ETSI TS 103 029 V3.1.1 (2011-11)

IMS Network Testing (INT);
IMS & EPC Interoperability test descriptions

Reference
DTS/INT-00050

Keywords
EPC, IMS, interworking, testing

ETSI

650 Route des Lucioles
F-06921 Sophia Antipolis Cedex - FRANCE

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

Siret N° 348 623 562 00017 - NAF 742 C
Association à but non lucratif enregistrée à la
Sous-Préfecture de Grasse (06) N° 7803/88

Contents

Intellectual Property Rights

IPRs essential or potentially essential to the present document may have been declared to ETSI. The information pertaining to these essential IPRs, if any, is publicly available for **ETSI members and non-members**, and can be found in ETSI SR 000 314: *"Intellectual Property Rights (IPRs); Essential, or potentially Essential, IPRs notified to ETSI in respect of ETSI standards"*, which is available from the ETSI Secretariat. Latest updates are available on the ETSI Web server (http://ipr.etsi.org).

Pursuant to the ETSI IPR Policy, no investigation, including IPR searches, has been carried out by ETSI. No guarantee can be given as to the existence of other IPRs not referenced in ETSI SR 000 314 (or the updates on the ETSI Web server) which are, or may be, or may become, essential to the present document.

Foreword

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

Introduction

The IP Multimedia core network Subsystem (IMS) is a key component in the ETSI NGN architecture. Each IMS consists of multiple functional entities and interfaces. *The Evolved Packet Core (EPC) is a key liant architecture between the UTRAN/E-UTRAN systems and an IP Application Function like IMS.*

The present document defines the inter-system interoperability test descriptions for standardized IMS - EPC interfacing.

Test Purposes (TP) defined in the present document have been developed based on the requirements stated in the 3GPP IMS and EPC Release 10 specification and uses as main signalling protocol Diameter version 1 [i.1].

1 Scope

The present document provides a set of interoperability use cases to be tested in order to validate an interconnection between IMS and EPC subsystems. For each use case there are conformance criteria and Test Descriptions (TD) detailed.

The target of the present document is to provide the boiler-plate for verifing interoperability between the IMS and EPC subsystems based on the exemplary scenarios network attachment, IMS registration and IMS session management. Verifying basic protocol interoperability or NNI interoperability between two peer EPC systems is out of scope of the present document.

2 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 http://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.

2.1 Normative references

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

[1] ETSI TS 123 228: "Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); LTE; IP Multimedia Subsystem (IMS); Stage 2 (3GPP TS 23.228 Release 10)".

[2] ETSI TS 124 229: "Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); LTE; IP multimedia call control protocol based on Session Initiation Protocol (SIP) and Session Description Protocol (SDP); Stage 3 (3GPP TS 24.229 Release 10)".

[3] ETSI TS 123 401: "LTE; General Packet Radio Service (GPRS) enhancements for Evolved Universal Terrestrial Radio Access Network (E-UTRAN) access (3GPP TS 23.401 Release 10)".

[4] ETSI TS 123 402: "Universal Mobile Telecommunications System (UMTS); LTE; Architecture enhancements for non-3GPP accesses (3GPP TS 23.402 Release 10)".

[5] ETSI TS 129 214: "Universal Mobile Telecommunications System (UMTS); LTE; Policy and charging control over Rx reference point (3GPP TS 29.214 Release 10)".

[6] ETSI TS 129 212: "Universal Mobile Telecommunications System (UMTS); LTE; Policy and charging control over Gx reference point (3GPP TS 29.212 Release 10)".

[7] ETSI TR 121 905: "Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); LTE; Vocabulary for 3GPP Specifications (3GPP TR 21.905)".

2.2 Informative references

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] IETF RFC 3588: "Diameter Base Protocol"; P. Calhoun et all, September 2003.

[i.2] ETSI TS 186 011-1 (V4.1.1): "IMS Network Testing (INT); IMS NNI Interoperability Test Specifications; Part 1: Test Purposes for IMS NNI Interoperability".

[i.3] ETSI TS 186 011-2 (V4.1.1): "IMS Network Testing (INT); IMS NNI Interoperability Test Specifications; Part 2: Test Descriptions for IMS NNI Interoperability".

[i.4] ETSI TS 123 008: "Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); LTE; Organization of subscriber data (3GPP TS 23.008 Release 10)".

[i.5] ETSI TS 123 203: "Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); LTE; Policy and charging control architecture (3GPP TS 23.203 Release 10)".

[i.1] 3GPP TS 23.203: "3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; Policy and charging control architecture (Release 11)".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in TS 123 203 [i.5], TS 124 229 [2], TS 123 401 [3], TS 123 402 [4], TS 129 214 [5] and the following apply:

authorised QoS: the maximum QoS that is authorised for a service data flow.

NOTE: In case of an aggregation of multiple service data flows within one IP-CAN bearer (e.g. for GPRS a PDP context), the combination of the "Authorised QoS" information of the individual service data flows is the "Authorised QoS" for the IP-CAN bearer. It contains the QoS class identifier and the data rate

binding: the association between a service data flow and the IP-CAN bearer (for GPRS the PDP context) transporting that service data flow

binding mechanism: the method for creating, modifying and deleting bindings

default bearer: the EPS bearer which is first established for a new PDN connection and remains established throughout the lifetime of the PDN connection

dynamic PCC Rule: PCC rule for which the definition is provided into the PCEF via the Gx reference point

event report: notification, possibly containing additional information, of an event which occurs that corresponds with an event trigger.

NOTE: Also, an event report is a report from the PCRF to the AF concerning transmission resources or requesting additional information

event trigger: rule specifying the event reporting behaviour of a PCEF or BBERF. Also, a trigger for credit management events

gating control: the process of blocking or allowing packets, belonging to a service data flow, to pass through to the desired endpoint

initial registration: the registration procedure for a public user identity initiated by the UE in the absence of any valid registration

IP-CAN bearer: IP transmission path of defined capacity, delay and bit error rate, etc. See TR 121 905 [7] for the definition of bearer

IP-CAN session: the association between a UE and an IP network.

NOTE: The association is identified by one IPv4 and/or an IPv6 prefix together with UE identity information, if available, and a PDN represented by a PDN ID (e.g. an APN). An IP-CAN session incorporates one or more IP-CAN bearers. Support for multiple IP-CAN bearers per IP-CAN session is IP-CAN specific. An IP-CAN session exists as long as UE IP addresses/prefix are established and announced to the IP network

PDN connection: the association between a UE represented by one IPv4 address and/or one IPv6 prefix and a PDN represented by an APN

policy control: the process whereby the PCRF indicates to the PCEF how to control the IP-CAN bearer. Policy control includes QoS control and/or gating control

QoS class identifier (QCI): scalar that is used as a reference to a specific packet forwarding behaviour (e.g. packet loss rate, packet delay budget) to be provided to a SDF.

NOTE: This may be implemented in the access network by the QCI referencing node specific parameters that control packet forwarding treatment (e.g. scheduling weights, admission thresholds, queue management thresholds, link layer protocol configuration, etc.), that have been pre-configured by the operator at a specific node(s) (e.g. eNodeB)

QoS rule: set of information enabling the detection of a service data flow and defining its associated QoS parameters

resource reservation: mechanism for reserving bearer resources that is required for certain access technologies

service information: set of information conveyed from the AF to the PCRF over the Rx interface to be used as a basis for PCC decisions at the PCRF, including information about the AF session (e.g. application identifier, type of media, bandwidth, IP address and port number)

3.2 Abbreviations

For the purposes of the present document, the abbreviations given in TS 124 229 [2], TS 123 401 [3], TS 123 402 [4], TS 123 203 [i.5] and the following apply:

ACK	Session Acknowledge Message Type
AF	Application Function
ANDSF	Access Network Discovery and Selection Function
AN-GW	Access Network Gateway
APN	Access Point Name
AVP	Attribute-Value Pair
BBERF	Bearer Binding and Event Reporting Function
CS	Circuit Switch
CSCF	Call Session Control Function
DHCP	Dynamic Host Configuration Protocol
DNS	Domain Name System
DV	Dragos Vingarzan
EPC	Evolved Packet Core
ePDG	Evolved Packet Data Gateway
EPS	Evolved Packet System
FQDN	Fully Qualified Domain Name
GBR	Guaranteed Bitrate
GPRS	General Packet Radio Service
GTP	GPRS Tunneling Protocol
GW	Gateway
HSS	Home Subscriber Server
IMPI	IP Multimedia Private Identity
IMPU	IP Multimedia Public Identity
IMS	IP Multimedia core network Subsystem
IOP	Interoperability
IP	Internet Protocol
IP-CAN	IP-Connectivity Access Network
IPv4	Internet Protocol version 4
IPv6	Internet Protocol version 6

ISIM	IM Subscriber Identity Module
IUT	Interface Under Test
MGW	Media Gateway
NGN	Next Generation Network
NNI	Network to Network Interface
OK/ACK	Session Acknowledge Message Type
PCC	Policy and Charging Control
PCEF	Policy and Charging Enforcement Function
PCRF	Policy and Charging Rules Function
P-CSCF	Proxy CSCF
PDN	Packet Data Network
PDP	Packet Data Protocol
P-GW	PDN Gateway
PMIP	Proxy Mobile IP
PO	Point of Observation
PO_UE	Point of Observation on UE
PSTN	Pbulica Switch Telephone Network
QCI	QoS Class Identifier
QoS	Quality of Service
RAN	Radio Access Network
RAT	Radio Access Technology
RTP	Real Time Protocol
S-CSCF	Serving CSCF
SDF	Service Data Flow
SDP	Session Description Protocol
SIP	Session Initiation Protocol
SPR	Subscription Profile Repository
SUT	System - Under Test
TD	Test Description
TLS	Transport Layer Security
TP	Test Purpose
UA	User Agent
UDR	User Data Request
UE	User Equipment
UE_A	User Equipemnt A
UE_B	User Equipment B
UNI	User-Network Interface
URI	Uniform Resource Identifier
USIM	Universal Subscriber Identity
UTRAN	UMTS Terrestrial Radio Access Network

4 Overview of the EPC and IMS Architecture, in the scope of LTE/SAE

The IP Multimedia Subsystem defined in TS 123 228 [1] and TS 124 229 [2] describes the control and service delivery architecture standardized by 3GPP. It was initially started in 3GPP Release 5 as an all-IP core network for providing IP services in the context of the mobile domain evolution. Over the subsequent releases, various other standardization bodies have adopted the same principles and core network architecture for providing IP services, each complementing with requirements and specifics for their respective access network type of interest. Starting with 3GPP Release 8 onwards, the efforts converged into the Common-IMS specifications.

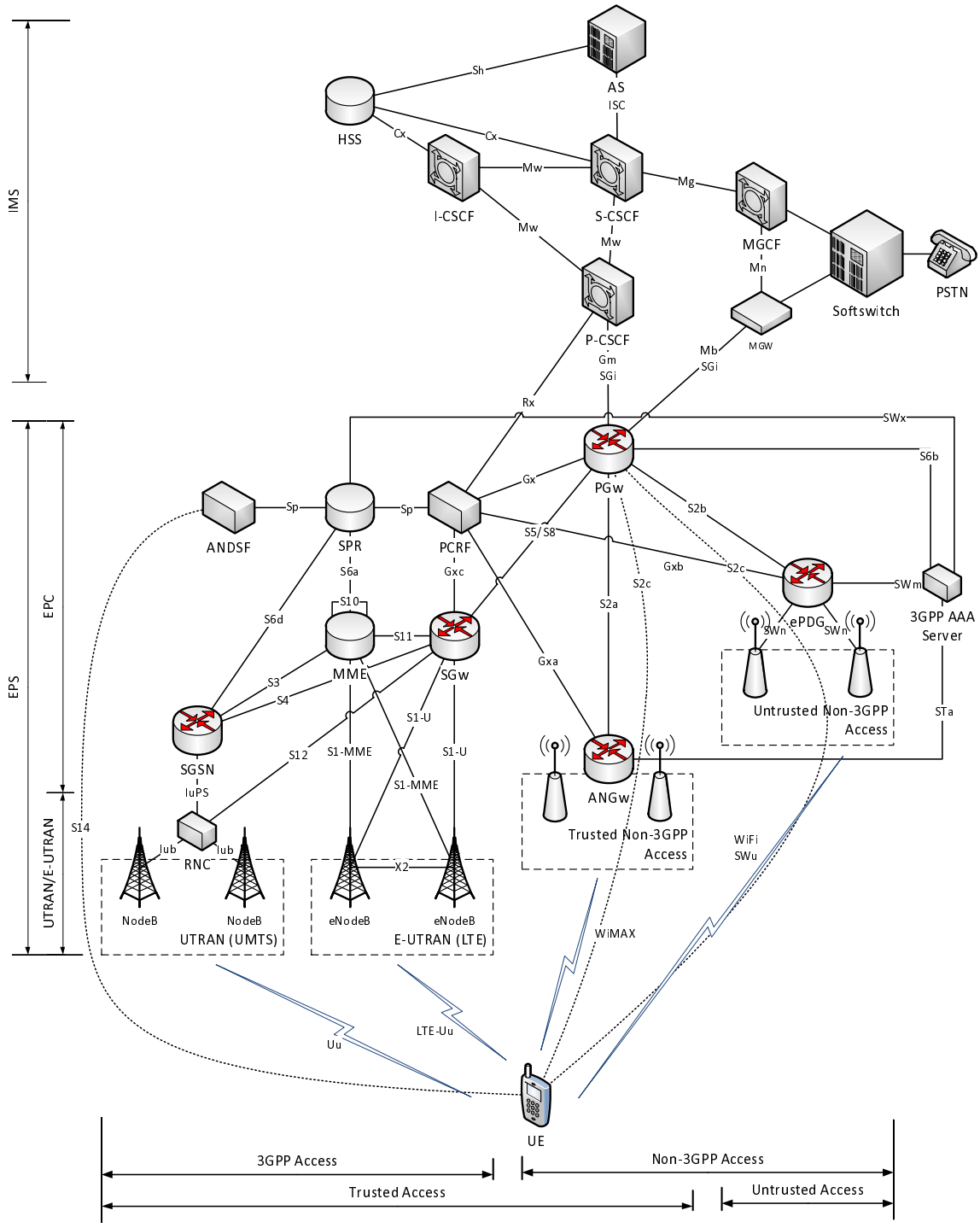

Figure 1: The EPC and IMS Core Network Architectures

At its core, IMS comprises of a set of specialized Call Session Control Functions (CSCF), which route and process SIP signalling between the IMS User Endpoints (UE), the IMS Application Servers (AS) and a set of Media Gateways (MGW) interfacing with the Public Switched Telephony Network (PSTN). The subscriber data is stored in a central database, the Home Subscriber Server (HSS). The HSS as well as the additional Authentication, Authorization and Accounting services use for signalling the Diameter protocol.

The main target of the IMS architecture is to provide service control for an extensible set of applications. It features an open-ended model, where a set of operations are defined as basic building blocks (e.g. authentication and registration, session set-up/tear-down, messaging, etc). These building blocks can later be re-used and re-combined by ASs in order to realize a future-proof Service Delivery Platform. This model is set to replace the currently obsolete silo-model approach for services of the legacy systems.

As IMS was adopted for the non-mobile access, the underlying network and attachment architectures and procedures started to diverge such that various types of fixed network could be supported. This prompted a split between the strict IMS standardization and that of the underlying Access Network.

The LTE path started an evolution of both the Radio Access Network (E-UTRAN) and its supporting GPRS Core Network architecture (Evolved Packet Core TS 123 401 [3], into a consolidated Evolved Packet System, as part of the System Architecture Evolution. Additionally to the 3GPP RAN, comes the All-IP Network as well as integration with less reliable yet more cost efficient Access Network solutions (non-3GPP Access TS 123 402 [4]).

The main targets of the EPC architecture are to provide a flexible and efficient IP-connectivity layer, capable of handling Inter-System Handovers, Policy and Charging Control as well as security for transparent IP services. The approach is more generalized than with IMS which requires SIP signalling for services. EPC is capable of supporting not only an IMS architecture on top, but also has a potential for generic Over-The-Top services.

The EPC and IMS architectures are not meant to compete or replace each-other. They are built as to complement each-other in an efficient manner, which abstracts services in the EPC as IP data flows, while providing transparent handling of both horizontal and vertical hand-over's without complex IMS signalling.

The EPC architectural nodes can be grouped, based on functionality, as following:

- Core Network Mobility - a 2-layer gateway model allowing vertical hand-over's; uses GTP for legacy and PMIP for non-3GPP access.
- Policy and Charging Control - split into Policy and Charging rules functions (PCRF), enforcement functions (PCEF, part of the P-GW) and access network specific functions (BBERF).
- Access Network Discovery and Selection Function - provides AN discovery and Inter-System Mobility policies directly to the mobile devices, helping in establishing the operator policies for AN selection and use.
- Subscription Profiles Repository - accessible from the (E-)UTRAN, PCC and ANDSF components, such that network attachments are secured with authentication and authorization procedures, while also providing per-subscriber customized service levels.

For EPC to support the IMS services requirements and for IMS to fully take advantage of the EPC provides IP connectivity, the inter-architecture interfacing is of critical importance. Unlike in the individual IMS or EPC cases, it is foreseen that in real life deployments the multi-vendor setups from different IMS and EPC providers will be much more common. The present standard aims at providing a set of test purposes and descriptions for testing the base inter-operability between the IMS and EPC systems, on the most common scenarios.

4.1 Scope of the IMS-EPC Interoperability

The interoperability in scope for testing here covers all the interactions on the border interfaces between the IMS and the EPC systems. It has to be noted that this is a bi-directional resource negotiation, event propagation and IP transport interaction point.

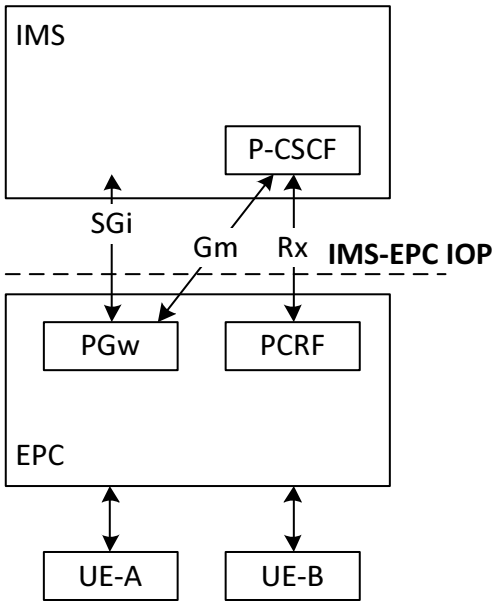

Figure 2: IMS-EPC Interoperability in scope

4.1.1 Reference Points in Scope

The SGi interface transports the User-Plane data from the UEs towards IMS as well as other Application Functions. This a generic reference point, for the transport of the IP User Plane data belonging to different more specific reference points, like Gm for SIP signalling or Mb for RTP media. These transported reference points though are end-to-end, such that the EPC system tunnels the IP packets through GTP and PMIP specific procedures, while the IMS processes the data itself, whether it is signalling or media.

