 and 5.11.2
Pre-test conditions:	• UE A previously established an emergency call of the (automatically or manually) initiated eCall type of emergency service as described in clause 5.3.4.1.	
Test Sequence:	**Step**	
	1	PSAP initiates a request for the transfer of an updated MSD to UE A.
	2	Verify that the PSAP request for the transfer of an updated MSD is successfully routed to the UE A. (INFO request including Info-Package header field set to "EmergencyCallData.eCall.MSD", a multipart/mixed body including "application/EmergencyCallData.Control+xml" MIME body part containing a "request" element with an "action" attribute set to "send-data" and a "datatype" attribute set to "eCall.MSD", a Content-Disposition header field set to "By-Reference" associated with the MIME body part, and a Content-Disposition header field set to "Info-Package" associated with the multipart/mixed body).
	3	Verify that UE A answers the request for the transfer of an updated MSD (INFO request including Info-Package header field set to "EmergencyCallData.eCall.MSD", a Content-Disposition header field set to "Info-Package", a multipart/mixed body including an "application/EmergencyCallData.eCall.MSD" MIME body part containing the MSD not exceeding 140 bytes and encoded in binary ASN.1 and a Content-Disposition header field set to "By-Reference" associated with the "application/EmergencyCallData.eCall.MSD" MIME body part).
	4	Verify that the UE A answer to request for the transfer of an updated MSD which is successfully routed to the PSAP.
Conformance criteria of test sequence step:	2, 3	Gm TP_GM_PCSCF_NGC_INFO_01 (Event 8) Mw TP_MW_PCSCF_NGC_INFO_01 (Event 7)



NOTE: For reasons of readability, only the SIP messages are shown in the figure above.

Figure 23: MSD update during NG eCall

1) (Option 1) PSAP initiates an MSD update request. PSAP sends the INFO to E-CSCF.
2) (Option 2) PSAP initiates an MSD update request. PSAP sends the INFO towards IBCF.
3) (Option 2) IBCF forwards the INFO to E-CSCF.
4) (Option 3) PSAP initiates an MSD update request. PSAP sends the INFO towards BGCF.
5) (Option 2) BGCF forwards the INFO to E-CSCF.
6) E-CSCF forwards the INFO to P-CSCF.
7) P-CSCF forwards the INFO to UE A.
8) UE A responds with an INFO with SDP answer to P-CSCF.
9) P-CSCF forwards the INFO to E-CSCF.
10) (Option 1) E-CSCF forwards the INFO to PSAP.
11) (Option 2) E-CSCF forwards the INFO to IBCF.

12) (Option 2) IBCF forwards the INFO towards PSAP.

13) (Option 3) E-CSCF forwards the INFO to BGCF.

14) (Option 3) BGCF forwards the INFO towards PSAP over PSTN (may not be a SIP message).

5.4 Emergency Deregistration

UE shall not perform user-initiated deregistration due to ETSI TS 124 229 [2], clause 5.1.6.6.

An emergency registration will not be deregistered by the network due to ETSI TS 124 229 [2], clause 5.1.6.7.

5.5 Emergency Network Detachment

5.5.0 General

These tests cover interaction between the EPC, PCRF and IMS when emergency network detachment takes place. Emergency detachment may be triggered by the UE or network.

At the point of detachment, a UE may or may not be registered to IMS and may or may not have active IMS sessions. All possibilities are covered. All affected bearers for a given established session will be removed, and administrative termination of the SIP registration/sessions will be triggered as appropriate.

5.5.1 UE Emergency Network Detachment (with/without Emergency Registration)

Interoperability Test Description		
Identifier:	TD_VoLTE_ECO_INT_DTC_01	
Objective:	To demonstrate UE initiated network emergency detachment (IP-CAN session termination) for a UE that has not yet emergency registered to the IMS or for UE that has been emergency registered to the IMS. (emergency deregistration shall not be performed by the UE due to ETSI TS 124 229 [2], clause 5.1.6.6)	
Summary:	On complete network detachment, the EPC removes emergency bearers.	
Configuration:	CF_VoLTE_INT_ES	
SUT:	IMS A and EPC A	
Interfaces:	Gx	
References:	Gx	ETSI TS 129 212 [7], clause 4.5.15.2.4
Pre-test conditions:	• UE A previously attached to EPC with an emergency attachment	
Test Sequence:	**Step**	
	1	UE A starts complete network emergency detachment, whilst being or not being registered at IMS.
	2	Verify that EPC removes the affected emergency bearer.
	3	Verify that EPC PGW informs the PCRF of the loss of the emergency bearer.
Conformance criteria of test sequence step:	2	Gx TP_GX_PCRF_ECO_CCA_02 (CCR, CCA - Events 2, 3)

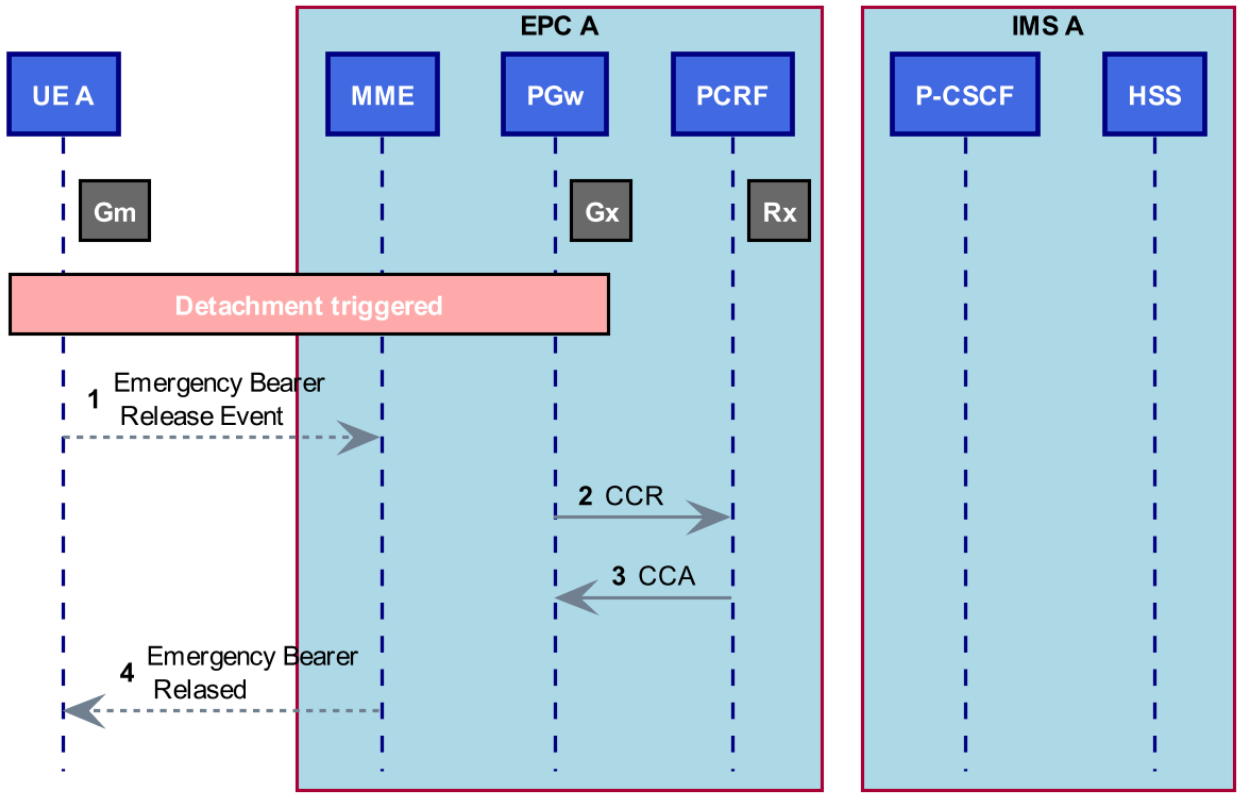


Figure 24: UE Emergency Initiated Network Detachment (with/without Emergency Registration)

1) User initiates emergency detachment on UE-A. The UE-A requests emergency IP-CAN session dis-establishment to the EPC (MME).