The Rx interface uses the Diameter protocol [i.1] to push from IMS to EPC the communication bearer establishment requirements, as derived by the P-CSCF from the SIP and SDP signalling that passes through, for the scope of establishing well-ruled communication paths in the Evolved Packet Core and the UTRAN/E-UTRAN systems. The EPC Policy and Charging Control concepts encompass Gating, QoS and Charging Rules which constitute the operator's (per subscriber dynamic) policies.

The Rx interface is also used as a feedback path for events and notifications pertaining to the status of the network attachments and communication bearers, to be delivered from the EPC system to the IMS one.

4.1.2 Out of Scope Inter-domain Interactions

In a realistic exploitation scenario, beside the architectural components and reference points presented in Figure 1, the multi-domain situation will have to be considered. As the aforementioned figure is quite complex and encompassing both architectures, these details have been previously omitted on purpose.

The present document will limit itself, at least in this first version, to the interfaces between IMS and EPC, considered in the simplest scenarios, without NNI interactions.

When considering the multi-domain situation, besides the IMS-EPC intra-domain interactions, IMS NNI is addressed in TS 186 011-1 [i.2] and TS 186 011-2 [i.3], although the respective specification abstracts from the Access Network situation.

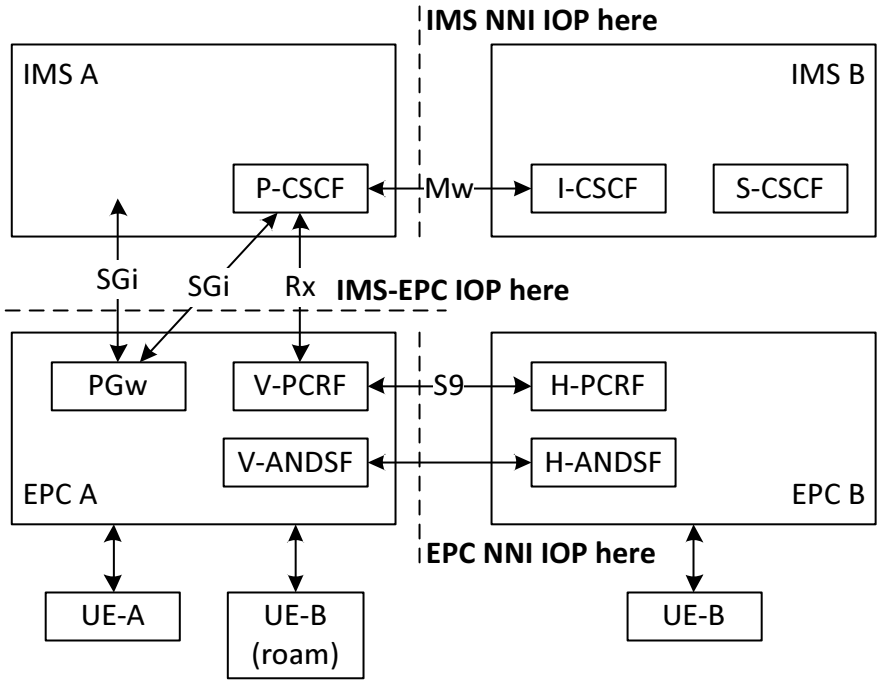

Figure 3: Complete IMS/EPC Interoperability (NNI out of scope)

Considering the EPC NNI communication, this will need to be addressed in the future for a complete coverage, as depicted in Figure 3. The respective inter-working reference points are still early in their standardization to be significantly addressed in implementations, while also the functional parts of the EPC architecture has to be addressed first. For these reasons, in the present document these NNI interactions are out of scope and will not be addressed.

5 Test Prerequisites

5.1 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. After testing all the use cases, the IMS system should be re-configured and the execution repeated.

5.2 Protocols, Security and Points of Observation

The IMS-EPC IOP tests employ SIP and Diameter protocol signalling, as well as transparent media (e.g. RTP).

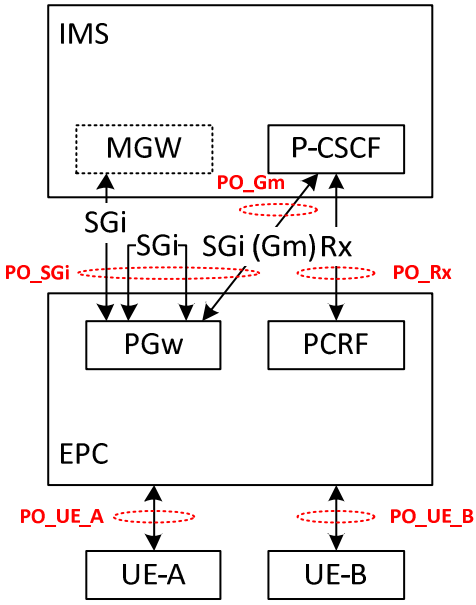

Figure 4: Points of Observation for Test Protocols

User Plane data as SIP and media is to be transported transparently between the UE and the P-CSCF, respectively MGW/correspondent-UE. The Point of Observation (PO) for SIP signalling be the Gm interface, which for observability reasons will not be secured. The PO for media happens at 2 points:

- the SGi interface between the P-GW and a generic IP router, positioned between IMS and EPC; all traffic, including direct UE to UE traffic, will be redirected and proxied through this IP router;
- the UE device's interface towards EPC.

The Rx Diameter interface is to be observed and as such not secured with encryption between the IMS and EPC systems. Basic Diameter connectivity is a pre-requisite for the tests, such that the P-CSCF and PCRF nodes should be correctly configured to establish and maintain (Capabilities-Exchange, Diameter-Watchdogs) stateful connectivity, as well as both declaring support for the Rx interface, such that Diameter Rx messages will be successfully routed and processed.

5.3 Test Infrastructure

This clause covers the list of relevant components and interfaces used for testing interoperability between EPC and AF represented by IMS. For components that are not present, standard functionality is assumed.

5.3.1 HSS/SPR

Subscriber data (TS 123 008 [i.4]) such as profile, location and subscriptions are located for IMS in the central database Home Subscriber Server/Universal Profile Server Function (HSS/UPSF), while EPC uses as a central database the Subscription Profile Repository (SPR). The data between the HSS and SPR has to be correlated, such that service functionality and charging will happen in a unitary manner.

As no reference point is envisioned here for Release 10, the HSS/UPSF/SPR can be regarded as a common node, exposing different interfaces towards different domains. As for example the HSS exposes the Sh interface for IMS applications and the Cx interface of the IMS Call Session Control Functions, a HSS/UPSF/SPR component will additionally expose interfaces like Sp towards EPC or S6a/d towards E-UTRAN/UTRAN.

In Release 11 (3GPP TS 23.203 [i.1]), a similar approach appears, with the introduction of an Universal Data Repository (UDR), which would constitute the common back-end between the HSS/UPSF/SPR/etc data retrieval components. This goes in the same direction as in our assumption for Release 10, of providing a common data back-end for all systems, with customized interfaces.

For practical deployment reasons, we have to observe that the 2 systems, IMS and EPC, in many situations would not share a common subscriber database. When performing IOP tests between IMS and EPC from different vendors, the following situations are possible:

a) two separate HSS entities, common data initially duplicated and later synchronized between them;

b) single HSS, as part of the IMS system, which will export SPR type interfaces as Sp, S6a/d, SWx a.s.o. interfaces towards the EPC system;

c) single SPR, as part of the EPC system, which will export HSS type interfaces as Cx and Sh towards the IMS system.

To simplify the architecture and generalize the practical usability of the interoperability tests to be specified here, case a) will be the only one considered. Interoperability between and IMS and EPC on the HSS interfaces is out of scope and will not be analyzed here. This is also in line with the aforementioned Release 11 evolution, which introduces a common data back-end.

The HSS and SPR entities will be provisioned for the test purposes with the required information for UE A and B, at both the EPS and IMS levels.

5.3.2 The P-CSCF (IMS) as the Application Function (AF) Interface to EPC

In EPC terms, the Application Function (AF) is an abstraction of the service provider plane, which communicates with the PCRF to enable Policy and Charging Control of the application layer and IMS session level services. The AF may be a single third party service, a complex operator controlled service delivery platform or an IP Multimedia Subsystem.

When the AF in the EPC architecture is represented by IMS, the inter-working function is provided by the P-CSCF. Based on the SIP signalling and the transported SDP payloads, the P-CSCF is able to derive QoS and charging requirements for the EPC system to provide. Also the P-CSCF will follow the status of the respectively provided communication bearers, such that it can act on events (e.g. loss of bearer, QoS changes, etc). For all these purposes the Rx reference point is used to communicate with the PCRF component in the EPC system.

The P-CSCF acts also as the Session Border Controller for the SIP User-to-Network Interface, Gm. From the perspective of EPC, the SIP signalling is transparently delivered between the UE and the P-CSCF. From the IMS perspective, the P-CSCF employs ciphering and integrity protection procedures, in order to further route and process the SIP signalling.

5.3.3 PCRF (EPC)

The Policy and Charging Control (PCC) is ensured through the Policy Decision Point, namely the Policy Charging and Rules Function (PCRF) and several Policy Enforcement Points located in the EPC gateways (TS 123 203 [i.5]).

The PCRF interfaces with the AF (P-CSCF in our IMS case) over the Rx reference point. The service requests are processed through a policy engine designed to allow for operator based control of gating, QoS and charging. The decisions are also taking as input the profiles of the respective subscribers, such that the provided policies are subscriber dynamically customized.

The resulting policies are pushed to be enforced towards the P-GW for gating and charging control, as well as towards the access specific gateway (S-GW, AN-GW, ePDG) for gating and QoS on the radio links. These resulting policies, as well as feedback from the charging and RAN systems, are passed back upstream over the Rx reference point to the AF (P-CSCF component in the case of IMS).

5.3.4 P-GW (EPC)

The Packet Data Network (PDN) Gateway provides transparent IP connectivity between the AF over multiple gateways and a radio link to the UE. The P-GW acts as IPv6 mobility anchor between trusted and un-trusted 3GPP and non-3GPP technologies and performs packet filtering, charging as well as IP address allocation.

5.3.5 User Endpoints

The test infrastructure must contain also User Endpoints. These are represented by client devices or simulators, capable of performing the EPC and IMS procedures.

The Use Cases and Test Descriptions have been developed such that during execution, only one client dev ice has to be observed. The counterpart UE in calls for example can be places either as a full EPC and IMS client, or only as IMS client, or even as a stand-alone SIP UA. In all cases the main requirement is that IP and SIP traffic would be observable for test validation. For this purpose, the Test Description refer to PO_SGi interface.

5.4 Reference Points and Protocols

5.4.1 The SGi reference point (IP)

The SGi reference point, performs User-Plane generic IP interfacing, breaking out the user IP data from the EPC plane towards the Application Functions (IMS, Internet, etc). Towards the UTRAN/E-UTRAN or non-3GPP access, this data is transported always as tunnelled and not merely routed on IP principles, such that the SGi correspondent node is provided with direct IP connectivity to the UE device. The SIP signalling as well as the IMS media are transported over this interface.

Packet data network may be an operator-external public or private packet data network or an intra-operator packet data network, e.g. for provision of IMS services. This reference point corresponds to Gi for GERAN/UTRAN accesses.

5.4.1.1 The Gm reference point (SIP)

The Gm reference point represents the 1st hop in SIP signalling between the UE and the IMS network represented by the P-CSCF. Its scope is to provide a secure SIP signalling channel, independent of the access network level security.

As such, with the exception of initial security negotiations, all signalling should be regarded as un-interceptable. However, for the interoperability purposes here in scope, intercepting this interface is critical for verifying the correct test scenario functionality, without requiring proprietary signalling tapping alternatives. Security measures as 3GPP-IPsec or TLS will be disabled on the Gm interface during the interoperability testing. Nevertheless, security is still to be regarded as mandatory when testing IMS UNI interoperability.

5.4.1.2 The Mb reference point between PDN and MGW (IP/UDP/RTP)

The Media Gateway (MGW) interconnects the circuit with the packet switched domain by converting RTP into CS correspondents and vice versa. The MGW is able to adapt the service rate and to change the used codec based on changes in the network.

For the interoperability purposes here, only the correct exchange of the packets between the UE and the MGW will be observed, according to the requested session parameters. Besides measurements for checking the correct delivery and enforcement of traffic QoS, priority levels and charging, negative testing is to be employed to verify that once the session bearers are removed, further media traffic is being filter out by the EPC.

5.4.2 The Rx reference point between AF and PCRF (Diameter)

As the policy signalling interface, the Rx interface will be monitored for correct signalling as derived from the specific test described SIP signalling. For the purpose of charging event notifications and bearer level event notifications, the Rx signalling will be monitored for correct activity as well as for correct actions on the involved nodes.

For practical test reasons, as with the Gm interface, security is to be disabled on this interface for the scope of interoperability monitoring. Interoperability with the security features enabled can be verified by re-executing the scenarios in scope and verifying only the end-events and not the Rx interface data.

5.5 Applicable 3GPP Release Number

The targeted 3GPP TS version for applicable procedures is Release 10, with the latest published versions.

However, considering the purposes of these tests to attest base IOP between two different systems from potentially different vendors, much of the functionality has been kept to a minimum, while exhaustive conformance testing is out of the scope of the present document. As such, Release 9 implementations should still be able to perform most of the tests without major difficulties.

6 Use Cases (Conformance Criteria)

This clause will present the main Use Cases to be tested. The Use Cases are general Test Purposes and as such are defined more or less abstract. These Use Cases are then used as blueprints for generating groups of Test Descriptions, which describe scenario instantiations of the Use Cases.

6.1 Network Attachment and Default Bearer Operations

The attachment to the EPC system is customized based on the specific Access Network types. For the purposes of the IMS-EPC interoperability, the Network Attachment procedures will be considered as the procedures for UTRAN, E-UTRAN, WiMAX or Wi-Fi/ePDG attachments. In all (or in subsequent) tests, any of these attachment procedures can be employed, considering the characteristics of the respective Radio Access Technologies (RAT) to provide bearer-based services.

The specific network attachment procedure themselves, employed by the UE to attach to EPC, are out of scope of these tests and will not be presented. Only the common and minimalistic set of operations between all of them is considered to be provided by the EPC system:

- the presence of a BBERF inside the specific AN-GW (e.g. S-GW, ePDG) with a Gxx interface to the PCRF;
- the presence of a PCEF inside the P-GW with a Gx interface to the PCRF.

The Gx and Gxx flows are also out of scope, only their resulting effects as triggered by the Network Attachments, Bearer Modifications, IP-CAN changes, RAT Type changes and Network Detachments will be investigated, as being transmitted over the Rx interface to the P-CSCF and as such influencing the IMS system.

6.1.1 Initial Network Attachment and Establishment of the Default Bearer

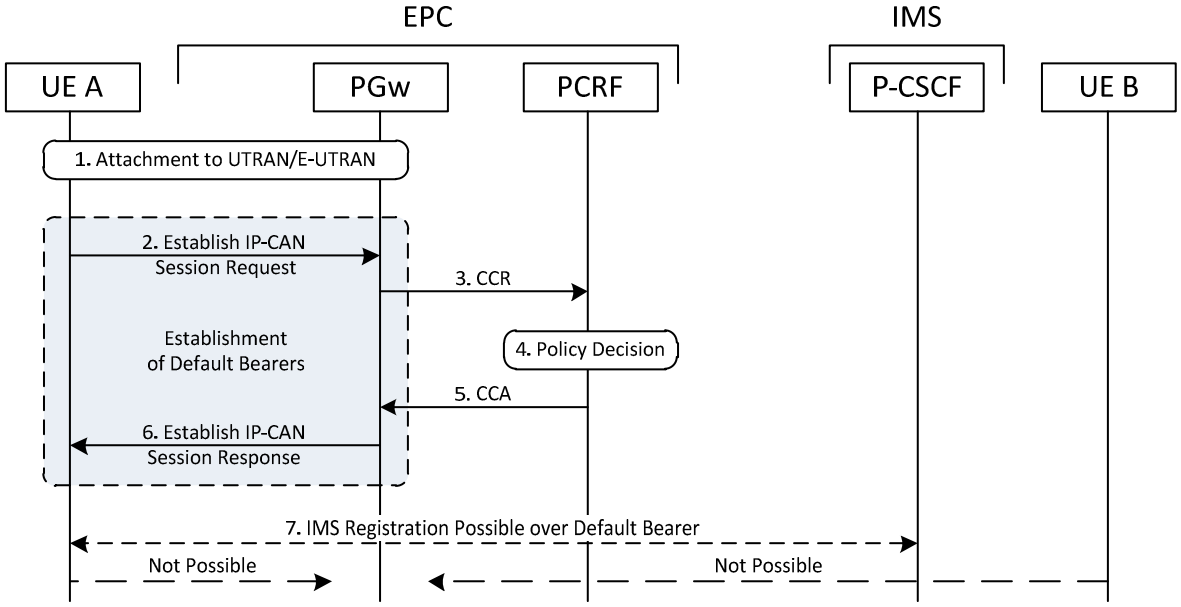

Figure 5: Initial Network Attachment

The test assumes that the UE has been provisioned with the proper credentials for performing network authentication and attachment(e.g in the USIM application). Correspondent provisioning is also assumed on the SPR in the EPC, such that network attachments can be successfully conducted.

The Initial Attachment procedures used as a reference are those from TS 129 212 [6], clause 4.5.1, 1 for Gx, respectively clause 4a.5.1 1 for Gxx, as well as from TS 124 229 [2], clause L.2.2.1 for UE initiated procedures. PCC policies for the creation of Default Bearers are assumed as pre-provisioned in the PCRF, such that the aforementioned procedures will result in the creation and acceptance of a Default Bearer allowing communication only between the UE and the P-CSCF. Communication between UE and other IP endpoints outside of the EPC network (UE - ANDSF communication over the S14 interface may still be allowed for functional reasons) will be denied (the default PCC gating policy will be set to "Deny"). Such a policy will allow for easier identification of correct bearer allocation and usage during the tests.

In case the EPC system supports the delivery to the UE of a network-provided P-CSCF address (e.g. DHCPv6 options), this is also assumed to be provisioned in the EPC system. Otherwise, the P-CSCF address should be provisioned in the alternative mechanisms (e.g. ISIM stored, DNS), such that in any situation, at the end of the network attachment procedure, the UE can exchange the initial SIP REGISTER request with the P-CSCF.

The test procedure will perform an Initial Attachments to the EPC system, sequentially verifying the request and allocation of:

1) an IPv4 APN context

2) an IPv6 APN context

3) a dual IPv4 and IPv6 APN context

The test will verify the following outcomes:

1) The network attachment is successful and the UE receives IP addresses according to the requested APN contexts.

2) The P-CSCF address is discovered by the UE (optional, if this is network provided).

3) A default bearer is established, allowing the exchange of a SIP REGISTER request and answer between the UE and the P-CSCF.

4) IP communication to other IP endpoints than the P-CSCF is denied (optional).

Test Purpose	
Identifier:	**TP_IMSEPC_Network_Attachment**
Summary:	On successful initial network attachment, the UE should discover the P-CSCF IP address. The EPC will create the Default Bearers which will allow communication only between the UE and the P-CSCF.
Config.:	CF_IMSEPC
IUT Role:	EPC
Ref.:	TS 124 229 [2], clause 9.2.1 (Connecting to the IP-CAN and P-CSCF discovery) TS 124 229 [2], clause L.2.2.1 (EPS bearer context activation and P-CSCF discovery) TS 129 212 [6], clause 4.5.1-1) (PCC procedures over Gx reference point / Request for PCC Rules) TS 129 212 [6], clause 4a.5.1-1) (PCC procedures over Gx reference point / Gateway control and QoS Rules Request)

	Entities				Condition
	UE A	**EPC**	**IMS**	**UE B**	
	✓	✓			Network attachment credential provisioned in UE A and EPC
	✓	✓			EPC and UE A provisioned with selectable APN configurations for IPv4, IPv6 or IPv4&IPv6 PDN types
		✓			P-CSCF address provisioned in the EPC for the purpose of delivery to UE A on attachment
		✓			Default Bearer PCRF policies set to allow UE A - P-CSCF communication
		×			Default EPC Gating Policy set to “deny”
	×	×			UE A not attached to network and EPC
	UE A	**EPC**	**IMS**	**UE B**	
Step	**Direction**				**Message**
1	→	→			**UE A attachment to RAN requests** ✓ parameter containing ➔ APN according to the required IPv4 and/or IPv6 attachment
2	←	←			**UE A attachment to RAN responses, including the P-CSCF address** ✓ one or two parameters containing ➔ UE A IPv4 and/or IPv6 address ✓ parameter containing ➔ P-CSCF IP address or ➔ P-CSCF FQDN
3		→ ←			**Establishment of Default Bearers** ✓ Service-Data-Flow (Uplink) ➔ “permit in ip from <ue_ip> to <pcscf_ip>” ✓ Service-Data-Flow (Downlink) ➔ “permit out ip from <pcscf_ip> to <ue _ip>” ✓ Default Gating Policy ➔ “deny”
4	→		→		**SIP REGISTER Request** × Contact header
5	←		←		**SIP REGISTER Response**
6	→	×		||→	**IP packet from UE A to UE B** ||→ not delivered to UE B
7	←||	×		←	**IP packet from UE B to UE A** ←|| not delivered to UE A

6.1.2 Network Detachment with Previously Established IMS Registration and sessions

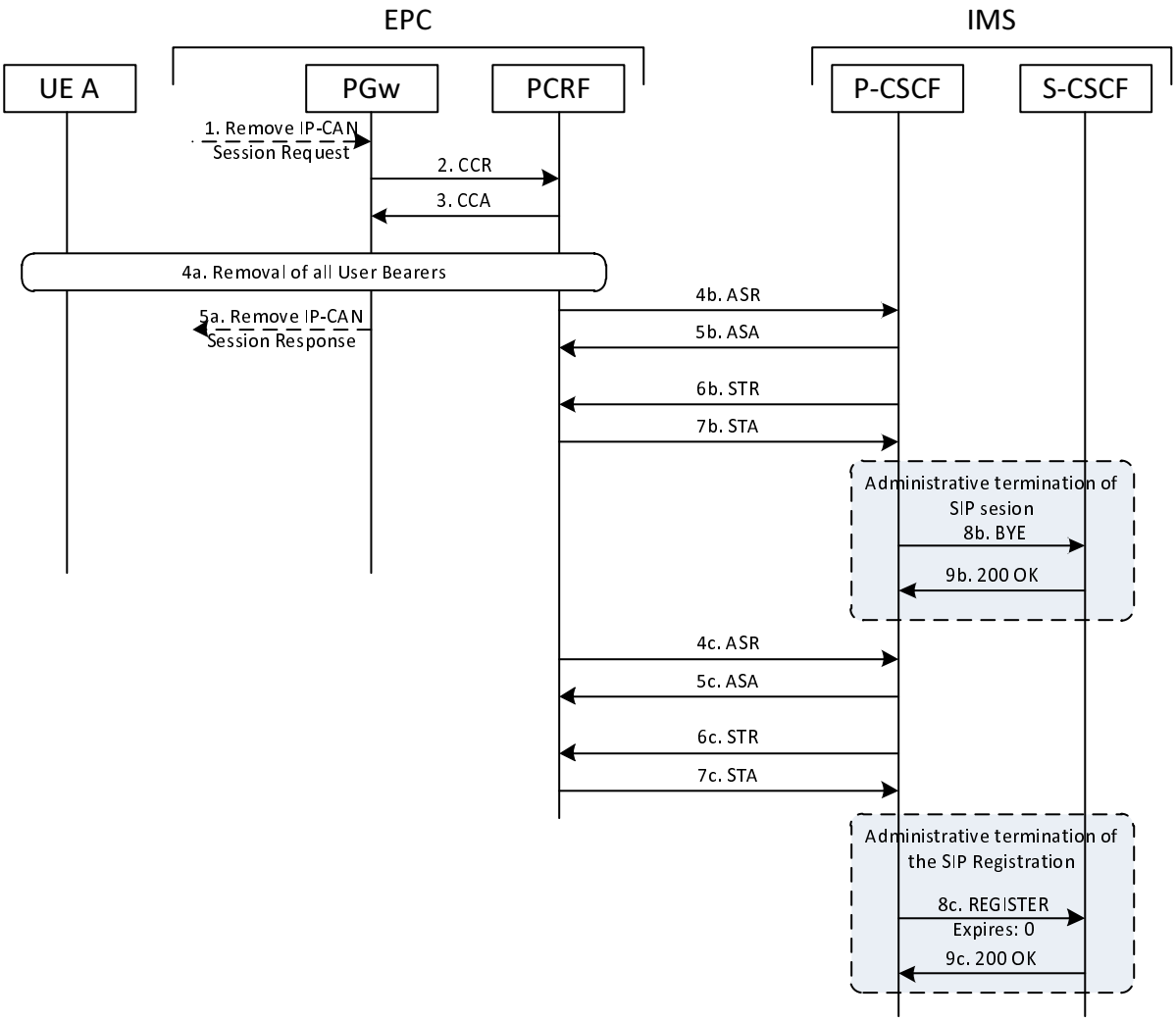

Figure 6: Network Detachment

The test assumes that the UE has previously been attached to network and EPC, with a single attachment, such that a detach command will result in a complete disconnection of the UE. The UE has registered to IMS. The UE has one active IMS session (call).

A complete UE network detachment will be triggered, without previously triggering and orderly IMS de-registration and session termination. In case the UE employed in the test will not support this partial operation, an administrative network detachment should be triggered from the EPS.

The test will verify the following outcomes:

1) The event is sent over the Rx interface to the P-CSCF in the IMS system.

2) The session bearers are removed in EPC.

3) The IMS signalling bearer is removed in EPC.

4) The Default Bearer is removed and any communication with the UE is interrupted.

5) The IMS system will perform administrative termination of ongoing sessions belonging to the UE.

6) The IMS system will perform IMS de-registration of the UE.

Test Purpose	
Identifier:	**TP_IMSEPC_Network_Detachment**
Summary:	On UE A network detachment EPC will inform the IMS about the IP-CAN session termination. EPC will remove all bearers related to the respective UE A. IMS will take action and terminate all ongoing SIP sessions and the IMS registration.
Config.:	CF_IMSEPC
IUT Role:	IMS, EPC
Ref:	TS 124 229 [2], clause 5.2.8.1.2 (P-CSCF-initiated call release / Release of an existing session) TS 129 214 [5], clause 4.4.6.1 (IP-CAN Session Termination)

Entities			Condition
UE A	**EPC**	**IMS**	
✓	✓		UE A attached to EPC, with a single attachment
✓		✓	UE A registered in IMS
✓		✓	UE A has an active SIP session established

	UE A	**EPC**	**IMS**	
Step	**Direction**			**Message**
1	↯	↯		**UE A or EPC triggers complete network detachment**
2a		↯ ↯		**EPC removes the SIP session related bearer**
2a.1a		↯	↯	**Diameter Abort-Session-Request** ✓ Session-Id AVP ➔ session for active SIP Session ✓ Abort-Cause AVP ➔ BEARER_RELEASED (0)
2a.2a		↯	↯	**Diameter Abort-Session-Answer** ✓ Session-Id AVP ➔ session for active SIP Session ✓ Result-Code AVP ➔ DIAMETER_SUCCESS(2001)
2a.3a		↯	↯	**Diameter Session-Termination-Request** ✓ Session-Id AVP ➔ session for active SIP session
2a.4a		↯	↯	**Diameter Session-Termination-Answer** ✓ Session-Id AVP ➔ session for active SIP session ✓ Result-Code AVP ➔ DIAMETER_SUCCESS(2001)
2a.1b			↯ ↯	**SIP BYE Request** ✓ Request-URI ➔ stored Contact header field provided by UE B ✓ To header ➔ To header field value as received in the 200 (OK) response for initial INVITE request ✓ From header ➔ From header field value as received in initial INVITE request ✓ Call-ID header ➔ Call-Id header field value as received in initial INVITE request ✓ CSeq header ➔ current CSeq value stored for direction from calling to called user, incremented by one ✓ Route header ➔ routeing information towards called user as stored for dialog ✓ Reason header ➔ 503 (Service Unavailable) response code
2a.1c			↯ ↯	**SIP BYE Response**
2b		↯ ↯		**EPC removes the IMS signalling bearer**
2b.1a		↯	↯	**Diameter Abort-Session-Request** ✓ Session-Id AVP ➔ session for IMS Signalling ✓ Abort-Cause AVP ➔ BEARER_RELEASED (0)
2b.2a		↯	↯	**Diameter Abort-Session-Answer** ✓ Session-Id AVP ➔ session for IMS Signalling ✓ Result-Code AVP ➔ DIAMETER_SUCCESS(2001)

2b.3a		←	→	**Diameter Session-Termination-Request** ✓ Session-Id AVP ➔ session for IMS Signalling
2b.3a		→	←	**Diameter Session-Termination-Answer** ✓ Session-Id AVP ➔ session for IMS Signalling ✓ Result-Code AVP ➔ DIAMETER_SUCCESS(2001)
3			→ ←	**SIP REGISTER Request** ✓ Request-URI ➔ stored domain URI for affected IMPU ✓ To header ➔ affected IMPU ✓ From header ➔ affected IMPU ✓ Contact header ➔ affected contacts ✓ Authorization header ➔ scheme “Digest” ➔ username as storred IMPI for initial registration ➔ realm as stored realm for initial registration ➔ uri as stored domain for initial registration ➔ “integrity-protected=yes” ✓ Expires header ➔ “0” ✓ Reason header ➔ 503 (Service Unavailable) response code
4			← →	**SIP BYE Response**

6.2 IMS Registration and AF Signalling Bearer Operations

6.2.1 IMS Initial Registration

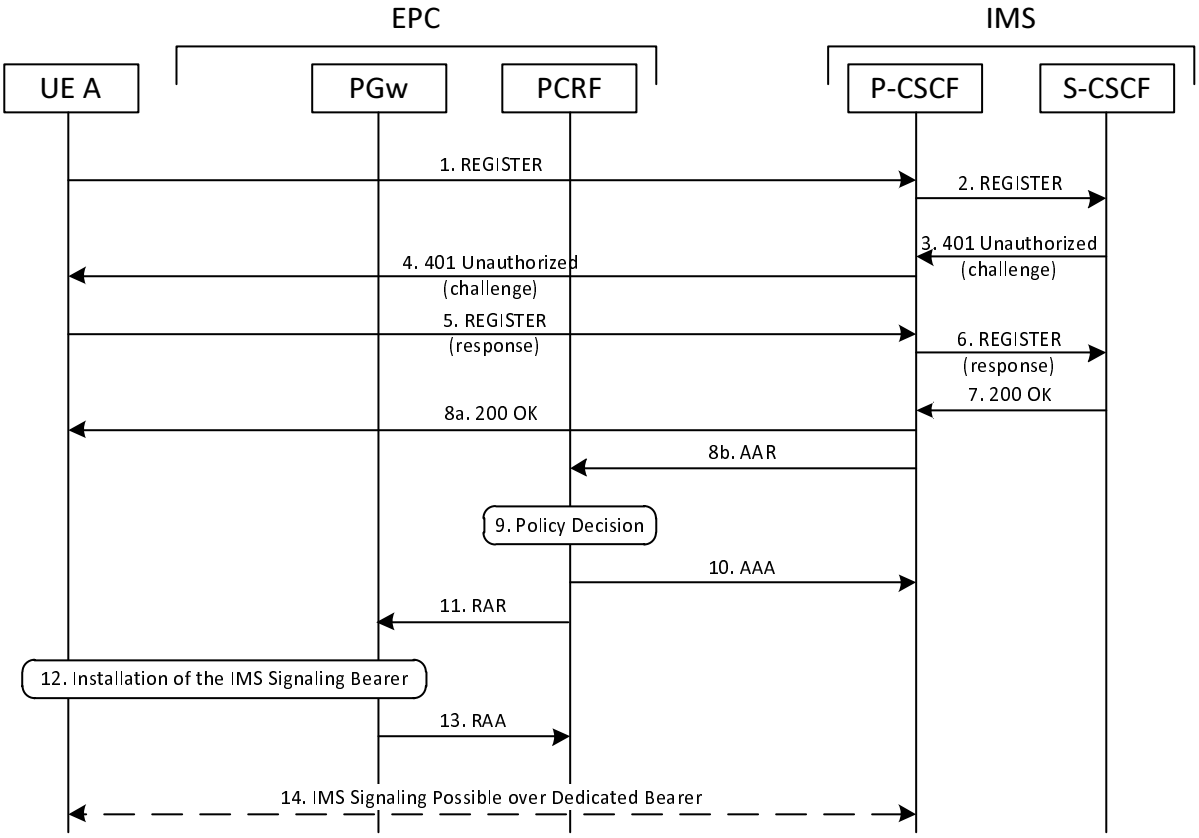

Figure 7: IMS Initial Registration

The test assumes that a network attachment has been previously performed and the P-CSCF address has been discovered, such that the UE can send the initial REGISTER request to the P-CSCF.

The test procedure will perform an IMS initial registration of the UE to the IMS system. On successful completion, the IMS should trigger the provisioning of the AF signalling flow information, for the purpose of reserving a communication bearer in the EPC for transporting the subsequent IMS signalling.

The test will verify the following outcomes:

1) IMS correctly produces the Media-Component-Description AVP for IMS signalling between UE and P-CSCF

2) An IMS signalling bearer is created in the EPC

3) The IMS signalling is transported between the UE and the P-CSCF (PO_UE and PO_Gm)

4) The IMS signalling bearer is used to transport the IMS signalling between the UE and IMS with the following parameters (see TS 123 203 [i.5]):

QoS Class Identifier	Resource-Type	Priority	Packet Delay Budget	Packet Error Loss Rate	Example Services
5	Non-GBR	1	100 ms	10^{-6}	IMS Signalling

Test Purpose	
Identifier:	**TP_IMSEPC_Registration_Initial**
Summary:	On successful initial registration, the P-CSCF shall request at the PCRF the allocation of a bearer for SIP signalling. The PCRF should act on the request and allocate the bearer. Subsequent signalling should make use of the respective bearer's QoS and priority characteristics.
Config.:	CF_IMSEPC
IUT Role:	IMS, EPC
Ref:	TS 124 229 [2], clause 5.4.1.2 (Initial registration and user-initiated re-registration) TS 129 214 [5], clause 4.4.5a (Provisioning of AF Signalling Flow Information) TS 129 214 [5], clause A.8 (Provision of Signalling Flow Information at P-CSCF) TS 129 214 [5], annex B (Flow identifiers: Format definition and examples)

	Entities			Condition
	UE A	**EPC**	**IMS**	
	✓	✓		UE A attached to EPC and pre-provisioned a default bearer for enabling communication between UE and IMS
			✓	UE A provisioned in IMS
	×		×	UE A not registered with IMS

	UE A	**EPC**	**IMS**	
Step	**Direction**			**Message**
1	→		→	**SIP REGISTER Request**
2	←		←	**SIP 2xx Response**
3		←	←	**Diameter AA-Request** ✓ Framed-IP-Address AVP or Framed-IPv6-Prefix AVP ➔ UE_A IP ✓ Media-Component-Description AVP ✓ Media-Component-Number AVP ➔ "0" ✓ one or more Media-Sub-Component AVP ✓ Flow-Number AVP ✓ Flow-Description AVP (Uplink) ➔ "permit in ip from <ue_a_ip> <ue_a_port> to <pcscf_ip> <pcscf_port>" ✓ Flow-Description AVP (Downlink) ➔ "permit out ip from <pcscf_ip> <pcscf_port> to <ue_a_ip> <ue_a_port>" ✓ Flow-Usage AVP ➔ AF_SIGNALING(0) ✓ Flow-Status AVP ➔ ENABLED(2) ✓ AF-Signalling-Protocol AVP ➔ SIP(1)
4		→	→	**Diameter AA-Answer** ✓ Result-Code AVP ➔ DIAMETER_SUCCESS(2001) ✓ Acceptable-Service-Info AVP ✓ Media-Component-Description AVP ➔ similar value to what was requested in Diameter AA-Request ✓ IP-CAN-Type AVP ✓ RAT-Type AVP

Observations:

1) In the Flow-Description AVP, instead of protocol "ip", alternative values as "udp" or "tcp" can be used. These are more specific, but might require the use of multiple Media-Sub-Component AVP.

2) The Flow-Number AVP is derived according to the respective rules in TS 129 214 [5], annex B.

3) The IP address and port of the UE A and P-CSCF should mirror the values "on wire" used by the SIP protocol. Special attention has to be taken for situations when these might differ from the values in the SIP Contact header (e.g. 3GPP-IPsec security on Gm).