2) The PGW sends a CCR message to the PCRF to inform the PCRF that the emergency bearer is being released.

3) The PCRF responds with a CCA.

4) The MME responds to the UE, confirming that the emergency IP-CAN has been successfully released. User is informed that the emergency bearer has been successfully released.

5.5.2 UE Emergency Network Detachment with Previously Established Emergency Registration & Emergency Session

Interoperability Test Description		
Identifier:	TD_VoLTE_ECO_INT_DTC_02	
Objective:	To demonstrate UE initiated emergency network detachment (emergency IP-CAN session termination) for a UE that is emergency registered to IMS and also has active emergency session.	
Summary:	UE terminates emergency session towards IMS. IMS will take action and terminate ongoing emergency SIP session. IMS release the session with PCRF and EPC removes relevant emergency bearer.	
Configuration:	CF_VoLTE_INT_ES (Option 1, Option 2 and Option 3)	
SUT:	IMS A and EPC A	
Interfaces:	Gm, Mw, Rx, Gx, Mm, Mx, Mi	
References:	Gm, Mw	ETSI TS 124 229 [2], clauses 5.1.5 (1st paragraph), 5.1.6.9, 5.2.8.1.2, 5.4.5.2 and 6.2
	Rx	ETSI TS 129 214 [6], clause 4.4.4
	Gx	ETSI TS 129 212 [7], clause 4.5.15.2.4
Pre-test conditions:	• UE A previously emergency attached to EPC with a single attachment. • UE A previously emergency registered to IMS. • UE A previously established emergency SIP session with PSAP.	

Interoperability Test Description		
Test Sequence:	**Step**	
	1	UE A starts emergency detachment and perform release of emergency call first.
	2	Verify that IMS performs P-CSCF-initiated emergency call release on affected emergency SIP sessions.
	3	Verify that EPC aborts affected Rx sessions with IMS.
	4	Verify that IMS does not performs emergency De-registration.
	5	EPC triggers removal of all affected bearers. Verify that media is no longer exchanged after these procedures.
	6	Verify that media between UE and other endpoint can no longer be exchanged and is filtered out by EPC.
Conformance criteria of test sequence step:	2	Gm TP_GM_PCSCF_ECO_BYE_01 (Event 2) Mw TP_MW_PCSCF_ECO_BYE_01 (Event 7) Mm TP_MM_ECSCF_ECO_BYE_01 (Event 8) Mx TP_MX_ECSCF_ECO_BYE_01 (Events 9, 10) Mi TP_MI_ECSCF_ECO_BYE_01 (Event 11, 12) Gm TP_GM_PCSCF_200OK_BYE_01 (Event 19) Mw TP_MW_PCSCF_200OK_BYE_01 (Event 18)
	3	Gx TP_GX_PCRF_RAR_02 (RAR - Event 4) Gx TP_GX_PGW_RAA_03 (RAA - Event 5) Rx TP_RX_PCRF_STA_02 (STR, STA - Events 3, 6)
	5	Gx TP_GX_PCRF_ECO_CCA_02 (CCR, CCA - Events 20, 21)

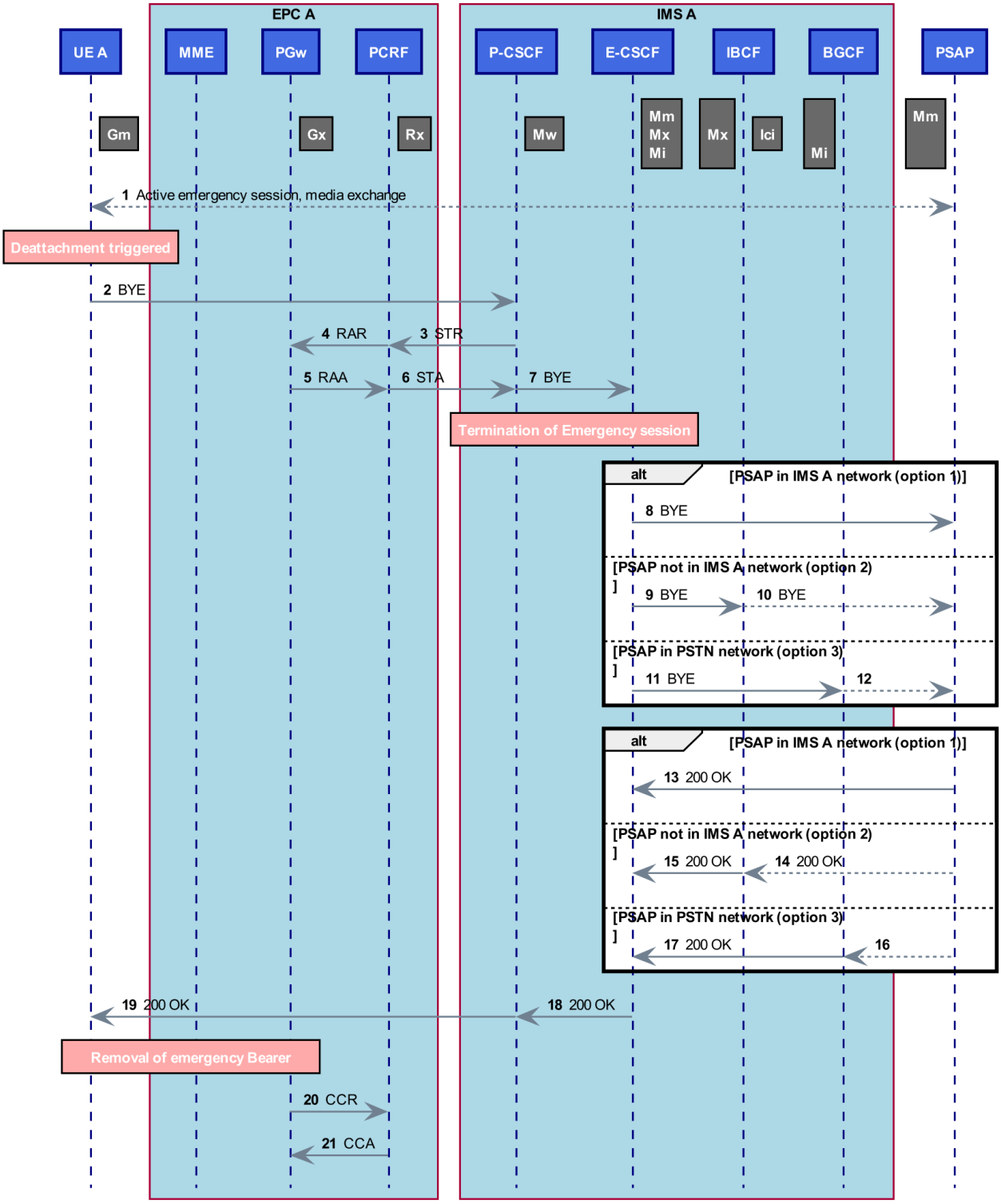


Figure 25: UE Emergency Network Detachment (Emergency Registered & Emergency session)

1) UE-A, PSAP active session, media exchange.

2) User initiates detachment on UE-A. UE-A sends BYE towards P-CSCF.

3) IMS P-CSCF sends STR to abort the Rx session (emergency bearer).