6.2.2 IMS De-registration

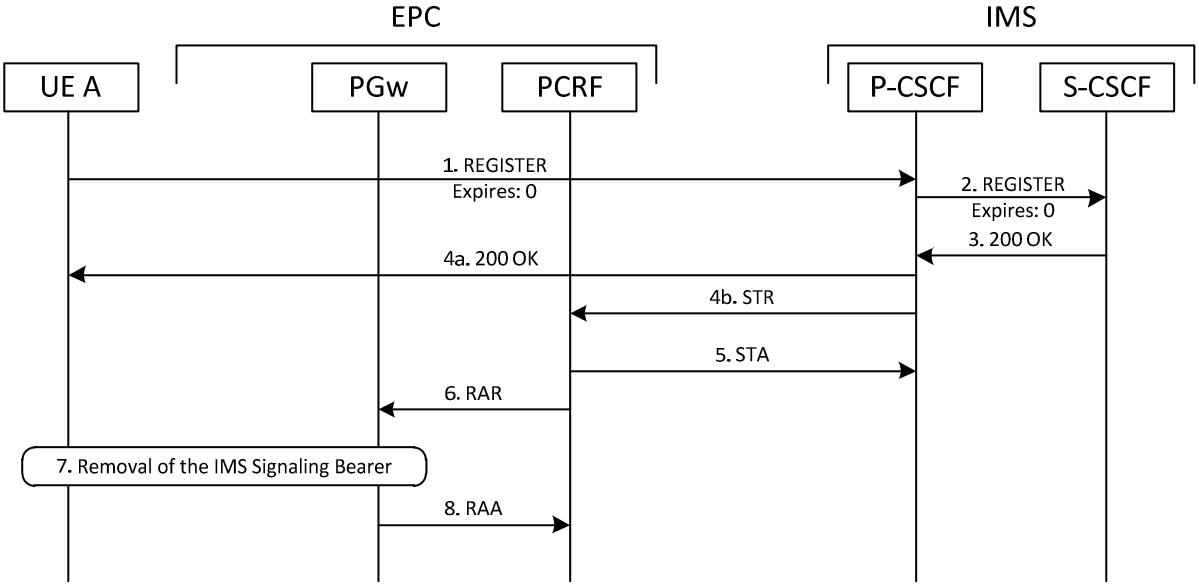

Figure 8: IMS De-registration

The test assumes that the UE has been previously registered to IMS.

The test procedure will follow an IMS de-registration initiated by the UE. The P-CSCF should trigger a termination of the IMS signalling bearer in the EPC. Signalling between the UE and the P-CSCF should still be possible, yet the traffic should be classified in the Default Bearer, which should still be active.

The test will verify the following outcomes:

1) The UE de-registration will trigger the termination of the Rx session for IMS signalling.

2) The EPC will remove the bearer for IMS signalling between the UE and the P-CSCF.

3) An initial IMS registration is still possible, yet the remaining Default Bearer will be used.

Test Purpose	
Identifier:	**TP_IMSEPC_DeRegistration_UE**
Summary:	On UE_A de-registration, P-CSCF signals to PCRF the termination of the IMS signalling session. EPC removes the IMS signalling bearer. Initial registration are still possible, but traffic will be categorized in the Default Bearer.
Config.:	CF_IMSEPC
IUT Role:	IMS, EPC
Ref:	TS 124 229 [2], clause 5.4.1.4.1 (User-initiated de-registration / Normal cases) TS 129 214 [5], clause 4.4.5a (Provisioning of AF Signalling Flow Information) TS 129 214 [5], clause 4.4.4 (AF Session Termination) TS 129 214 [5], clause A.8 (Provision of Signalling Flow Information at P-CSCF)

	Entities			Condition
	UE A	**EPC**	**IMS**	
	✓	✓		UE A attached to EPC and pre-provisioned a default bearer for enabling communication between UE A and IMS
	✓		✓	UE A registered in IMS
		✓	✓	An IMS signalling bearer established between IMS and EPC for the UE A

	UE A	**EPC**	**IMS**	
Step	**Direction**			**Message**
1	→		→	**SIP REGISTER Request** ✓ Expires header ➔ "0" ✓ Contact header ➔ all currently registered contact addresses
2	←		←	**SIP 2xx Response**
3		→	←	**Diameter Session-Termination-Request** ✓ Session-Id AVP ➔ session for IMS signalling session
4		→	→	**Diameter Session-Termination-Answer** ✓ Session-Id AVP ➔ session for IMS signalling session ✓ Result-Code AVP ➔ DIAMETER_SUCCESS(2001)
4	→		→	**SIP REGISTER Request** × Contact header
5	←		←	**SIP REGISTER Response**

6.2.3 IMS De-registration with Active Sessions

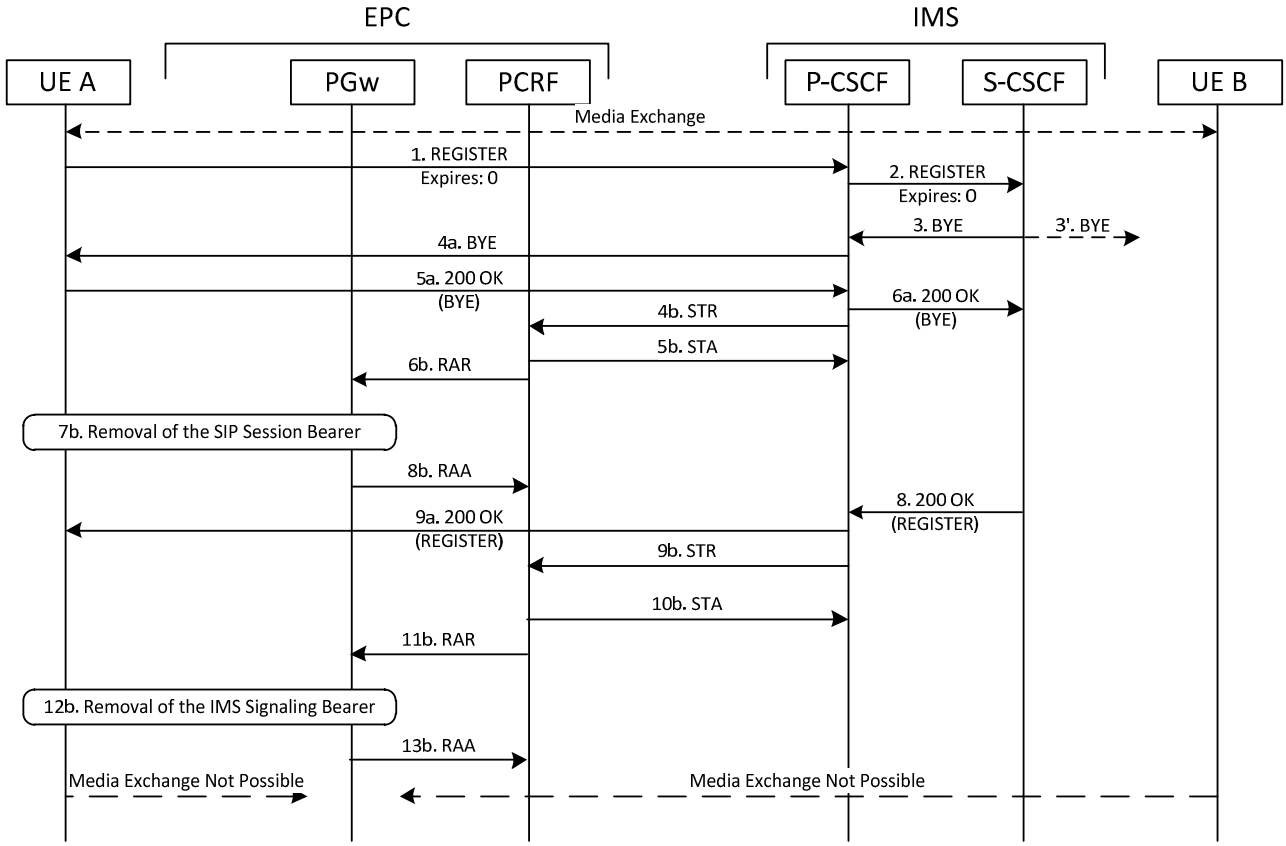

Figure 9: IMS UE De-registration with Active Session

The test assumes that an UE has been previously attached to EPC, performed and IMS registration and established a SIP session. The session is considered to be active at the moment of the test.

The test procedure will trigger an UE-initiated de-registration. On this event the S-CSCF will perform a S-CSCF initiated call release. On receiving the call release, the P-CSCF will act and trigger the termination of the SIP session bearers in the EPC. As a result, SIP session media will be filtered and should no longer pass the EPC, in either direction.

Eventually the S-CSCF will also respond to the IMS de-registration. On receipt of the response, the P-CSCF will trigger the termination of the IMS signalling bearer.

The test will verify the following outcomes:

1) Active SIP sessions and their associated bearers are removed.

2) Session's media will be filtered-out by EPC, as the session bearers have been removed and the Default Bearer has a default policy of "deny".

3) The IMS signalling bearer is removed.

Test Purpose	
Identifier:	**TP_IMSEPC_DeRegistration_UE_Active_Session**
Summary:	On UE A de-registration, the S-CSCF performs S-CSCF-initiated termination of active session. P-CSCF will act on this event and signals to PCRF termination of the SIP session bearers. EPC removes the SIP Session bearer. Media cannot be exchange any longer on previous SIP Session bearer. The S-CSCF answers to the de-registration. The P-CSCF signals to PCRF the termination of IMS signalling session. EPC removes IMS signalling bearer.
Config.:	CF_IMSEPC
IUT Role:	IMS, EPC
Ref:	TS 124 229 [2], clause 5.4.1.4.1 (User-initiated de-registration) TS 124 229 [2], clause 5.4.5.1 (S-CSCF-initiated call release) TS 129 214 [5], clause 4.4.5a (Provisioning of AF Signalling Flow Information) TS 129 214 [5], clause 4.4.4 (AF Session Termination) TS 129 214 [5], clause A.8 (Provision of Signalling Flow Information at P-CSCF)

	Entities				Condition
	UE A	**EPC**	**IMS**	**UE B**	
	✓	✓			UE A attached to EPC and pre-provisioned a default bearer for enabling communication between UE A and IMS
	✓		✓		UE A registered in IMS
		✓	✓		An IMS signalling bearer established between IMS and EPC for the UE A
	✓		✓	✓	UE A in an active SIP session with UE B
	✓	✓	✓	✓	A SIP session bearer established between UE A and other communication endpoint
		×			Default EPC gating policy set to “deny”

	UE A	**EPC**	**IMS**	**UE B**	
Step	**Direction**				**Message**
1	↯			⇗	**Session Media from UE A to UE B** ⇗ delivered to UE B
2	⇖			↯	**Session Media from UE B to UE A** ⇖ delivered to UE A
3	↯		⇗		**SIP REGISTER Request** ✓ Expires header ➔ “0” ✓ Contact header ➔ all currently registered contact addresses
4	⇖		↯		**SIP BYE Request** ✓ Request-URI ➔ contact address from stored Contact header ✓ To header ➔ From or To header as received in initial INVITE request ✓ To header ➔ From or To header as received in initial INVITE request ✓ Call-ID header ➔ stored Call-ID header ✓ CSeq header ➔ stored value for respective direction, incremented by one ✓ Route header ➔ routeing information for respective direction ✓ Reason header
5	↯		⇗		**SIP 2xx Response**
6		⇖	↯		**Diameter Session-Termination-Request** ✓ Session-Id AVP ➔ session for SIP session
7		↯	⇗		**Diameter Session-Termination-Answer** ✓ Session-Id AVP ➔ session for SIP session ✓ Result-Code AVP ➔ DIAMETER_SUCCESS(2001)
8	↯	×		‖⇗	**Session Media from UE A to UE B** ‖⇗ not delivered to UE B
9	⇖‖	×		↯	**Session Media from UE B to UE A** ⇖‖ not delivered to UE A

10		←	→		**Diameter Session-Termination-Request** ✓ Session-Id AVP ➔ session for IMS signalling session
11		→	←		**Diameter Session-Termination-Answer** ✓ Session-Id AVP ➔ session for IMS signalling session ✓ Result-Code AVP ➔ DIAMETER_SUCCESS(2001)

Observations:

1) The actual use of the Default Bearer for an eventual IMS initial registration is no longer tested, as TD_IMSEPC_DeRegistration_UE should be sufficient to check this functionality.

2) It is not relevant what the other endpoint of the active SIP session is. However, care should be taken such that the media will not fall-back on the Default Bearer when removing the SIP session bearer, but be filtered-out by the default gating policy of "Deny".

6.2.4 IMS Administrative De-Registration

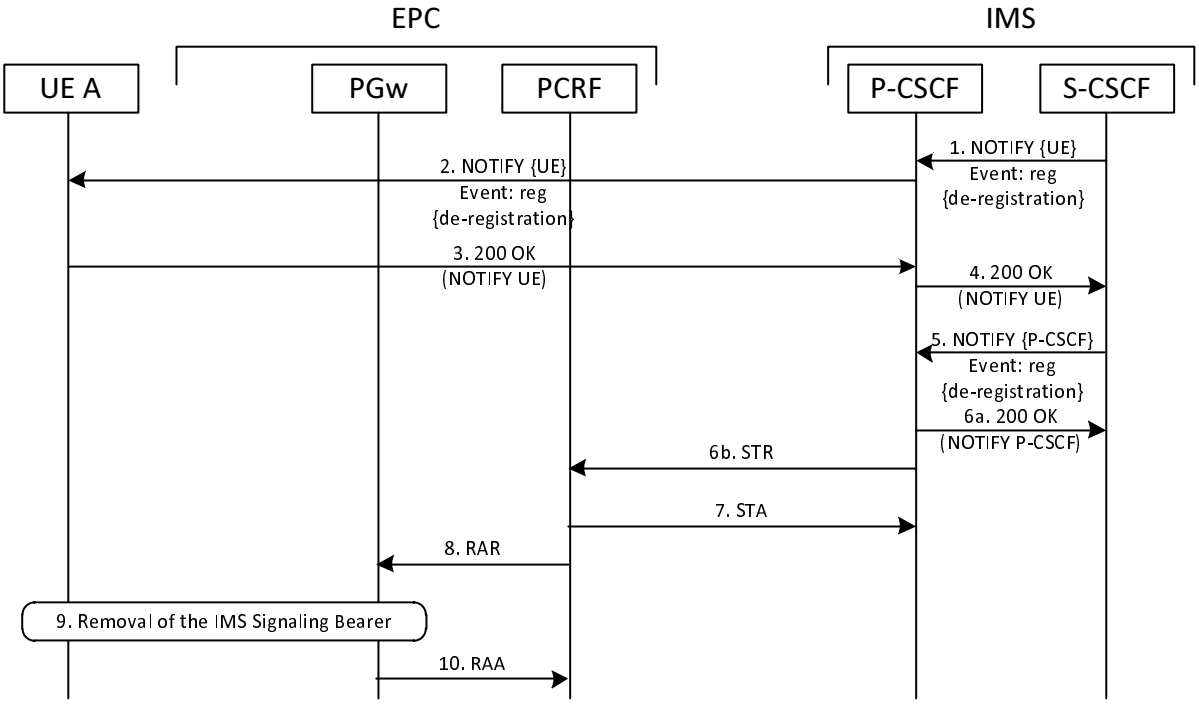

Figure 10: IMS Administrative De-Registration

The test assumes that the UE has been previously attached to EPC and registered to IMS. As part of the IMS registration, both the UE and the P-CSCF have subscribed to the "reg" event at the S-CSCF, such that they are following the registration status of the UE in the S-CSCF.

The test procedure will trigger an administrative de-registration of the UE, in the HSS or S-CSCF. This will trigger "reg" event notifications to the be sent. When the P-CSCF receives this, it will delete the respective entries from its internal registrar and it will terminate the IMS signalling session towards EPC. The EPC will then delete the respective bearers, such that signalling will no longer be possible, but by using the Default Bearer.

The test will verify that:

1) The P-CSCF will act on the de-registration notification and will terminate the IMS signalling session

2) The EPC will remove the IMS signalling bearer

3) UE signalling is still possible by using the Default Bearer

Test Purpose	
Identifier:	**TP_IMSEPC_DeRegistration_Administrative**
Summary:	On administrative de-registration, S-CSCF notifies the UE A and P-CSCF about the event. P-CSCF signals to PCRF the termination of the IMS signalling session. EPC removes the IMS signalling bearer. Initial registration are still possible, but traffic will be categorized in the Default Bearer.
Config.:	CF_IMSEPC
IUT Role:	IMS, EPC
Ref:	TS 124 229 [2], clause 5.4.1.5 (Network-initiated de-registration) TS 129 214 [5], clause 4.4.5a (Provisioning of AF Signalling Flow Information) TS 129 214 [5], clause 4.4.4 (AF Session Termination) TS 129 214 [5], clause A.8 (Provision of Signalling Flow Information at P-CSCF)

	Entities			Condition
	UE A	**EPC**	**IMS**	
	✓	✓		UE A attached to EPC and pre-provisioned a default bearer for enabling communication between UE A and IMS
	✓		✓	UE A registered in IMS
		✓	✓	An IMS signalling bearer established between IMS and EPC for the UE A

		UE A	**EPC**	**IMS**	
Step	**Direction**				**Message**
1		←		←	**SIP NOTIFY Request** ✓ Request-URI ➔ UE contact address for SUBSCRIBE dialog ✓ Event header ➔ "reg" ✓ Body ➔ indicating complete de-registration of all relevant UE contacts and identities
2		→		→	**SIP 2xx Response**
3				←←	**SIP NOTIFY Request** ✓ Request-URI ➔ P-CSCF contact address for SUBSCRIBE dialog ✓ Event header ➔ "reg" ✓ Body ➔ indicating complete de-registration of all relevant UE contacts and identities
4				→→	**SIP 2xx Response**
5			←	←	**Diameter Session-Termination-Request** ✓ Session-Id AVP ➔ session for IMS signalling session
6			→	→	**Diameter Session-Termination-Answer** ✓ Session-Id AVP ➔ session for IMS signalling session ✓ Result-Code AVP ➔ DIAMETER_SUCCESS(2001)
7		→		→	**SIP REGISTER Request** × Contact header
8		←		←	**SIP REGISTER Response**

6.2.5 IMS Registration Expiration

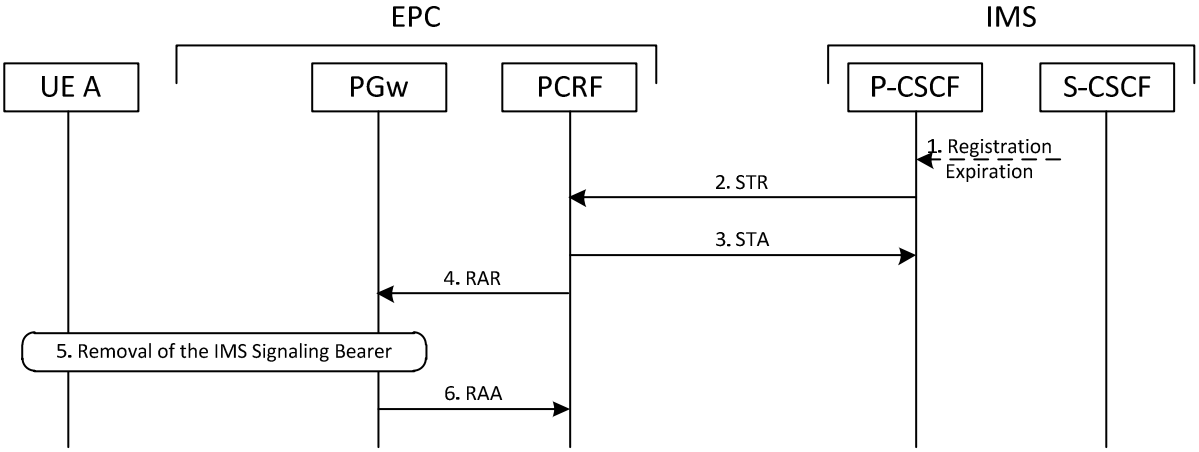

Figure 11: IMS Registration Expiration

The test assumes that the UE has been previously attached to EPC and registered to IMS.

The test procedure will follow the registration expiration in the P-CSCF, which will trigger the termination of the IMS signalling session in EPC.

The test will verify that:

1) The P-CSCF will act on the registration expiration and will terminate the IMS signalling session

2) The EPC will remove the IMS signalling bearer

3) UE signalling is still possible by using the Default Bearer

Test Purpose	
Identifier:	**TP_IMSEPC_DeRegistration_Expiration**
Summary:	On registration expiration, P-CSCF signals to PCRF the termination of the IMS signalling session. EPC removes the IMS signalling bearer. Initial registration are still possible, but traffic will be categorized in the Default Bearer.
Config.:	CF_IMSEPC
IUT Role:	IMS, EPC
Ref:	TS 129 214 [5], clause 4.4.5a (Provisioning of AF Signalling Flow Information) TS 129 214 [5], clause 4.4.4 (AF Session Termination) TS 129 214 [5], clause A.8 (Provision of Signalling Flow Information at P-CSCF)

	Entities			Condition
	UE A	**EPC**	**IMS**	
	✓	✓		UE A attached to EPC and pre-provisioned a default bearer for enabling communication between UE A and IMS
	✓		✓	UE A registered in IMS
		✓	✓	An IMS signalling bearer established between IMS and EPC for the UE A

	UE A	**EPC**	**IMS**	
Step	**Direction**			**Message**
1	←		←↩	**Registration timer expiration**
2		←	↩	**Diameter Session-Termination-Request** ✓ Session-Id AVP ➔ session for IMS signalling session
3		↳	↩	**Diameter Session-Termination-Answer** ✓ Session-Id AVP ➔ session for IMS signalling session ✓ Result-Code AVP ➔ DIAMETER_SUCCESS(2001)
4	↳		↩	**SIP REGISTER Request** × Contact header
5	←		↩	**SIP REGISTER Response**

6.3 SIP Session and Session Bearer Operations

The SIP Session and Session Bearer Operations cover the allocation, modification and deletion of EPC bearers for the media data between two UEs. As long as the bearers are present, media can be transported in both direction. The respective bearers will have QoS and charging characteristics according to the EPC's operator profiles and preferences. For verifying the different characteristics, both audio and video media can be exchanged, each with different bearer policies. As the bearers are modified or deleted, media traffic will be filtered-out by EPC. To achieve this effect, the same default EPC gateway policy set to "Deny" will be employed, like in the previous Use Cases.

To simplify the signalling, the 2nd endpoint of the communication can be an IMS network service (e.g. gateway to a PSTN phone, media server, etc), such that the operations will only be triggered on a single side of the communication. Alternatively, two UEs can be employed and the originating and terminating Use Cases merged into common tests. In any situation though, the Use Case will assume that just the UE in scope for the respective originating/terminating case will be attached to and using EPC services.

It has to be considered that the SDP negotiation during the SIP session establishment, can happen in various ways:

- SDP offer in INVITE and SDP answer in 200 OK;
- SDP offer in INVITE and SDP answer in 183 Progress;
- SDP offer in INVITE and SDP offer in 180 Ringing;
- SDP offer in 200 OK and SDP answer in ACK;
- no SDP negotiation in the initial transaction.

The relevant scenario paths are described in individual Test Descriptions of the same SIP Session Establishment Use Case.

The tests are following in principle the IMS call setup, modification and release procedures. They are not named as "calls" as the "SIP Session" term will encompass broader Use Cases, beyond the use of IMS for telephony purposes.

Each Use Case is described both for the originating and terminating situations.

6.3.1 SIP Session Establishment

The test assumes that the UE A for originating cases and UE B for terminating cases have been previously attached to EPC and registered to IMS.

The test procedure will follow the IMS call setup procedures.

The test will verify that:

1) The P-CSCF will act on successful call establishment and trigger creation of call bearers.

2) Media is only transported after the call setup is successfully completed (tests will start media before call setup and verify that the default EPC gating policy of "Deny" will initially stop the media).

3) The EPC will create new bearers for transporting call's media.

4) The media bearer is used to transport the media between the UEs with the following parameters (see TS 123 203 [i.5]):

QoS Class Identifier	Resource-Type	Priority	Packet Delay Budget	Packet Error Loss Rate	Example Services
1	GBR	2	100 ms	10^{-2}	Conversational Voice
2	GBR	4	150 ms	10^{-3}	Conversational Video (Live Streaming)

6.3.1.1 Originating Leg

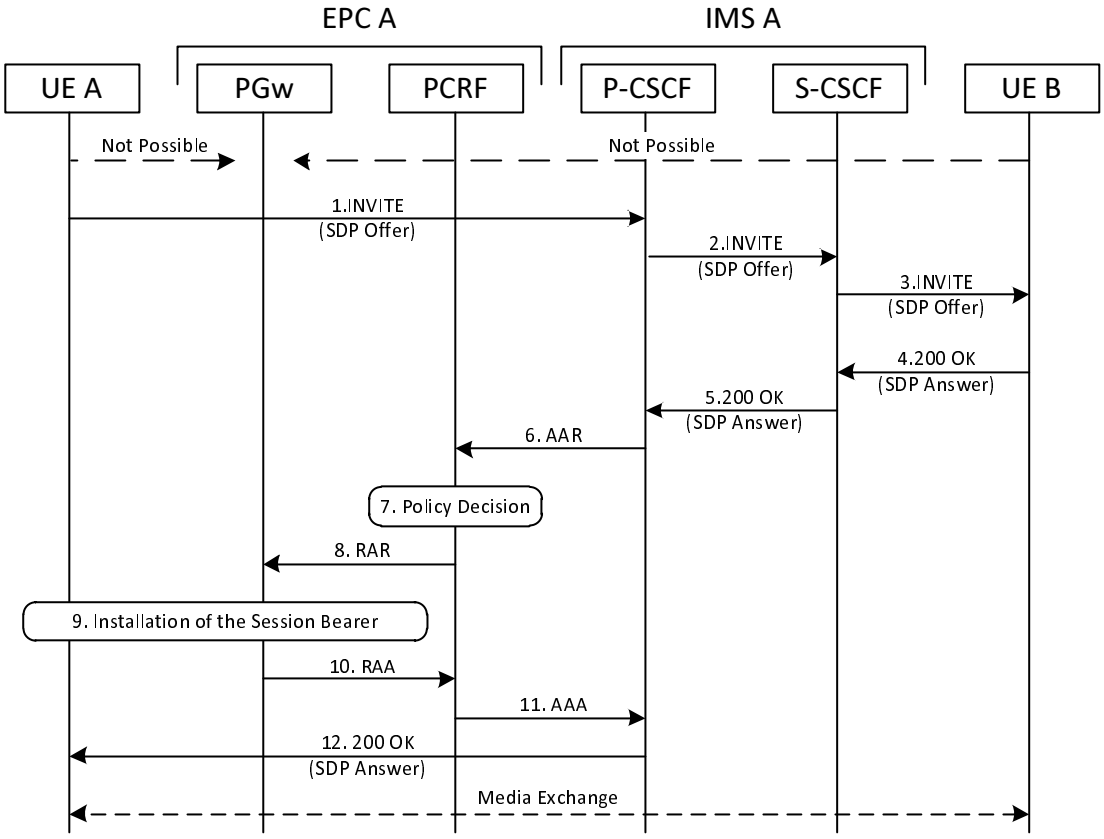

Figure 12: SIP Session Establishment - Originating Leg

Test Purpose	
Identifier:	**TP_IMSEPC_Session_Establishment_Originating**
Summary:	On successful call setup, the P-CSCF should derive from the SDP offer and answer, descriptions of the Service Data Flow. These are pushed towards EPC as request for creation of adequate bearers. EPC creates based on the EPC's operator policies the bearers for media. When transporting media, the EPC will employ the respective bearer's characteristics. Media transport is possible only after the successful establishment of the session.
Config.:	CF_IMSEPC
IUT Role:	IMS, EPC
Ref:	TS 124 229 [2], clause 5.2.7.2 (Initial INVITE / Originating Case) TS 129 214 [5], clause 4.4.1 (Initial Provisioning of Session Information) TS 129 214 [5], clause A.1 (Provision of Service Information at the P-CSCF) TS 129 214 [5], clause A.2 (Enabling of IP Flows) TS 129 214 [5], annex B (Flow identifiers: Format definition and examples)

	Entities				Condition
	UE A	**EPC**	**IMS**	**UE B**	
	✓	✓			UE A attached to EPC and pre-provisioned a default bearer for enabling communication between UE A and IMS
	✓		✓		UE A registered in IMS
		✓	✓		An IMS signalling bearer established between IMS and EPC for UE A

	UE A	**EPC**	**IMS**	**UE B**	
Step	**Direction**				**Message**
1	↯	×		‖⇗	**Session Media from UE A to UE B** ‖⇗ not delivered to UE B
2	⇖‖	×		⇙	**Session Media from UE B to UE A** ⇖‖ not delivered to UE A
3	↯		⇗↯	⇗	**SIP INVITE Request** ✓ Body ➔ SDP offer
4			⇖	⇙	**SIP 2xx Response** ✓ Body ➔ SDP answer
5		⇖	⇙		**Diameter AA-Request** ✓ Framed-IP-Address AVP or Framed-IPv6-Prefix AVP ➔ UE IP ✓ one or more Media-Component-Description AVP ✓ Media-Component-Number AVP ➔ suitable value as derived from SDP ✓ one or more Media-Sub-Component AVP ➔ as derived from SDP
6		↯	⇗		**Diameter AA-Answer** ✓ Result-Code AVP ➔ DIAMETER_SUCCESS(2001) ✓ Acceptable-Service-Info AVP ✓ Media-Component-Description AVP ➔ similar value to what was requested in Diameter AA-Request ✓ IP-CAN-Type AVP ✓ RAT-Type AVP
7	⇖		⇙		**SIP 2xx Response** ✓ Body ➔ SDP answer
8	↯			⇗	**Session Media from UE A to UE B** ⇗ delivered to UE B
9	⇖			⇙	**Session Media from UE B to UE A** ⇖ delivered to UE A

6.3.1.2 Terminating Leg

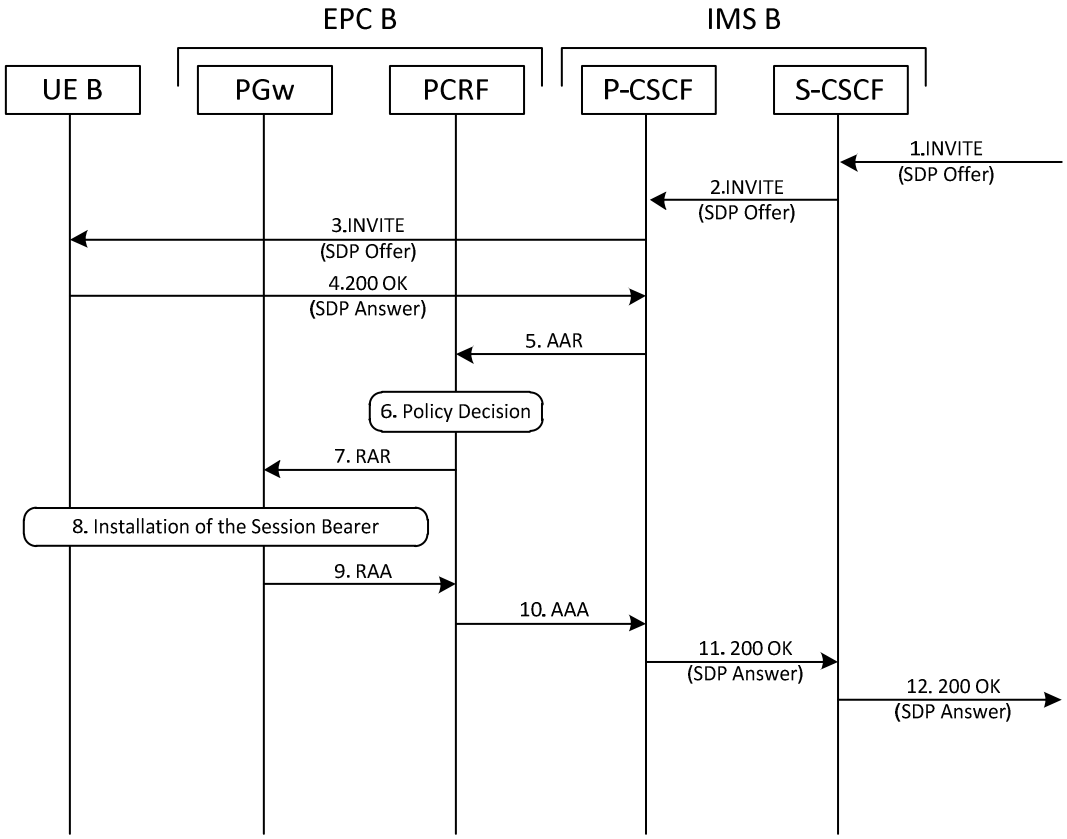

Figure 13: SIP Session Establishment - Terminating Leg

Test Purpose	
Identifier:	**TP_IMSEPC_Session_Establishment_Terminating**
Summary:	On successful call setup, the P-CSCF should derive from the SDP offer and answer, descriptions of the Service Data Flow. These are pushed towards EPC as request for creation of adequate bearers. EPC creates based on the EPC's operator policies the bearers for media. When transporting media, the EPC will employ the respective bearer's characteristics. Media transport is possible only after the successful establishment of the session.
Config.:	CF_IMSEPC
IUT Role:	IMS, EPC
Ref:	TS 124 229 [2], clause 5.2.7.3 (Initial INVITE / Terminating Case) TS 129 214 [5], clause 4.4.1 (Initial Provisioning of Session Information) TS 129 214 [5], clause A.1 (Provision of Service Information at the P-CSCF) TS 129 214 [5], clause A.2 (Enabling of IP Flows) TS 129 214 [5], annex B (Flow identifiers: Format definition and examples)

	Entities				Condition
	UE B	**EPC**	**IMS**	**UE A**	
	✓	✓			UE B attached to EPC and pre-provisioned a default bearer for enabling communication between UE B and IMS
	✓		✓		UE B registered in IMS
		✓	✓		An IMS signalling bearer established between IMS and EPC for the UE B

	UE B	**EPC**	**IMS**	**UE A**	
Step	**Direction**				**Message**
1	↯	×		‖⇗	**Session Media from UE B to UE A** ‖⇗ not delivered to UE A
2	⇦‖	×		⇗	**Session Media from UE A to UE B** ⇦‖ not delivered to UE B
3	⇦			⇗	**SIP INVITE Request** ✓ Body ➔ SDP offer
4	↯		⇗		**SIP 2xx Response** ✓ Body ➔ SDP answer
5		⇦	⇗		**Diameter AA-Request** ✓ Framed-IP-Address AVP or Framed-IPv6-Prefix AVP ➔ UE IP ✓ one or more Media-Component-Description AVP ✓ Media-Component-Number AVP ➔ suitable value as derived from SDP ✓ one or more Media-Sub-Component AVP ➔ as derived from SDP
6		↯	⇗		**Diameter AA-Answer** ✓ Result-Code AVP ➔ DIAMETER_SUCCESS(2001) ✓ Acceptable-Service-Info AVP ✓ Media-Component-Description AVP ➔ similar value to what was requested in Diameter AA-Request ✓ IP-CAN-Type AVP ✓ RAT-Type AVP
7			↯	⇗	**SIP 2xx Response** ✓ Body ➔ SDP answer
8	↯			⇗	**Session Media from UE B to UE A** ⇗ delivered to UE A
9	⇦			⇗	**Session Media from UE A to UE B** ⇦ delivered to UE B

6.3.2 SIP Session Modification

There are multiple reasons for session modifications, like for example adding or removing video to an audio call. For exemplification, here we will consider the simple case of a Call-Hold scenario, for muting the audio stream. Additional scenarios can be built and presented in the Test Descriptions.

The test assumes that the UE A/B have been previously attached to EPC and registered to IMS. A call has been successfully established, and both audio and video media are flowing.

The test procedure will follow the Call-Hold procedures, removing the audio media from the call.

The test will verify that:

1) The P-CSCF will act on successful call session modification and trigger modification of call bearer.

2) The EPC will modify the call's media bearers accordingly.

3) Audio media will not be transported after the session modification. Tests will continue transmitting audio media after the session modification and verify that the default EPC gating policy of "Deny" will stop (only) the audio media.