4) The PCRF removes the emergency SIP bearer - RAR.

5) The PGW in the EPC responds with RAA to the PCRF.

6) EPC PCRF responds with STA.

7) P-CSCF forwards the BYE to E-CSCF.

8) Option 1: E-CSCF forwards the BYE to PSAP over Mm interface.

9) Option 2: E-CSCF forwards the BYE to IBCF over Mx interface.

10) Option 2: IBCF forwards the BYE towards PSAP in another network.

11) Option 3: E-CSCF forwards the BYE to BGCF over Mi interface.

12) Option 3: BGCF forwards the request towards PSAP in PSTN network.

13) Option 3: PSAP send an answer towards BGCF.

14) Option 3: BGCF responds with 200 OK (BYE) towards E-CSCF.

15) Option 2: PSAP responds with 200 OK (BYE) towards IBCF.

16) Option 2: IBCF forwards the 200 OK (BYE) towards E-CSCF.

17) Option 1: PSAP responds with 200 OK (BYE) towards E-CSCF.

18) E-CSCF forwards 200 OK (BYE) to P-CSCF.

19) P-CSCF forwards 200 OK (BYE) to UE A.

20) The PGW sends a CCR message to the PCRF to inform the PCRF that the emergency bearer is being released.

21) The PCRF responds with a CCA.

6 Test Descriptions (Roaming)

6.1 Network Attachment

6.1.1 UE Emergency Network Attachment and Establishment of the Emergency Bearer with USIM

Interoperability Test Description		
Identifier:	TD_VoLTE_ECO_RMI_ATT_01	
Objective:	To perform UE emergency attachment to the visited network with USIM and establish an emergency bearer.	
Summary:	On successful emergency attachment, the UE/IVS should discover the P-CSCF IP address. The EPC will create the Emergency Bearers which will allow communication only between the UE and the P-CSCF and allowed forwarding towards E-CSCF.	
Configuration:	CF_VoLTE_RMI_ES	
SUT:	IMS A and EPC A	
Interfaces:	Gx, S6a	
References:		ETSI TS 124 229 [2], clauses 9.2.1 and L.2.2.6
	Gx	ETSI TS 129 212 [7], clauses 4.5.15 and 4a.5.12
	S6a	ETSI TS 129 272 [8], clause 5.2.1.1 (MME shall proceed even if Update Location fails)

Interoperability Test Description		
Pre-test conditions:	• Network emergency attachment credential provisioned in UE B, HSS/SPR and PCRF. • HSS/SPR and UE B provisioned with selectable emergency APN configurations for Ipv4, Ipv6 or Ipv4&Ipv6 PDN types. • P-CSCF address provisioned in the PCRF for the purpose of delivery to UE on emergency attachment. • Emergency Bearer PCRF policies set to allow UE B - P-CSCF communication. • Default EPC Gating Policy set to "Deny". • UE B contains USIM and is not attached to network and EPC.	
Test Sequence:	**Step**	
	1	UE B starts emergency network attachment to visited EPC
	2	Verify that the message sequence is correct
	3	Verify that EPC establishes Emergency Bearer for allowing UE B - P-CSCF communication, by starting at UE B an Emergency registration
	4	Verify that UE B attached successfully and received the following information: • suitable Ipv4 and/or Ipv6 address(es) • DNS configuration information P-CSCF IP address or FQDN
	5	Verify that arbitrary IP packets from UE B to arbitrary node, other than the P-CSCF, are filtered-out by EPC and not visible on PO_Sgi
	6	Verify that arbitrary IP packets from another node (e.g. PSAP sent over PO_Sgi) to UE B, are filtered-out by EPC and not visible on PO_UE B
Conformance criteria of test sequence step:	2	S6a TP_S6A_MME_ULR_01 (ULR - Event 2) S6a TP_S6A_HSS_ECO_ULA_01 (ULA - Event 3) Gx TP_GX_PCRF_ECO_CCA_01 (CCR, CCA - Events 4, 5)

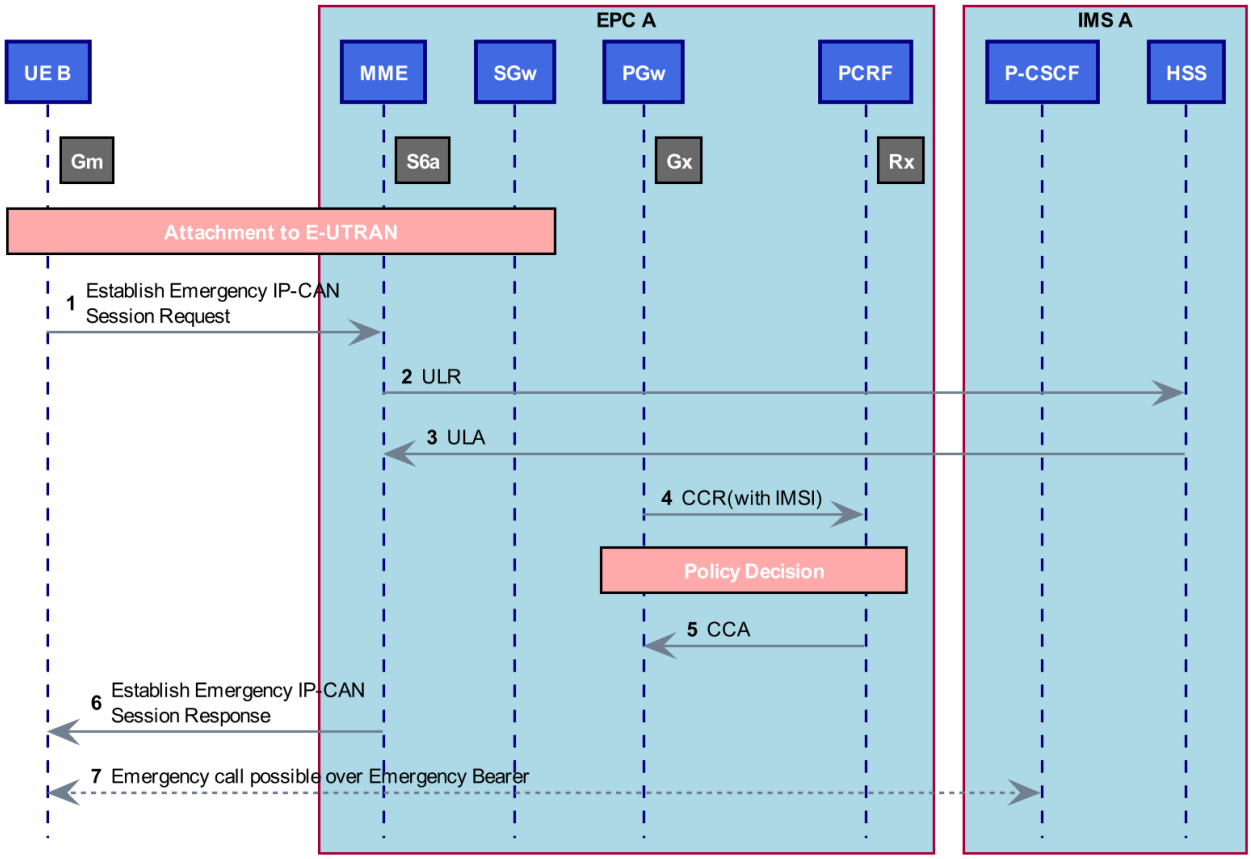


Figure 26: Visited emergency network attachment with USIM

1) The UE-B requests IP-CAN emergency session establishment to the visited EPC (MME).

2) The MME sends a ULR message to the HSS/SPR.

3) The HSS responds with ULA.

4) The PGW sends a CCR message with IMSI to the PCRF to request the emergency bearer.