6.3.2.1 Originating Leg

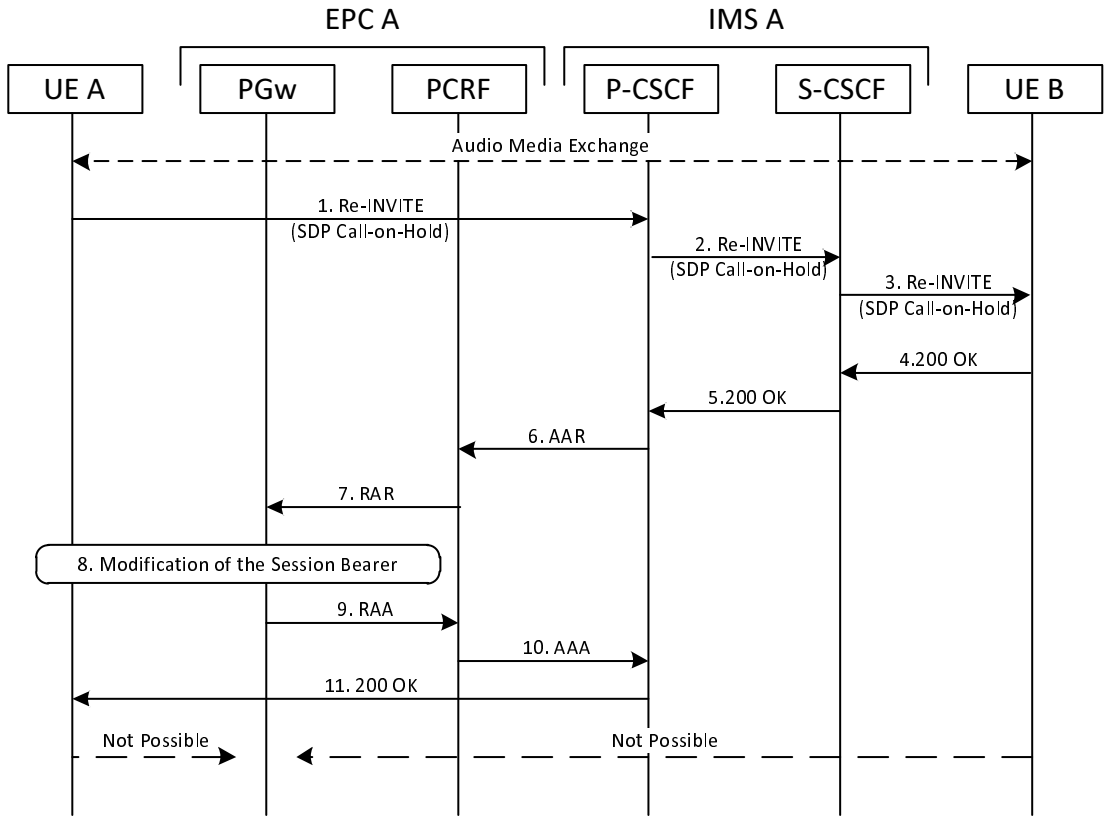

Figure 14: SIP Session Modification - Originating Leg

Test Purpose	
Identifier:	**TP_IMSEPC_Session_Modification_Originating**
Summary:	On successful call hold, the P-CSCF should derive from the SDP offer and answer, updates for the Service Data Flows. These are pushed towards EPC as request for modification of the previously created bearers. EPC modifies, based on the EPC's operator policies, the bearers for media. When transporting media, the EPC will employ the respective bearer's characteristics. Media transport is possible, after the successful modification of the session, only on the remaining active Service Data Flows.
Config.:	CF_IMSEPC
IUT Role:	IMS, EPC
Ref:	TS 124 229 [2], clause 5.2.9.1 (Subsequent requests / UE-originating Case) TS 129 214 [5], clause 4.4.2 (Modification of Session Bearers) TS 129 214 [5], clause A.1 (Provision of Service Information at the P-CSCF) TS 129 214 [5], clause A.2 (Enabling of IP Flows) TS 129 214 [5], annex B (Flow identifiers: Format definition and examples)

	Entities				Condition
	UE A	**EPC**	**IMS**	**UE B**	
	✓	✓			UE A attached to EPC and pre-provisioned a default bearer for enabling communication between UE A and IMS
	✓		✓		UE A registered in IMS
		✓	✓		An IMS signalling bearer established between IMS and EPC for UE A
	✓	✓	✓	✓	An IMS call/session established between UE A and UE B, with 2 media components - audio and video

	UE A	**EPC**	**IMS**	**UE B**	
Step	**Direction**				**Message**
1	↯			⇗	**Session Audio Media from UE A to UE B** ⇗ delivered to UE B
2	⇖			↯	**Session Audio Media from UE B to UE A** ⇖ delivered to UE A
3	↯		⇗↯	⇗	**SIP re-INVITE Request** ✓ Body ➔ SDP update for removing audio
4				⇖↯	**SIP 2xx Response** ✓ Body ➔ SDP update answer
5		⇖	↯		**Diameter AA-Request** ✓ Framed-IP-Address AVP or Framed-IPv6-Prefix AVP ➔ UE IP ✓ one or more Media-Component-Description AVP ✓ Media-Component-Number AVP ➔ suitable value as derived from SDP ✓ one or more Media-Sub-Component AVP ➔ as derived from SDP
6		↯	⇗		**Diameter AA-Answer** ✓ Result-Code AVP ➔ DIAMETER_SUCCESS(2001) ✓ Acceptable-Service-Info AVP ✓ Media-Component-Description AVP ➔ similar value to what was requested in Diameter AA-Request ✓ IP-CAN-Type AVP ✓ RAT-Type AVP
7	⇖		↯		**SIP 2xx Response** ✓ Body ➔ SDP update answer
8	↯	×		‖⇗	**Session Audio Media from UE A to UE B** ‖⇗ not delivered to UE B
9	⇖‖	×		↯	**Session Audio Media from UE B to UE A** ⇖‖ not delivered to UE A

6.3.2.2 Terminating Leg

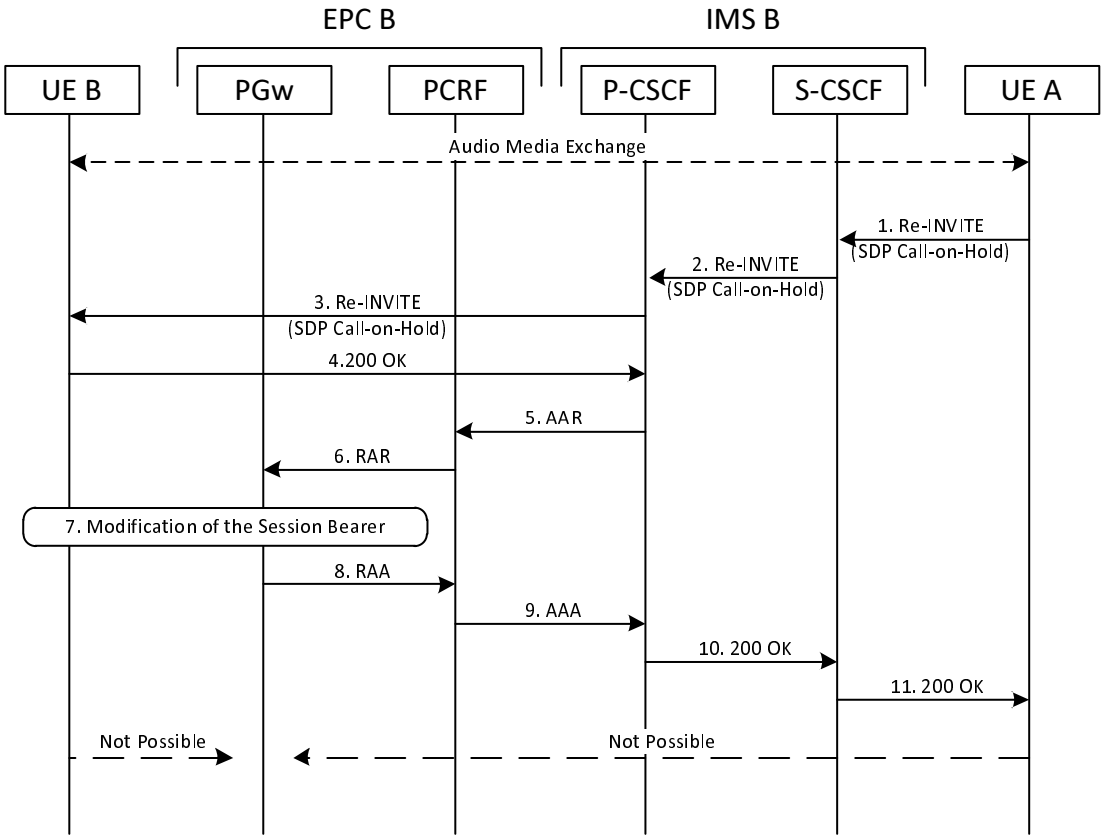

Figure 15: SIP Session Modification - Terminating Leg

Test Purpose	
Identifier:	**TP_IMSEPC_Session_Modification_Terminating**
Summary:	On successful call hold, the P-CSCF should derive from the SDP offer and answer, updates for the Service Data Flows. These are pushed towards EPC as request for modification of the previously created bearers. EPC modifies, based on the EPC's operator policies, the bearers for media. When transporting media, the EPC will employ the respective bearer's characteristics. Media transport is possible, after the successful modification of the session, only on the remaining active Service Data Flows
Config.:	CF_IMSEPC
IUT Role:	IMS, EPC
Ref:	TS 124 229 [2], clause 5.2.9.2 (Subsequent requests / UE-terminating Case) TS 129 214 [5], clause 4.4.2 (Modification of Session Bearers) TS 129 214 [5], clause A.1 (Provision of Service Information at the P-CSCF) TS 129 214 [5], clause A.2 (Enabling of IP Flows) TS 129 214 [5], annex B (Flow identifiers: Format definition and examples)

	Entities				Condition
	UE B	**EPC**	**IMS**	**UE A**	
	✓	✓			UE B attached to EPC and pre-provisioned a default bearer for enabling communication between UE B and IMS
	✓		✓		UE A registered in IMS
		✓	✓		An IMS signalling bearer established between IMS and EPC for UE B
	✓	✓	✓	✓	An IMS call/session established between UE B and UE A, with 2 media components - audio and video

	UE B	**EPC**	**IMS**	**UE A**	
Step	**Direction**				**Message**
1	🡸			🡺	**Session Audio Media from UE B to UE A** 🡺 delivered to UE A
2	🡺			🡸	**Session Audio Media from UE A to UE B** 🡺 delivered to UE B
3	🡺			🡸	**SIP re-INVITE Request** ✓ Body ➔ SDP update for removing audio
4	🡸		🡺		**SIP 2xx Response** ✓ Body ➔ SDP update answer
5		🡺	🡸		**Diameter AA-Request** ✓ Session-Id AVP ➔ respective Rx session attached to this SIP session ✓ Framed-IP-Address AVP or Framed-IPv6-Prefix AVP ➔ UE IP ✓ one or more Media-Component-Description AVP ✓ Media-Component-Number AVP ➔ suitable value as derived from SDP ✓ one or more Media-Sub-Component AVP ➔ as derived from SDP
6		🡸	🡺		**Diameter AA-Answer** ✓ Session-Id AVP ➔ respective Rx session attached to this SIP session ✓ Result-Code AVP ➔ DIAMETER_SUCCESS(2001) ✓ Acceptable-Service-Info AVP ✓ Media-Component-Description AVP ➔ similar value to what was requested in Diameter AA-Request ✓ IP-CAN-Type AVP ✓ RAT-Type AVP
7			🡸	🡺	**SIP 2xx Response** ✓ Body ➔ SDP update answer
8	🡸	×		‖🡺	**Session Audio Media from UE B to UE A** ‖🡺 not delivered to UE A
9	🡺‖	×		🡸	**Session Audio Media from UE A to UE B** 🡺‖ not delivered to UE B

6.3.3 SIP Session Release

This Use Case follows the removal of the session bearers during the normal release procedures of an already established session.

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

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

The test will verify that:

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

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

3) Audio 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.

6.3.3.1 Originating Leg

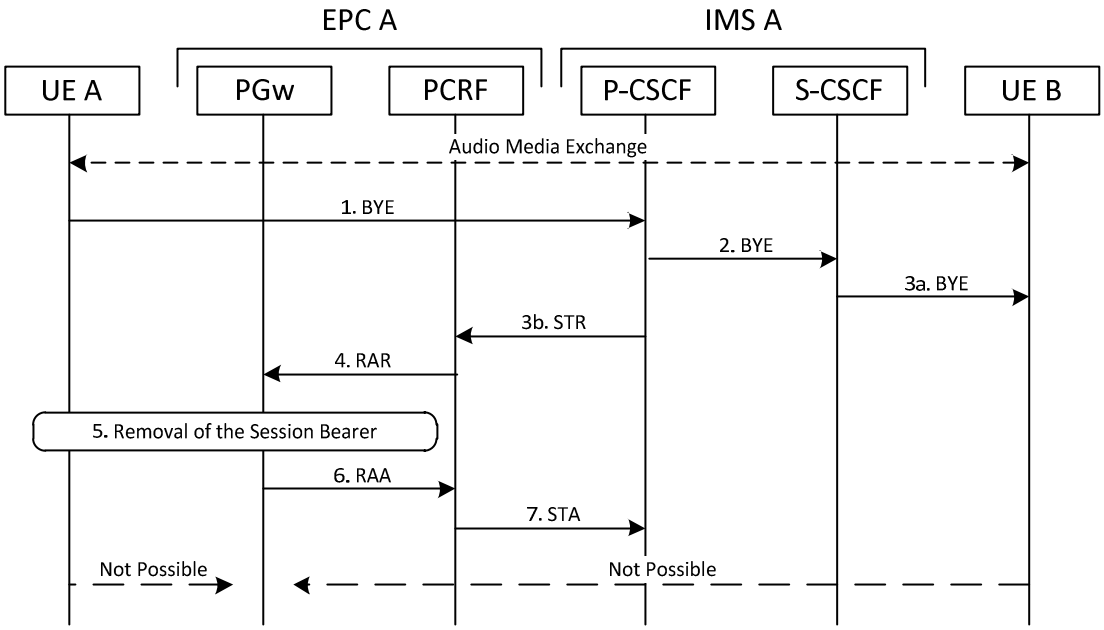

Figure 16: SIP Session Tear-down - Originating Leg

Test Purpose	
Identifier:	**TP_IMSEPC_Session_Release_Originating**
Summary:	On call release, the P-CSCF should trigger the removal of all relevant previously created bearers. EPC removes the bearers for media. Media transport is no longer possible, after the session release.
Config.:	CF_IMSEPC
IUT Role:	IMS, EPC
Ref:	TS 124 229 [2], clause 5.2.8.2 (Call release initiated by any other entity) TS 129 214 [5], clause 4.4.4 (AF Session Termination)

	Entities				Condition
	UE A	**EPC**	**IMS**	**UE B**	
	✓	✓			UE A attached to EPC and pre-provisioned a default bearer for enabling communication between UE A and IMS
	✓		✓		UE A registered in IMS
		✓	✓		An IMS signalling bearer established between IMS and EPC for UE A
	✓	✓	✓	✓	An IMS call/session established between UE A and UE B
	UE A	**EPC**	**IMS**	**UE B**	
Step	**Direction**				**Message**
1	↯			⇗	**Session Media from UE A to UE B** ⇗ delivered to UE B
2	⇦			↯	**Session Media from UE B to UE A** ⇦ delivered to UE A
3	⇦		↯⇦	↯	**SIP BYE Request**
5		⇦	↯		**Diameter Session-Termination-Request** ✓ Session-Id AVP ➔ respective Rx session attached to this SIP session
6		↯	⇗		**Diameter Session-Termination-Answer** ✓ Session-Id AVP ➔ respective Rx session attached to this SIP session ✓ Result-Code AVP ➔ DIAMETER_SUCCESS(2001)
7	↯	×		‖⇗	**Session Media from UE A to UE B** ‖⇗ not delivered to UE B
8	⇦‖	×		↯	**Session Audio Media from UE B to UE A** ⇦‖ not delivered to UE A

6.3.3.2 Terminating Leg

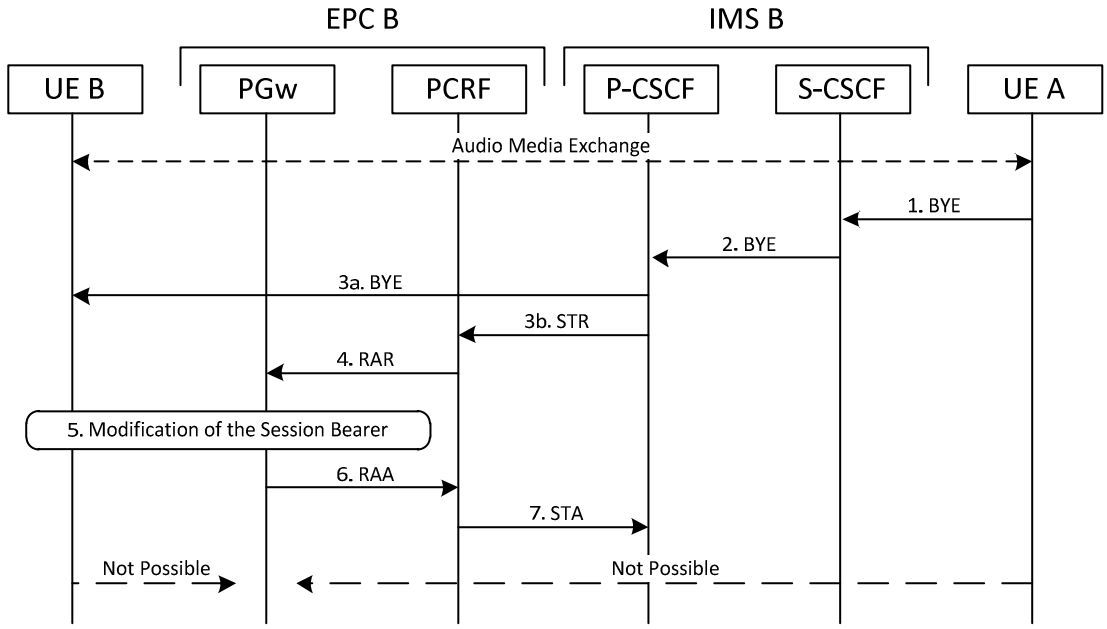

Figure 17: SIP Session Tear-down - Terminating Leg

Test Purpose	
Identifier:	**TP_IMSEPC_Session_Release_Terminating**
Summary:	On call release, the P-CSCF should trigger the removal of all relevant previously created bearers. EPC removes the bearers for media. Media transport is no longer possible, after the session release.
Config.:	CF_IMSEPC
IUT Role:	IMS, EPC
Ref:	TS 124 229 [2], clause 5.2.8.2 (Call release initiated by any other entity) TS 129 214 [5], clause 4.4.4 (AF Session Termination)

	Entities				Condition
	UE B	**EPC**	**IMS**	**UE A**	
	✓	✓			UE A attached to EPC and pre-provisioned a default bearer for enabling communication between UE B and IMS
	✓		✓		UE A registered in IMS
		✓	✓		An IMS signalling bearer established between IMS and EPC for UE B
	✓	✓	✓	✓	An IMS call/session established between UE B and UE A
	UE B	**EPC**	**IMS**	**UE A**	
Step	**Direction**				**Message**
1	↯			⇗	**Session Audio Media from UE B to UE A** ⇗ delivered to UE A
2	⇜			↯	**Session Audio Media from UE A to UE B** ⇜ delivered to UE B
3	⇜		↯⇜	↯	**SIP BYE Request**
4		⇜	↯		**Diameter Session-Termination-Request** ✓ Session-Id AVP ➔ respective Rx session attached to this SIP session
5		↯	⇗		**Diameter Session-Termination-Answer** ✓ Session-Id AVP ➔ respective Rx session attached to this SIP session ✓ Result-Code AVP ➔ DIAMETER_SUCCESS(2001)
6	↯	×		‖⇗	**Session Audio Media from UE B to UE A** ‖⇗ not delivered to UE A
7	⇜‖	×		↯	**Session Audio Media from UE A to UE B** ⇜‖ not delivered to UE B

6.3.4 SIP Session Abort/Reject

This Use Case follows the unsuccessful session setup. Either the call is aborted in the originating side or rejected in the terminating side.

The test assumes that the UE A/B has been previously attached to EPC and registered to IMS.

The test procedure will follow the initiation of a session. Early-Media can be established optionally, as result of a 180 Ringing response, based on the individual test configuration. Following Call Abort or respectively Call Reject procedures, if bearers for early-media were established, they will be terminated.

The test will verify that:

1) Only early-media will be transported during the session establishment phase.

2) The P-CSCF will act on call abort/reject and trigger release of the optionally established early-media bearer.

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

6.3.4.1 SIP Session Abort

6.3.4.1.1 Originating Case

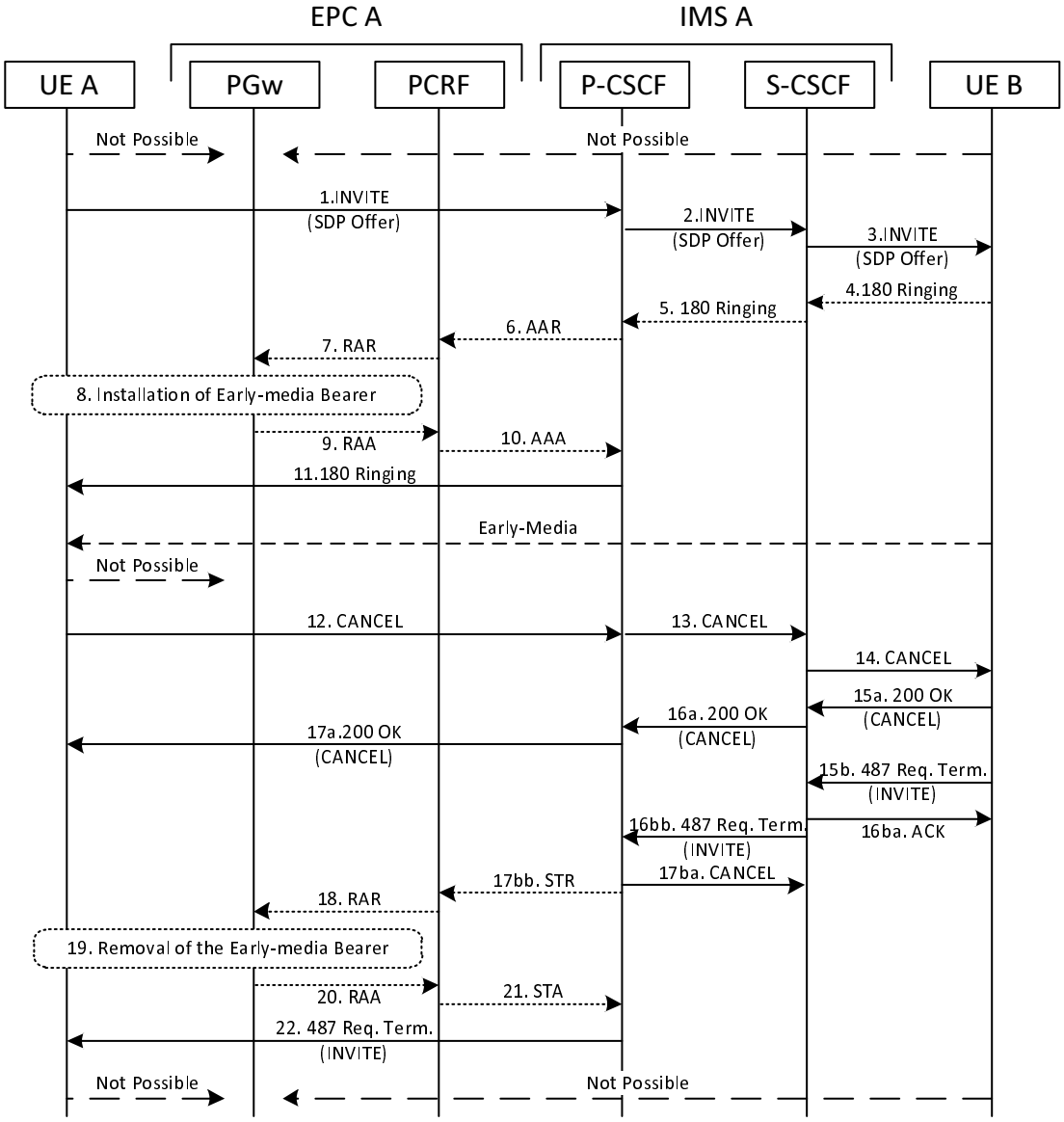

Figure 18: SIP Session Abort - Originating Leg

Test Purpose	
Identifier:	**TP_IMSEPC_Session_Abort_Originating**
Summary:	On session abort, the P-CSCF should trigger the removal of all relevant previously created early-media bearers. EPC removes the bearers for early-media. Media transport is no longer possible, after the session abort.
Config.:	CF_IMSEPC
IUT Role:	IMS, EPC
Ref:	TS 124 229 [2], clause 5.2.7.2 (Initial INVITE / Originating Case) No better section found TS 129 214 [5], clause 4.4.4 (AF Session Termination)

	Entities				Condition
	UE A	**EPC**	**IMS**	**UE B**	
	✓	✓			UE A attached to EPC and pre-provisioned a default bearer for enabling communication between UE A and IMS
	✓		✓		UE A registered in IMS
		✓	✓		An IMS signalling bearer established between IMS and EPC for UE A

	UE A	**EPC**	**IMS**	**UE B**	
Step	**Direction**				**Message**
1	→	×		→||	**Session Media from UE A to UE B** →|| not delivered to UE B
2	←||	×		←	**Session Media from UE B to UE A** ←|| not delivered to UE A
3	→		→→	→	**SIP INVITE Request** ✓ Body ➔ SDP offer
4			←	←	**SIP 180 Ringing Response** ✓ Body ➔ SDP answer Early Media
5		←	←		**Diameter AA-Request** ✓ Framed-IP-Address AVP or Framed-IPv6-Prefix AVP ➔ UE IP ✓ one or more Media-Component-Description AVP ✓ Media-Component-Number AVP ➔ suitable value as derived from SDP ✓ one or more Media-Sub-Component AVP ➔ as derived from SDP
6		→	→		**Diameter AA-Answer** ✓ Result-Code AVP ➔ DIAMETER_SUCCESS(2001) ✓ Acceptable-Service-Info AVP ✓ Media-Component-Description AVP ➔ similar value to what was requested in Diameter AA-Request ✓ IP-CAN-Type AVP ✓ RAT-Type AVP
7	←		←		**SIP 180 Ringing Response** ✓ Body ➔ SDP answer Early media
8	←			←	**Session Early-Media from UE B to UE A** ← delivered to UE A
9	→		→→	→	**SIP CANCEL Request**
10	←		←←	←	**SIP 200 OK Response (CANCEL)**
11			←	←	**SIP 487 Request Terminated (INVITE)**
12			→	→	**SIP ACK Request**
13		←	←		**Diameter Session-Termination-Request** ✓ Session-Id AVP ➔ respective Rx session attached to this SIP session
14		→	→		**Diameter Session-Termination-Answer** ✓ Session-Id AVP ➔ respective Rx session attached to this SIP session ✓ Result-Code AVP ➔ DIAMETER_SUCCESS(2001)
15	←		←		**SIP 487 Request Terminated (INVITE)**
16	→		→		**SIP ACK Request**
17	←||	×		←	**Session Early-Media from UE B to UE A** ||→ not delivered to UE A

6.3.4.1.2 Terminating Leg

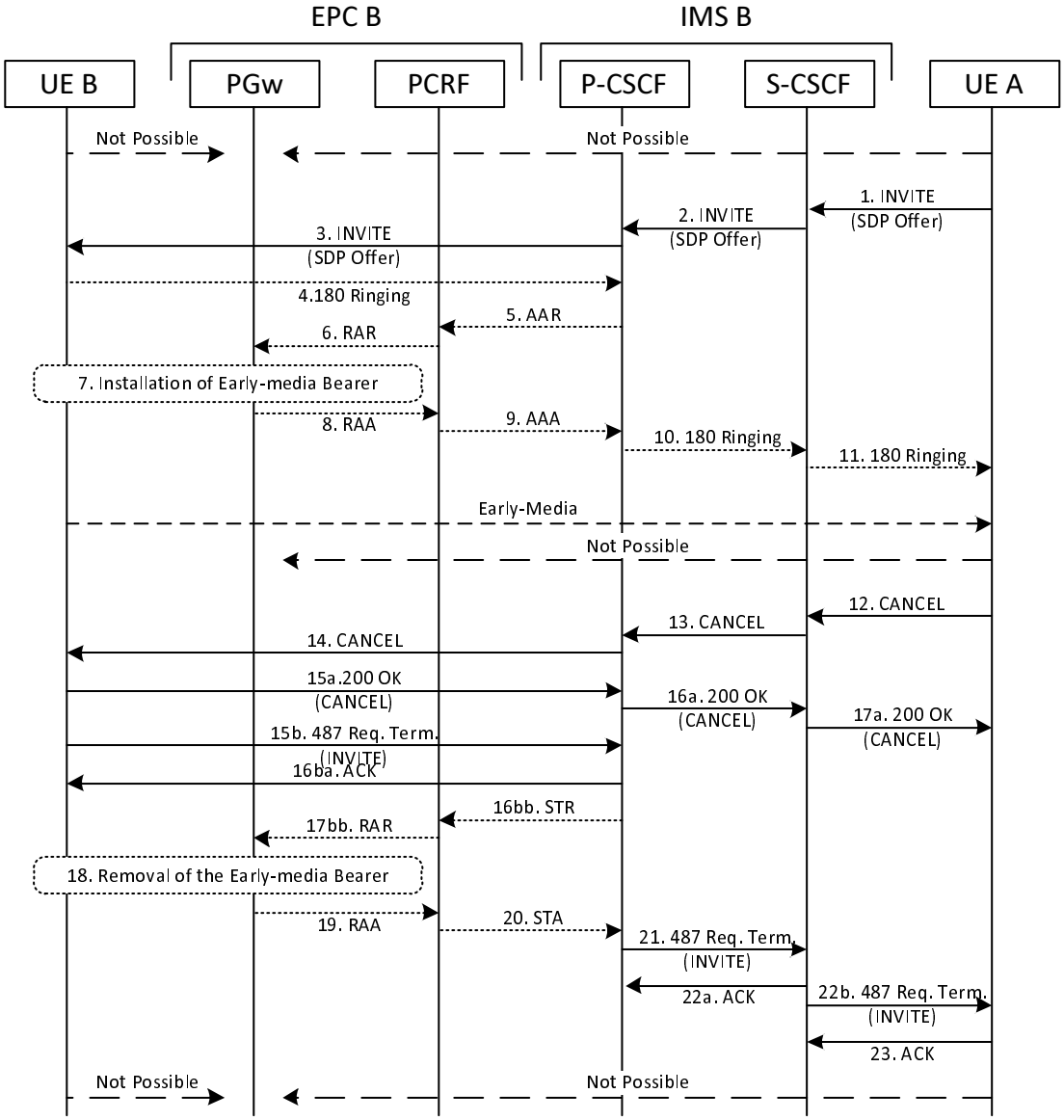

Figure 19: SIP Session Abort - Terminating Leg

Test Purpose	
Identifier:	**TP_IMSEPC_Session_Abort_Terminating**
Summary:	On session abort, the P-CSCF should trigger the removal of all relevant previously created early-media bearers. EPC removes the bearers for early-media. Media transport is no longer possible, after the session abort.
Config.:	CF_IMSEPC
IUT Role:	IMS, EPC
Ref:	TS 124 229 [2], clause 5.2.7.3 (Initial INVITE / Terminating Case) No better section found TS 129 214 [5], clause 4.4.4 (AF Session Termination)

	Entities				Condition
	UE B	**EPC**	**IMS**	**UE A**	
	✓	✓			UE B attached to EPC and pre-provisioned a default bearer for enabling communication between UE A and IMS
	✓		✓		UE B registered in IMS
		✓	✓		An IMS signalling bearer established between IMS and EPC for UE B

	UE B	**EPC**	**IMS**	**UE A**	
Step	**Direction**				**Message**
1	→	×		‖→	**Session Media from UE B to UE A** ‖→ not delivered to UE A
2	←‖	×		←	**Session Media from UE A to UE B** ←‖ not delivered to UE B
3	←		←←	←	**SIP INVITE Request** ✓ Body ➔ SDP offer
4	→		→		**SIP 180 Ringing Response** ✓ Body ➔ SDP answer Early Media
5		←	←		**Diameter AA-Request** ✓ Framed-IP-Address AVP or Framed-IPv6-Prefix AVP ➔ UE IP ✓ one or more Media-Component-Description AVP ✓ Media-Component-Number AVP ➔ suitable value as derived from SDP ✓ one or more Media-Sub-Component AVP ➔ as derived from SDP
6		→	→		**Diameter AA-Answer** ✓ Result-Code AVP ➔ DIAMETER_SUCCESS(2001) ✓ Acceptable-Service-Info AVP ✓ Media-Component-Description AVP ➔ similar value to what was requested in Diameter AA-Request ✓ IP-CAN-Type AVP ✓ RAT-Type AVP
7			→	→	**SIP 180 Ringing Response** ✓ Body ➔ SDP answer Early media
8	→			→	**Session Early-Media from UE B to UE A** → delivered to UE A
9	←		←←	←	**SIP CANCEL Request**
10	→		→→	→	**SIP 200 OK Response (CANCEL)**
11	→		→		**SIP 487 Request Terminated (INVITE)**
12	←		←		**SIP ACK Request**
13		←	←		**Diameter Session-Termination-Request** ✓ Session-Id AVP ➔ respective Rx session attached to this SIP session
14		→	→		**Diameter Session-Termination-Answer** ✓ Session-Id AVP ➔ respective Rx session attached to this SIP session ✓ Result-Code AVP ➔ DIAMETER_SUCCESS(2001)
15			→	→	**SIP 487 Request Terminated (INVITE)**
16			←	←	**SIP ACK Request**
17	→	×		‖→	**Session Early-Media from UE B to UE A** ‖→ not delivered to UE A

6.3.4.2 SIP Session Reject

6.3.4.2.1 Originating Case

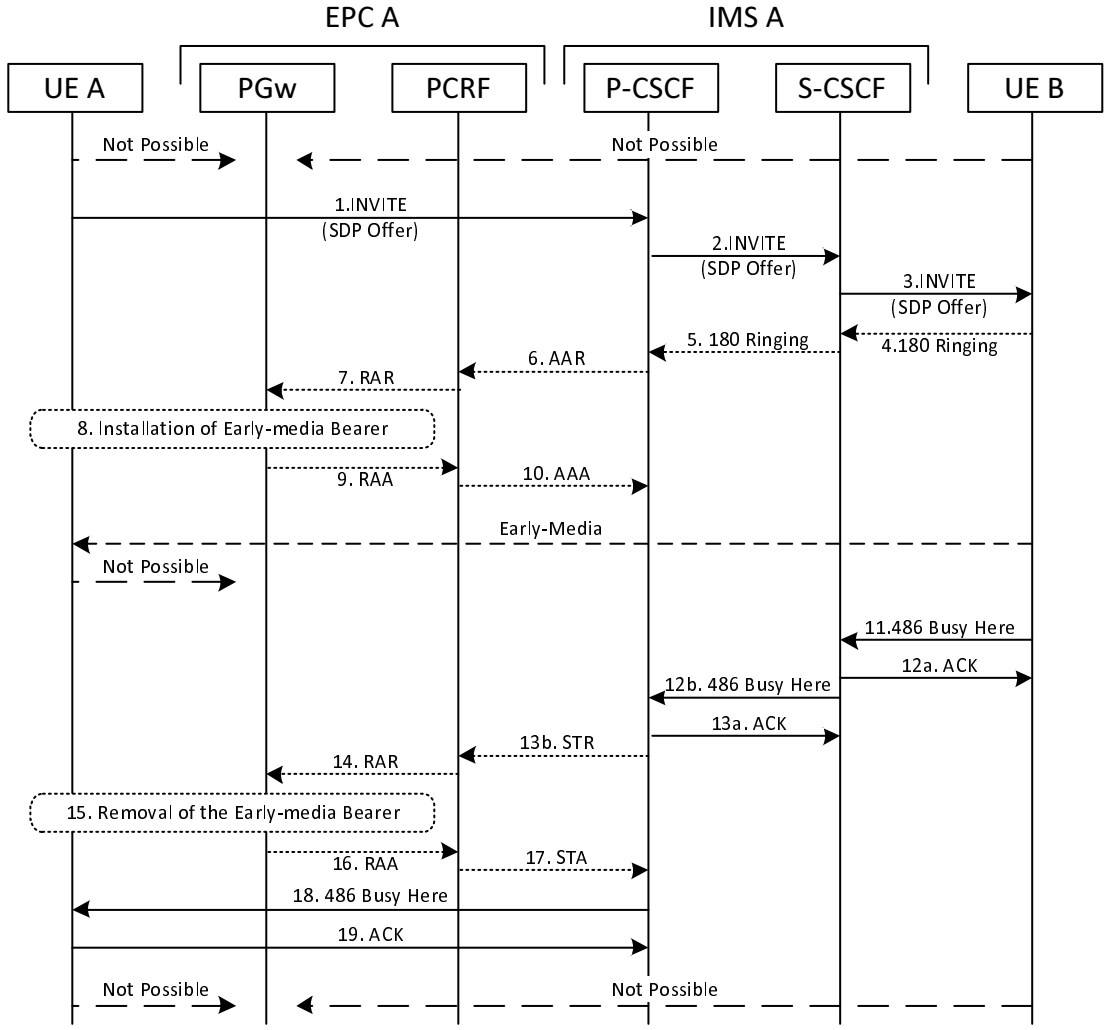

Figure 20: SIP Session Reject - Originating Leg

Test Purpose	
Identifier:	**TP_IMSEPC_Session_Reject _Originating**
Summary:	On session reject, the P-CSCF should trigger the removal of all relevant previously created early-media bearers. EPC removes the bearers for early-media. Media transport is no longer possible, after the session reject.
Config.:	CF_IMSEPC
IUT Role:	IMS, EPC
Ref:	TS 124 229 [2], clause 5.2.7.2 (Initial INVITE / Originating Case) No better section found TS 129 214 [5], clause 4.4.4 (AF Session Termination)