5) The PCRF responds with a CCA.

6) The MME responds to the UE B, confirming that the emergency IP-CAN has been successfully set up.

7) User is informed that the emergency bearer has been successfully set up.

6.1.2 UE Emergency Network Attachment and Establishment of the Emergency Bearer without USIM

Interoperability Test Description		
Identifier:	TD_VoLTE_EMC_RMI_ATT_02	
Objective:	To perform UE emergency attachment to the visited network without USIM (related only to emergency call) and establish an emergency bearer.	
Summary:	On successful emergency attachment, the UE/IVS should discover the P-CSCF IP address. The EPC will create the Emergency Bearers which will allow communication only between the UE and the P-CSCF and allowed forwarding towards E-CSCF.	
Configuration:	CF_VoLTE_RMI_ES	
SUT:	IMS A and EPC A	
Interfaces:	Gx, S6a	
References:		ETSI TS 124 229 [2], clauses 9.2.1 and L.2.2.6
	Gx	ETSI TS 129 212 [7], clause 4.5.15
	S6a	ETSI TS 129 272 [8], clause 5.2.1.1 (MME shall proceed even if Update Location fails)
Pre-test conditions:	• Network emergency attachment credential provisioned in UE B, HSS/SPR and PCRF. • HSS/SPR and UE B provisioned with selectable emergency APN configurations for Ipv4, Ipv6 or Ipv4&Ipv6 PDN types. • P-CSCF address provisioned in the PCRF for the purpose of delivery to UE on emergency attachment. • Emergency Bearer PCRF policies set to allow UE B - P-CSCF communication. • Default EPC Gating Policy set to "Deny". • UE B does not contain USIM and is not attached to network and EPC.	
Test Sequence:	**Step**	
	1	UE B starts emergency network attachment to EPC
	2	Verify that the message sequence is correct
	3	Verify that EPC establishes Emergency Bearer for allowing UE B - P-CSCF communication, by starting at UE B an Emergency registration
	4	Verify that UE B attached successfully and received the following information: • suitable Ipv4 and/or Ipv6 address(es) • DNS configuration information P-CSCF IP address or FQDN
	5	Verify that arbitrary IP packets from UE B to arbitrary node, other than the P-CSCF, are filtered-out by EPC and not visible on PO_Sgi
	6	Verify that arbitrary IP packets from another node (e.g. PSAP sent over PO_Sgi) to UE B, are filtered-out by EPC and not visible on PO_UE B
Conformance criteria of test sequence step:	2	S6a TP_S6A_MME_ULR_01 (ULR - Event 2) S6a TP_S6A_HSS_ECO_ULA_01 (ULA - Event 3) Gx TP_GX_PCRF_EMC_CCA_01 (CCR, CCA - Events 4, 5)

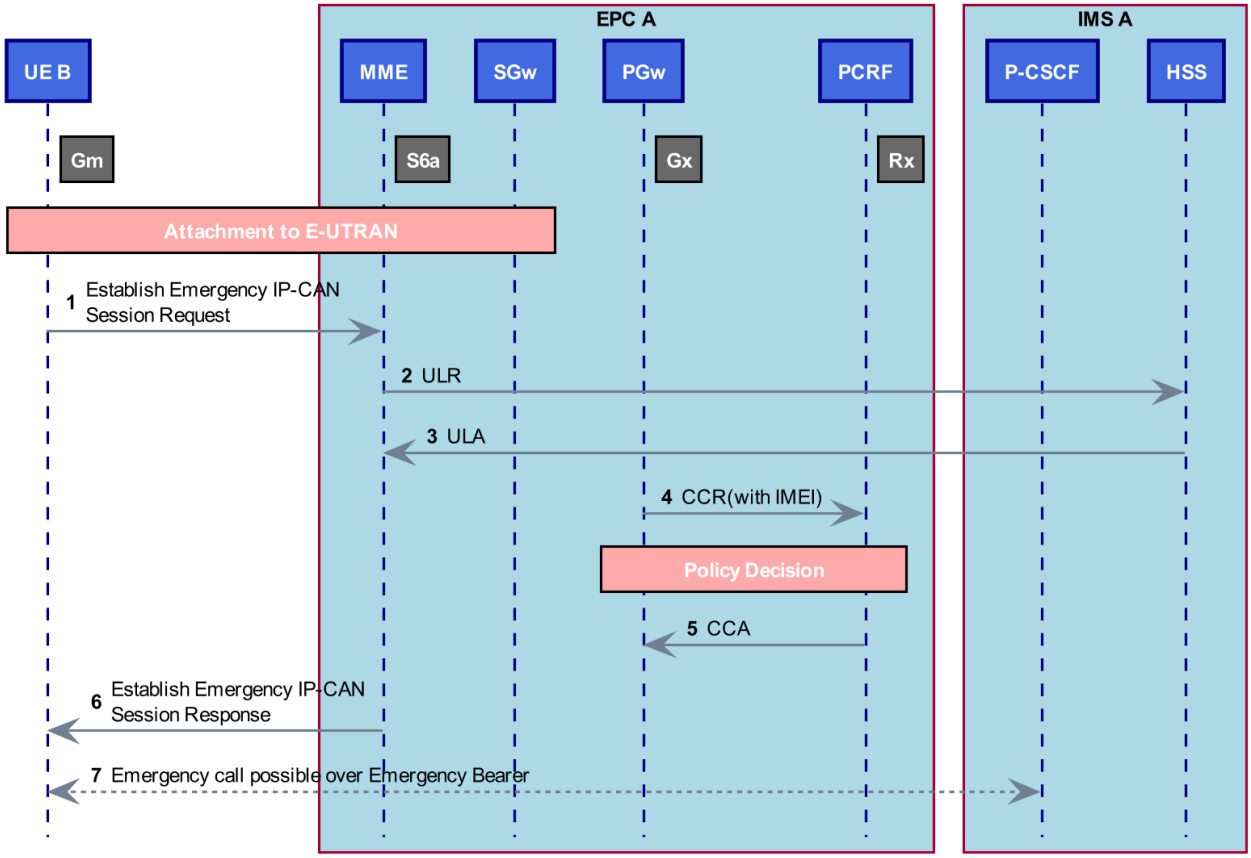


Figure 27: Visited emergency network attachment without USIM

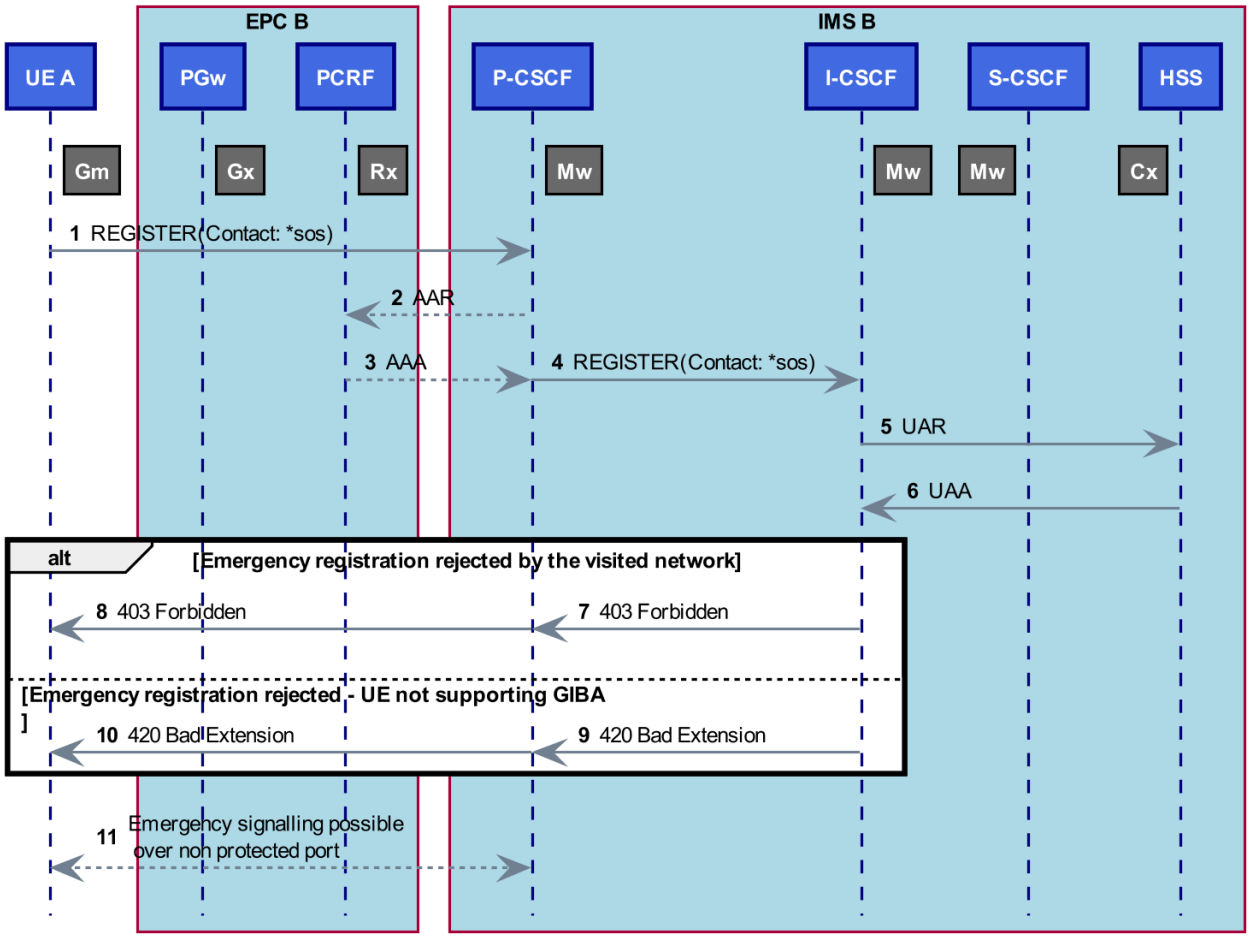
1) The UE B requests IP-CAN emergency session establishment to the visited EPC (MME).
2) The MME sends a ULR message to the HSS/SPR.
3) The HSS responds with ULA.
4) The PGW sends a CCR message with IMEI to the PCRF to request the emergency bearer.
5) The PCRF responds with a CCA.
6) The MME responds to the UE B, confirming that the emergency IP-CAN has been successfully set up.
7) User is informed that the emergency bearer has been successfully set up.

6.2 IMS Emergency Registration in a visited network

6.2.1 IMS Emergency Registration - Rejection

Interoperability Test Description		
Identifier:	TD_VoLTE_ECO_RMI_REG_01	
Objective:	To attempt initial emergency registration via the established emergency bearer for a roaming UE. In this case, the emergency registration is rejected due to visited network or due to not supported GIBA at UE side. Emergency call can be established without emergency registration in visited network(see TD_VoLTE_ECO_RMI_INI_02.	
Summary:	On failed UE emergency Registration to IMS, IMS will be able to transport emergency signalling.	
Configuration:	CF_VoLTE_RMI_ES	
SUT:	IMS B and EPC B	
Interfaces:	Gm, Mw, Cx, Rx	
References:	Gm, Mw	ETSI TS 124 229 [2], clauses 5.1.6.2, 5.2.10.5 ETSI TS 134 229-1 [13], clause 19.4.6 or 19.4.7
	Rx	ETSI TS 129 214 [6], clause A.5

Interoperability Test Description		
	Cx	ETSI TS 129 228 [4], clause 6.1.1.1
Pre-test conditions:	• UE A previously attached to EPC, but not registered to IMS. • EPC established a Default Bearer allowing UE A - P-CSCF IP communication. • HSS of IMS not provisioned with UE A's subscription. • UE A discovered the P-CSCF address.	
Test Sequence:	**Step**	
	1	UE A triggers Emergency registration with not acceptable credentials.
	2	Verify that the Emergency registration has been rejected.
	3	Verify that the PCRF is not invoked.
Conformance criteria of test sequence step:	2	Gm TP_GM_PCSCF_ECO_REGISTER_04 (Events 1, 8) or Gm TP_GM_PCSCF_ECO_REGISTER_05 (Events 1, 10) Mw TP_MW_ICSCF_ECO_REGISTER_04 (Events 4, 7) or Mw TP_MW_ICSCF_ECO_REGISTER_05 (Events 4, 9) Cx TP_CX_HSS_UAA_03 (UAR, UAA - Events 5, 6)
	3	Rx TP_RX_PCSCF_ECO_AAR_01 (AAR - Event 2) Rx TP_RX_PCRF_ECO_AAA_01 (AAA - Event 3)



NOTE: In the above figure, the Gx interaction may take place after completion of the Rx interaction.

Figure 28: IMS Initial Registration - unsuccessful (Roaming)

1) The UE A requests IMS B Registration.

2) P-CSCF optionally sent AAR to PCRF to provide EPC-level identities (MSISDN, IMSI, IMEI).

3) PCRF responds with AAA.

4) P-CSCF forwards the REGISTER to I-CSCF.

5) I-CSCF sends UAR to HSS.

6) HSS responds with UAA - USER_UNKNOWN.

7) Option 1: I-CSCF sends 403 response to P-CSCF due to emergency registration rejected by the visited network.

8) Option 1: P-CSCF forwards 403 response to UE A.

9) Option 2: I-CSCF sends 420 response to P-CSCF due to emergency registration rejected because UE does not support GIBA.

10) Option 2: P-CSCF forwards 420 response to UE A.

11) Emergency signalling possible over non protected port in visited network.

6.3 Emergency Session Establishment (Roaming)

6.3.1 Roaming UE calling PSAP with emergency registration

The emergency session establishment for emergency registered roaming UE to which the exceptions in ETSI TS 124 229 [2], clauses 5.2.10.3 case 1B) a) do not apply is the same as for not roaming UE described in clause 5.3.1.2.

Identifier:	TD_VoLTE_ECO_RMI_INI_01	
Objective:	To demonstrate the establishment of dedicated bearers at the originating EPC due to SIP roaming emergency session establishment with an emergency registration. PSAP is located in the IM CN subsystem of IMS A.	
Summary:	An emergency call is setup between the roaming UE B and the PSAP located in the IM CN subsystem of IMS A. UE-B is attached to EPC A and registered to IMS A, has performed the emergency registration to IMS A, and requests emergency session establishment using an emergency URN. The P-CSCF derives descriptions of the Service Data Flow from the SDP data, requests creation of adequate bearers from PCRF and EPC, and forwards the request to the E-CSCF. The E-CSCF retrieves the PSAP URI from local configuration and forwards the request to this PSAP. Media transport is possible only after the successful establishment of the session. Media negotiation happens during INVITE/200 OK (UE A sends SDP-offer, PSAP responds with SDP-answer).	
Configuration:	CF_VoLTE_RMI_ES option 1	
SUT:	IMS A, EPC A and PSAP	
Interfaces:	Gm, Mw, Rx, Gx, Mm	
References:	Mm	ETSI TS 124 229 [2], clause 5.11.2 ETSI TS 123 167 [14]
	Gm, Mw	ETSI TS 124 229 [2], clauses 5.1.6.8.3, 5.1.6.11, 5.2.6.3.3, 5.2.10.3 case 1B) and 5.11.2
	Rx	ETSI TS 129 214 [6], clauses 4.4.1, A.1, A.2 and annex B
	Gx	ETSI TS 129 212 [7], clause 4.5.2
Pre-test conditions:	• UE B previously attached to EPC A. • UE B previously registered to IMS A. • EPC established an emergency Bearer allowing UE B - P-CSCF IP communication. • EPC established an IMS signalling bearer. • PSAP is registered or connected to the IMS A and ready to accept the session establishment. • UE B previously performed emergency registration.	

Test Sequence:	**Step**	
	1	Verify that media between UE B and PSAP is not delivered in any direction before call establishment.
	2	UE B initiates an emergency call to establish a communication session using an emergency service URN.
	3	Verify that the UE B inserts in the INVITE request, a From header field that includes the public user identity registered via emergency registration or the tel URI associated with the public user identity registered via emergency registration and a To header indicating one of the emergency URNs defined in Table 1.
	4	Verify that IMS A (P-CSCF, E-CSCF) routes the emergency call to the PSAP in the same IM CN subsystem of the own network.
	5	Verify that the IMS produced a Media Description for the session according to SDP-offer in SIP INVITE Request and SDP-answer in SIP 183 to the PCRF.
	6	Verify that the PCRF invokes the EPC PGW with a RA-Request to create a new bearer for the requested media.
	7	Verify that PCRF requested media description was found acceptable by EPC and dedicated bearers are established and that a RA-Answer is sent to the PCRF.
	8	Verify that media between UE B and PSAP is successfully routed over the dedicated bearer.
	9	Verify that media between UE B and PSAP is transported with appropriate PCC characteristics.
Conformance criteria of test sequence step:	2	Gm TP_GM_PCSCF_ECO_INVITE_02 (Event1) Gm TP_GM_PCSCF_ECO_INVITE_04 for eCall (Event 1)
	3	Gm TP_GM_PCSCF_ECO_REGISTER_02 (Pre-test)
	4	Mw TP_MW_PCSCF_ECO_INVITE_02 (Event 10) Mm TP_MM_ECSCF_ECO_INVITE_01 (Event 11)
	6/7	Rx TP_RX_PCSCF_AAR_03 (AAR - Event 2) Rx TP_RX_PCSCF_AAR_04 (AAR - Event 14) Rx TP_RX_PCRF_AAA_02 (AAA - Events 5, 17) Gx TP_GX_PCRF_RAR_01 (RAR - Events 3, 15) Rx TP_RX_PCSCF_RAA_01 (RAR, RAA - Events 7, 8) Gx TP_GX_PGW_RAA_02 (RAA - Events 4, 16) Gx TP_GX_PCRF_CCA_06 (CCR, CCA - Events 6, 9)
	8	Rtp TP_RTP_ECO_03 (Event 29)

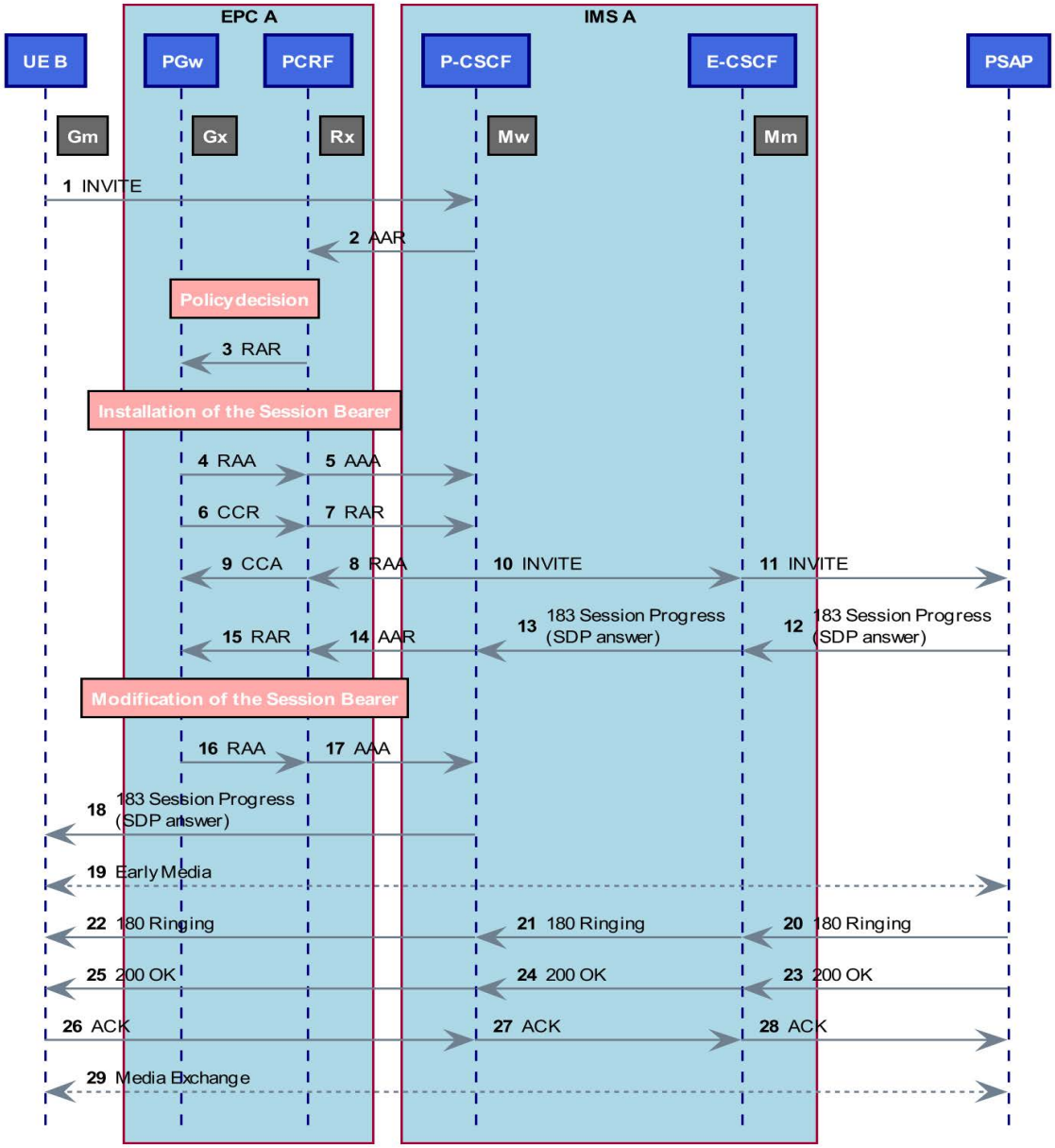


Figure 29: Emergency Session Establishment with emergency registration, PSAP in same IM CN subsystem, UE in another subsystem

1) UE B initiates the emergency session with an INVITE request. The From header field includes the public user identity (registered via emergency registration) or the tel URI associated with the public user identity (registered via emergency registration).

2) The IMS A P-CSCF invokes the PCRF.

3) PCRF sends RAR to EPC A PGW.

4) EPC A PGW responds with RAA.

5) PCRF responds to IMS A P-CSCF with AAA.

6) EPC A P- GW sends CCR.

7) PCRF sends RAR to P-CSCF.

8) P-CSCF responds with RAA.

9) PCRF responds with CCA to PGW.

10) P-CSCF sends the INVITE to E-CSCF.

11) E-CSCF sends the INVITE to PSAP.

12) PSAP responds with the 183 response with SDP answer to E-CSCF.

13) E-CSCF sends the 183 response to P-CSCF.

14) The IMS A P-CSCF invokes the PCRF to modify the bearer with AAR.

15) PCRF sends RAR to EPC A PGW.

16) EPC A PGW responds with RAA.

17) PCRF responds to IMS A P-CSCF with AAA.

18) P-CSCF forwards the SIP 183 (SDP) to UE A.

19) Early media may flow between the UE B and PSAP.

20) The PSAP responds with the 180 Ringing to E-CSCF.

21) E-CSCF forwards the 180 to P-CSCF.

22) P-CSCF forwards the SIP 180 to UE A.

23) PSAP sends 200 OK to E-CSCF.

24) E-CSCF forwards the 200 OK to P-CSCF.

25) P-CSCF forwards the 200 OK towards UE A.

26) UE B sends ACK to P-CSCF.

27) P-CSCF sends ACK to E-CSCF.

28) E-CSCF sends ACK to PSAP.

29) Media Exchange.

6.3.2 Roaming UE calling PSAP with non-emergency registration

6.3.2.1 Roaming UE calling PSAP in same network

If the UE is roaming and the P-CSCF is in the same network as the UE is roaming, the emergency session establishment is treated as if the UE is not roaming. ETSI TS 124 229 [2], clauses 5.2.10.4, case 0A) b).

Interoperability Test Description	
Identifier:	TD_VoLTE_ECO_RMI_INI_02
Objective:	To demonstrate the establishment of dedicated bearers at the originating EPC due to roaming SIP emergency session establishment within non-emergency registration. PSAP is located in the IM CN subsystem of IMS A.
Summary:	An emergency call is setup between UE B and the PSAP located in the IM CN subsystem of IMS A. UE-A is attached to EPC A and registered to IMS A, has **NOT** performed the emergency registration to IMS A, and requests emergency session establishment using an emergency URN. The P-CSCF derives descriptions of the Service Data Flow from the SDP data, requests creation of adequate bearers from PCRF and EPC, and forwards the request to the E-CSCF. The E-CSCF retrieves the PSAP URI from local configuration and forwards the request to this PSAP. Media transport is possible only after the successful establishment of the session. Media negotiation happens during INVITE/200 OK (UE B sends SDP-offer, PSAP responds with SDP-answer).
Configuration:	CF_VoLTE_RMI_ES option 1
SUT:	IMS A and EPC A

Interfaces:	Gm, Mw, Rx, Gx, Mm	
References:	Mm	ETSI TS 124 229 [2], clause 5.11.2 ETSI TS 123 167 [14]
	Gm, Mw	ETSI TS 124 229 [2], clauses 5.1.6.8.4, 5.2.6.3.3, 5.2.10.4 case 0A) and 5.11.2
	Rx	ETSI TS 129 214 [6], clauses 4.4.1, A.1, A.2 and annex B
	Gx	ETSI TS 129 212 [7], clause 4.5.2
Pre-test conditions:	UE B previously attached to EPC A. UE B previously registered to IMS A. UE B has not performed emergency registration. EPC established a non-emergency Bearer allowing UE B - P-CSCF IP communication. EPC established an IMS signalling bearer. PSAP is registered or connected to the IMS A and ready to accept the session establishment.	
Test Sequence:	**Step**	
	1	Verify that media between UE B and PSAP is not delivered in any direction before call establishment.
	2	UE B initiates an emergency call to establish a communication session using an emergency service URN (To header indicating one of the emergency URNs defined in Table 1).
	3	Verify that IMS A (P-CSCF, E-CSCF) routes the emergency call to the PSAP in the same IM CN subsystem of the own network.
	4	Verify that the IMS produced a Media Description for the session according to SDP-offer in SIP INVITE Request and SDP-answer in SIP 183 to the PCRF.
	5	Verify that the PCRF invokes the EPC PGW with RA-Request to create a new bearer for the requested media.
	6	Verify that PCRF requested media description was found acceptable by EPC and emergency bearers are established and that a RA-Answer is sent to the PCRF.
	7	Verify that media between UE B and PSAP is successfully routed over the dedicated bearer.
	8	Verify that media between UE B and PSAP is transported with appropriate PCC characteristics.
Conformance criteria of test sequence step:	2	Gm TP_GM_PCSCF_ECO_INVITE_03 (Event1)
	4	Mw TP_MW_PCSCF_ECO_INVITE_03 (Event 10) Mm TP_MM_ECSCF_ECO_INVITE_01 (Event 11)
	5/6	Rx TP_RX_PCSCF_AAR_03 (AAR - Event 2) Rx TP_RX_PCSCF_AAR_04 (AAR - Event 14) Rx TP_RX_PCRF_AAA_02 (AAA - Events 5, 17) Gx TP_GX_PCRF_RAR_01 (RAR - Events 3, 15) Rx TP_RX_PCSCF_RAA_01 (RAR, RAA - Events 7, 8) Gx TP_GX_PGW_RAA_02 (RAA - Events 4, 18) Gx TP_GX_PCRF_CCA_06 (CCR, CCA - Events 6, 9)
	8	Rtp TP_RTP_ECO_03 (Event 29)

The message sequence as depicted in Figure 29 applies.

6.3.2.2 Roaming UE calling PSAP in home operator's network

Interoperability Test Description	
Identifier:	TD_VoLTE_ECO_RMI_INI_03
Objective:	To demonstrate the rejection of roaming UE emergency session establishment when the P-CSCF is in home operator's network within non-emergency registration. P-CSCF is located in the IM CN subsystem of IMS A.
Summary:	An emergency call is setup between roaming UE A and the P-CSCF located in the IM CN subsystem of IMS A. UE-A is attached to EPC B and registered to IMS A, has **NOT** performed the emergency registration to IMS A, and requests emergency session establishment using an emergency URN. The P-CSCF is in the home operator's network and shall reject the request as specified in ETSI TS 124 229 [2], clause 5.2.10.5.
Configuration:	CF_VoLTE_RMI_S8HR

Interoperability Test Description		
SUT:	IMS A and EPC A	
Interfaces:	Gm, Rx, Gx, S8	
	Gm, Mw	ETSI TS 124 229 [2], clauses 5.1.6.8.4, 5.2.6.3.3, 5.2.10.4, 5.2.10.5 and 5.11.2 ETSI TS 123 167 [14], clause 7.1.2
	Rx	ETSI TS 129 214 [6], clauses 4.4.1, A.1, A.2 and annex B
Pre-test conditions:	• Roaming UE A previously attached to EPC B. • UE A has not performed emergency registration. • EPC B established a Default Bearer allowing UE A - P-CSCF IP communication. • UE A previously registered to IMS A. • EPC B established an IMS A signalling bearer.	
Test Sequence:	**Step**	
	1	UE A initiates an emergency call to establish a communication session using an emergency service URN (To header indicating one of the emergency URNs defined in Table 1).
	2	Verify that IMS A (P-CSCF, E-CSCF) receives the emergency call of the roaming UE A.
	3	Verify that P-CSCF reject the request by returning a 380 (Alternative Service) response
Conformance criteria of test sequence step:	1	Gm TP_GM_PCSCF_ECO_INVITE_03 (Event1)

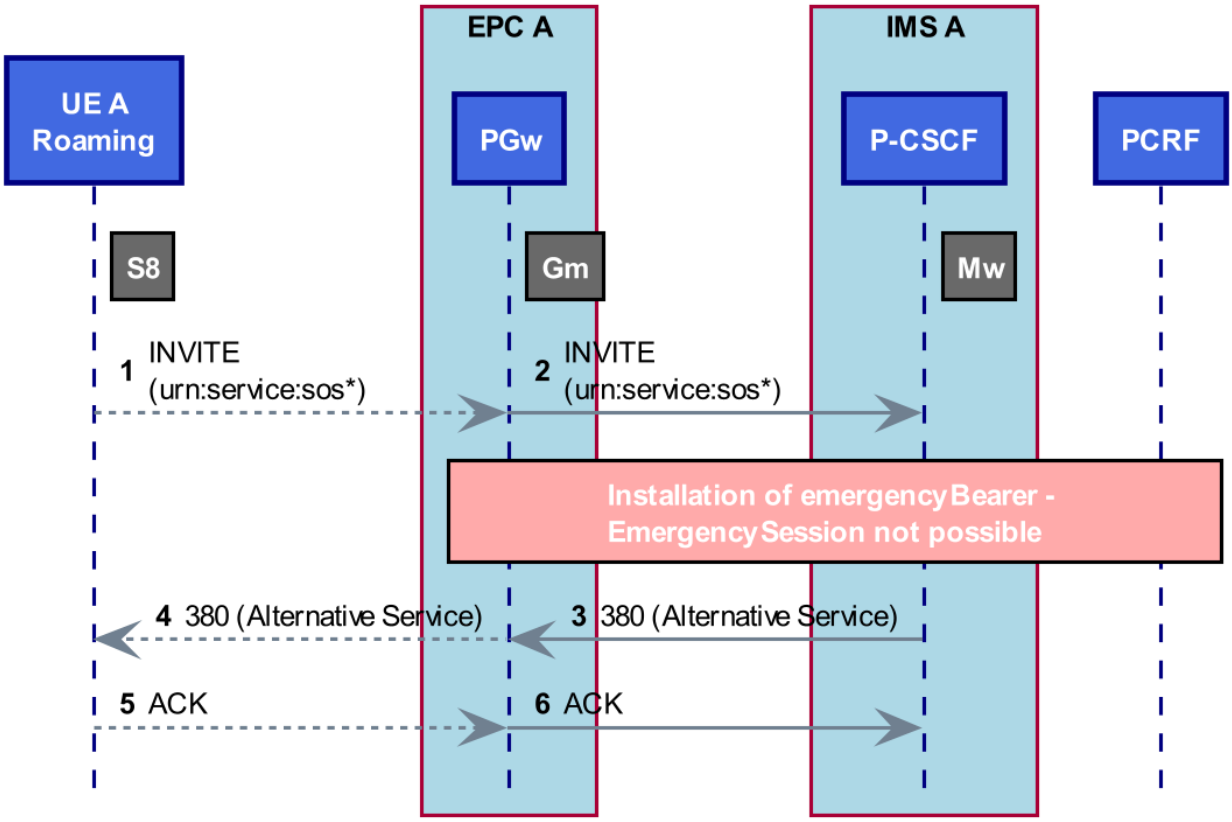


Figure 30: Roaming UE calling home operator

1) Roaming UE A initiates the emergency session with an INVITE containing the service URN "sos".

2) PGw forwards INVITE message to P-CSCF.

3) P-CSCF in IMS A sends 380 (Alternative Service) to PGw.

4) PGw forwards 380 (Alternative Service) to roaming UE A.

5) UE A sends ACK to PGw.

6) PGw forwards ACK to P-CSCF.

6.3.2.3 Roaming UE calling PSAP with non-registration

Interoperability Test Description		
Identifier:	TD_VoLTE_ECO_ RMI_INI_04	
Objective:	To demonstrate the establishment of emergency bearers for a roaming UE without any registration. PSAP is located in the IM CN subsystem of IMS A.	
Summary:	An emergency call is setup between UE B and the PSAP located in the IM CN subsystem of IMS A. UE-B connects to the visited network A attached to the EPC A but NOT registered to IMS A, has NOT performed the emergency registration to IMS A, and requests emergency session establishment using an emergency URN. The P-CSCF derives descriptions of the Service Data Flow from the SDP data, requests creation of adequate bearers from PCRF and EPC, and forwards the request to the E-CSCF. The E-CSCF retrieves the PSAP URI from local configuration and forwards the request to this PSAP. Media transport is possible only after the successful establishment of the session. Media negotiation happens during INVITE/200 OK (UE B sends SDP-offer, PSAP responds with SDP-answer).	
Configuration:	CF_VoLTE_RMI_ES option 1	
SUT:	IMS A and EPC A	
Interfaces:	Gm, Mw, Rx, Gx, Mm	
References:	Mm	ETSI TS 124 229 [2], clause 5.11.2 ETSI TS 123 167 [14]
	Gm, Mw	ETSI TS 124 229 [2], clauses 5.1.6.8.2, 5.2.6.3.3, 5.2.10.2 and 5.11.2
	Rx	ETSI TS 129 214 [6], clauses 4.4.1, A.1, A.2 and annex B
	Gx	ETSI TS 129 212 [7], clause 4.5.2
Pre-test conditions:	• UE B connects to the visited network A attached to the EPC A. • EPC established a default bearer allowing UE A - P-CSCF IP communication. • PSAP is registered or connected to the IMS A and ready to accept the session establishment. • UE B previously not registered to IMS A. • UE B has not performed emergency registration. • UE B discovered the P-CSCF address.	
Test Sequence:	**Step**	
	1	Verify that media between UE B and PSAP is not delivered in any direction before call establishment.
	2	UE B initiates an emergency call to establish a communication session using an emergency service URN.
	3	Verify that the UE B sets the From header field of the INVITE request to "Anonymous" as specified in IETF RFC 3261 [12] and a To header indicating one of the emergency URNs defined in Table 1.
	4	Verify that IMS A (P-CSCF, E-CSCF) routes the emergency call to the PSAP in the same IM CN subsystem of the own network.
	5	Verify that the IMS produced a Media Description for the session according to SDP-offer in SIP INVITE Request and SDP-answer in SIP 183 to the PCRF.
	6	Verify that the PCRF invokes the EPC PGW with RA-Request to create a new bearer for the requested media.
	7	Verify that PCRF requested media description was found acceptable by EPC and emergency bearers are established and that a RA-Answer is sent to the PCRF.
	8	Verify that media between UE B and PSAP is successfully routed over the dedicated bearer.

Interoperability Test Description			
	9	Verify that media between UE B and PSAP is transported with appropriate PCC characteristics.	
Conformance criteria of test sequence step:	2/3	Gm	TP_GM_PCSCF_ECO_INVITE_01 (Event 1)
	4	Mw	TP_MW_PCSCF_ECO_INVITE_01 (Event 10)
		Mm	TP_MM_ECSCF_ECO_INVITE_01 (Event 11)
	6/7	Rx	TP_RX_PCSCF_AAR_03 (AAR - Event 2)
		Rx	TP_RX_PCSCF_AAR_04 (AAR - Event 14)
		Rx	TP_RX_PCRF_AAA_02 (AAA - Events 5, 17)
		Gx	TP_GX_PCRF_RAR_01 (RAR - Events 3, 15)
		Rx	TP_RX_PCSCF_RAA_01 (RAR, RAA - Events 7, 8)
		Gx	TP_GX_PGW_RAA_02 (RAA - Events 4, 18)
		Gx	TP_GX_PCRF_CCA_06 (CCR, CCA - Events 6, 9)
	8	Rtp	TP_RTP_ECO_03 (Event 29)

The message sequence as depicted in Figure 29 applies.

Annex A (informative): Message Sequence Charts (MSCs)

A.1 The MSC files

The MSCs have been produced using the PlantUML tool with recommended ETSI styles.

The PlantUML text files and the derived Portable Network Graphics files (.png) of the MSCs related to the test descriptions are released in the ETSI forge repository:

- https://forge.etsi.org/rep/int/vxlte/emergency-iop/-/tree/main/msc_scripts.

History

Document history		
V1.1.1	March 2024	Publication