	Entities				Condition
	UE A	**EPC**	**IMS**	**UE B**	
	✓	✓			UE A attached to EPC and pre-provisioned a default bearer for enabling communication between UE A and IMS
	✓		✓		UE A registered in IMS
		✓	✓		An IMS signalling bearer established between IMS and EPC for UE A

	UE A	**EPC**	**IMS**	**UE B**	
Step	**Direction**				**Message**
1	→	×		||→	**Session Media from UE A to UE B** ||→ not delivered to UE B
2	←||	×		←	**Session Media from UE B to UE A** ←|| not delivered to UE A
3	→		→→	→	**SIP INVITE Request** ✓ Body ➔ SDP offer
4			←	←	**SIP 180 Ringing Response** ✓ Body ➔ SDP answer Early Media
5		←	←		**Diameter AA-Request** ✓ Framed-IP-Address AVP or Framed-IPv6-Prefix AVP ➔ UE IP ✓ one or more Media-Component-Description AVP ✓ Media-Component-Number AVP ➔ suitable value as derived from SDP ✓ one or more Media-Sub-Component AVP ➔ as derived from SDP
6		→	→		**Diameter AA-Answer** ✓ Result-Code AVP ➔ DIAMETER_SUCCESS(2001) ✓ Acceptable-Service-Info AVP ✓ Media-Component-Description AVP ➔ similar value to what was requested in Diameter AA-Request ✓ IP-CAN-Type AVP ✓ RAT-Type AVP
7	←		←		**SIP 180 Ringing Response** ✓ Body ➔ SDP answer Early media
8	←			←	**Session Early-Media from UE B to UE A** ← delivered to UE A
9			←	←	**SIP 486 Busy Here Response**
10			→	→	**SIP ACK Request**
11		←	←		**Diameter Session-Termination-Request** ✓ Session-Id AVP ➔ respective Rx session attached to this SIP session
12		→	→		**Diameter Session-Termination-Answer** ✓ Session-Id AVP ➔ respective Rx session attached to this SIP session ✓ Result-Code AVP ➔ DIAMETER_SUCCESS(2001)
13	←		←		**SIP 486 Busy Here Request**
14	→		→		**SIP ACK Request**
15	←||	×		←	**Session Early-Media from UE B to UE A** ||→ not delivered to UE A

6.3.4.2.2 Terminating Leg

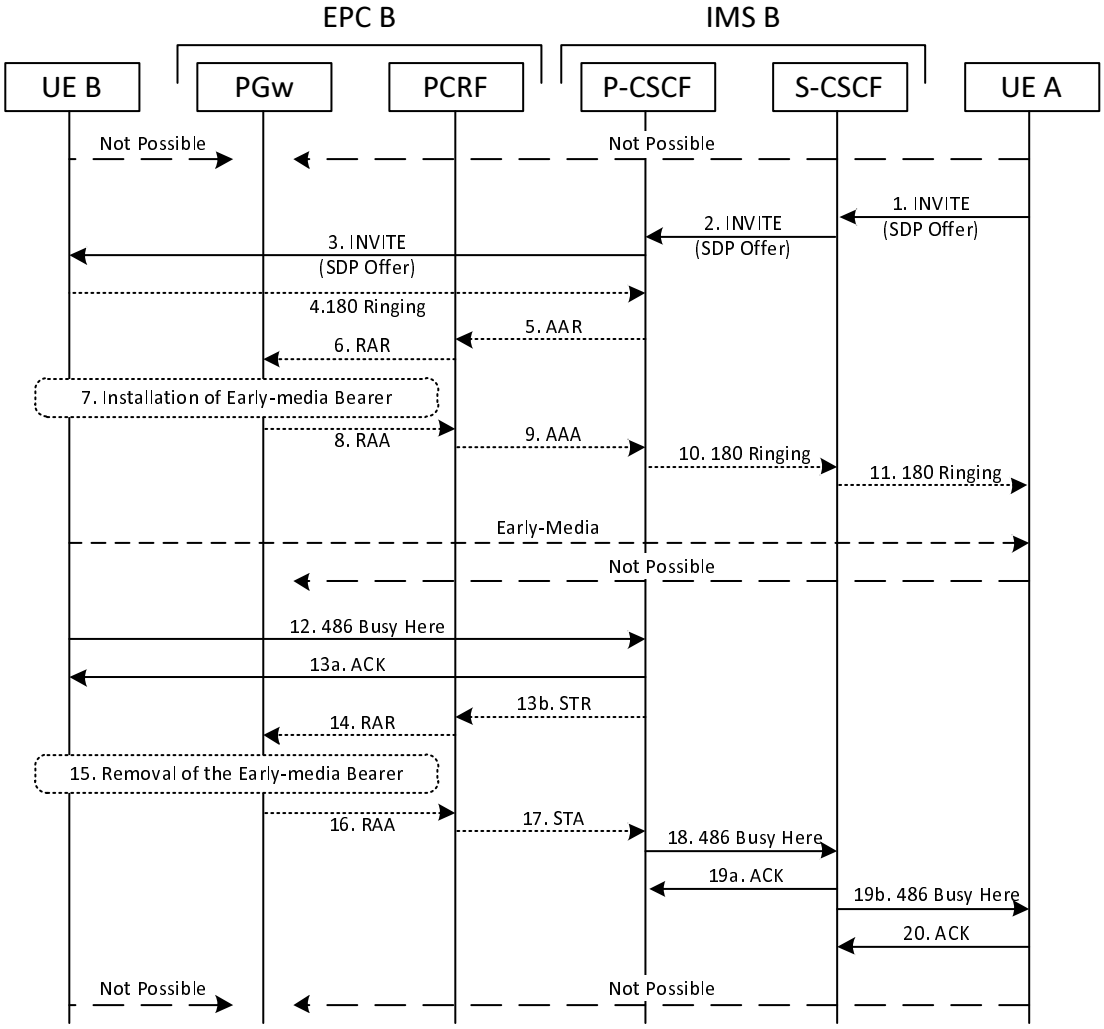

Figure 21: SIP Session Reject - Terminating Leg

Test Purpose	
Identifier:	**TP_IMSEPC_Session_Reject _Terminating**
Summary:	On session reject, the P-CSCF should trigger the removal of all relevant previously created early-media bearers. EPC removes the bearers for early-media. Media transport is no longer possible, after the session abort.
Config.:	CF_IMSEPC
IUT Role:	IMS, EPC
Ref:	TS 124 229 [2], clause 5.2.7.3 (Initial INVITE / Terminating Case) No better section found TS 129 214 [5], clause 4.4.4 (AF Session Termination)

	Entities				Condition
	UE B	**EPC**	**IMS**	**UE A**	
	✓	✓			UE B attached to EPC and pre-provisioned a default bearer for enabling communication between UE A and IMS
	✓		✓		UE B registered in IMS
		✓	✓		An IMS signalling bearer established between IMS and EPC for UE B

	UE B	**EPC**	**IMS**	**UE A**	
Step	**Direction**				**Message**
1	→	×		→||	**Session Media from UE B to UE A** →|| not delivered to UE A
2	←||	×		←	**Session Media from UE A to UE B** ←|| not delivered to UE B
3	←		←	←	**SIP INVITE Request** ✓ Body ➔ SDP offer
4	→		→		**SIP 180 Ringing Response** ✓ Body ➔ SDP answer Early Media
5		←	←		**Diameter AA-Request** ✓ Framed-IP-Address AVP or Framed-IPv6-Prefix AVP ➔ UE IP ✓ one or more Media-Component-Description AVP ✓ Media-Component-Number AVP ➔ suitable value as derived from SDP ✓ one or more Media-Sub-Component AVP ➔ as derived from SDP
6		→	→		**Diameter AA-Answer** ✓ Result-Code AVP ➔ DIAMETER_SUCCESS(2001) ✓ Acceptable-Service-Info AVP ✓ Media-Component-Description AVP ➔ similar value to what was requested in Diameter AA-Request ✓ IP-CAN-Type AVP ✓ RAT-Type AVP
7			→	→	**SIP 180 Ringing Response** ✓ Body ➔ SDP answer Early media
8	→			→	**Session Early-Media from UE B to UE A** → delivered to UE A
9	→		→		**SIP 486 Busy Here Response**
10	←		←		**SIP ACK Request**
11		←	←		**Diameter Session-Termination-Request** ✓ Session-Id AVP ➔ respective Rx session attached to this SIP session
12		→	→		**Diameter Session-Termination-Answer** ✓ Session-Id AVP ➔ respective Rx session attached to this SIP session ✓ Result-Code AVP ➔ DIAMETER_SUCCESS(2001)
13			→	→	**SIP 486 Busy Here Response**
14			←	←	**SIP ACK Request**
15	→	×		→||	**Session Early-Media from UE B to UE A** →|| not delivered to UE B

6.3.5 EPC Initiated Bearer Modification

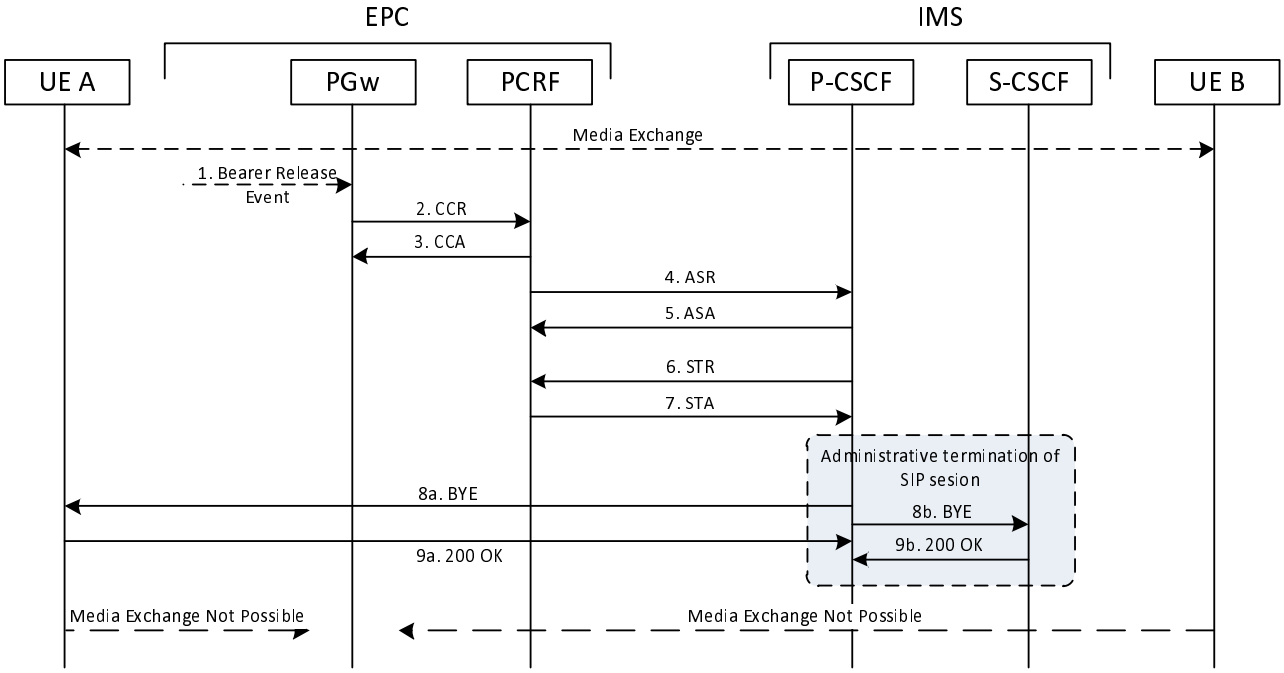

Figure 22: EPC Initiated Bearer Modification

This Use Case follows the EPC initiated modification of bearers for a session. All bearers for a given established session will be removed, which will trigger an administrative termination of the SIP session.

The test assumes that the UE has been previously attached to EPC and registered to IMS. Also UE A will be involved in an active SIP session with UE B.

The test procedure will follow a bearer release operation. The P-CSCF will be informed that, as no bearers are left or are no longer available for the session, the Rx session will be aborted. The P-CSCF will trigger an administrative termination of the related SIP session.

The test will verify that:

1) The P-CSCF will act on Rx session abort and administratively terminate the SIP session.

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

Test Purpose	
Identifier:	**TP_IMSEPC_Bearer_Modification**
Summary:	On removal of all bearers, EPC PCRF will notify IMS P-CSCF that Rx session should be aborted. IMS will take action and terminate all ongoing SIP sessions and the IMS registration.
Config.:	CF_IMSEPC
IUT Role:	IMS, EPC
Ref:	TS 129 214 [5], clause 4.4.6.1 (IP-CAN Session Termination) TS 124 229 [2], clause 5.2.8.1.2 (P-CSCF-initiated call release / Release of an existing session)

	Entities				Condition
	UE A	**EPC**	**IMS**	**UE B**	
	✓	✓			UE A attached to EPC and pre-provisioned a default bearer for enabling communication between UE A and IMS
	✓		✓		UE A registered in IMS
		✓	✓		An IMS signalling bearer established between IMS and EPC for UE A
	✓	✓	✓	✓	An IMS call/session established between UE A and UE B

	UE A	**EPC**	**IMS**	**UE B**	
Step	**Direction**				**Message**
1	↘			↗	**Session Media from UE A to UE B** ↗ delivered to UE B
2	↖			↙	**Session Media from UE B to UE A** ↖ delivered to UE A
3		↘↗			**EPC triggers removal of all bearers related to respective SIP session**
9		↘	↗		**Diameter Abort-Session-Request** ✓ Session-Id AVP ➔ session for active SIP Session ✓ Abort-Cause AVP ➔ BEARER_RELEASED (0)
10		↖	↙		**Diameter Abort-Session-Answer** ✓ Session-Id AVP ➔ session for active SIP Session ✓ Result-Code AVP ➔ DIAMETER_SUCCESS(2001)
11		↖	↙		**Diameter Session-Termination-Request** ✓ Session-Id AVP ➔ session for active SIP session
12		↘	↗		**Diameter Session-Termination-Answer** ✓ Session-Id AVP ➔ session for active SIP session ✓ Result-Code AVP ➔ DIAMETER_SUCCESS(2001)
13	↖		↙		**SIP BYE Request** ✓ Request-URI ➔ stored Contact header field provided UE A ✓ To header ➔ To header field value as received in the 200 (OK) response for initial INVITE request ✓ From header ➔ From header field value as received in initial INVITE request ✓ Call-ID header ➔ Call-Id header field value as received in initial INVITE request ✓ CSeq header ➔ current CSeq value stored for direction from calling to called user, incremented by one ✓ Route header ➔ routeing information towards called user as stored for dialog ✓ Reason header ➔ 503 (Service Unavailable) response code
	↘		↗		**SIP BYE Response**

14					**SIP BYE Request** ✓ Request-URI ➔ stored Contact header field provided by UE B ✓ To header ➔ To header field value as received in the 200 (OK) response for initial INVITE request ✓ From header ➔ From header field value as received in initial INVITE request ✓ Call-ID header ➔ Call-Id header field value as received in initial INVITE request ✓ CSeq header ➔ current CSeq value stored for direction from calling to called user, incremented by one ✓ Route header ➔ routeing information towards called user as stored for dialog ✓ Reason header ➔ 503 (Service Unavailable) response code
15					**SIP BYE Response**
16		×			**Session Media from UE A to UE B** || not delivered to UE B
17	||	×			**Session Media from UE B to UE A** || not delivered to UE A

7 Test Descriptions

The Test Descriptions present individual scenario instantiations of the Use Cases, which are no longer abstract, but present a definitive signalling and procedural flow through the test's execution. As a very high number of scenarios can be generated, for all possible outcomes and options of an Use Case, here only the most common scenarios are approached.

Each Test Description can be then reconfigured to test various aspects (e.g. IPv4 and IPv6 IMS registrations). Yet these configurations are to be regarded only as specific to the individual test executions as they should not affect the test descriptions.

7.1 Network Attachment and Default Bearer Operations

7.1.1 Initial Network Attachment and Establishment of the Default Bearer

Interoperability Test Description	
Identifier:	**TD_IMSEPC_Network_Attachment**
Summary:	On successful initial network attachment, the UE should discover the P-CSCF IP address. The EPC will create the Default Bearers which will allow communication only between the UE and the P-CSCF.
Config.:	CF_IMSEPC
SUT:	IMS and EPC
Ref.:	
Use Case Ref.:	**TP_IMSEPC_Network_Attachment**
Pre-test conditions:	• Network attachment credential provisioned in UE_A and EPC • EPC and UE_A provisioned with selectable APN configurations for IPv4, IPv6 or IPv4&IPv6 PDN types • P-CSCF address provisioned in the EPC for the purpose of delivery to UE on attachment • Default Bearer PCRF policies set to allow UE A - P-CSCF communication • Default EPC Gating Policy set to “Deny” • UE_A not attached to network and EPC

Interoperability Test Description		
Test Sequence:	**Step**	
	1	UE A starts initial network attachment to EPC
	2	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
	3	Verify that EPC establishes Default Bearer for allowing UE_A - P-CSCF communication, by starting at UE_A an IMS registration
	4	Verify that arbitrary IP packets from UE_A to arbitrary node UE_B, other than the P-CSCF, are filtered-out by EPC and not visible on PO_SGi
	5	Verify that arbitrary IP packets from UE B sent over PO_SGi to UE_A, are filtered-out by EPC and not visible on PO_UE_A
Conformance Criteria:	**Check**	

	1	TP_EPC_6001_01
		ensure that {
		when { UE_A completes initial network_attachment to EPC }
		then { receives IP_configuration_data
		(containing IPv4_address of UE_A or
		containing IPv6_address of UE_A or
		containing (IPv4_address and IPv6_address) of UE_A)
		containing DNS_information
		containing P-CSCF_information
		(indicating the P-CSCF-IP_address or
		indicating the P-CSCF-FQDN_address)
		}
		}

	2	TP_EPC_6002_01
		ensure that {
		when { UE_A sends REGISTER to IMS_P-CSCF }
		then { IMS_P-CSCF receives REGISTER }
		when { IMS_P-CSCF sends response on REGISTER to UE_A }
		then { UE_A receives response on REGISTER }
		}

	3	TP_EPC_6003_01
		ensure that {
		when { UE_A sends IP_packets to UE_B }
		then { EPC filters the IP_packets }
		then { the IP_packets not visible on PO_SGi }
		when { UE_B sends IP_packets to UE_A }
		then { EPC filters the IP_packets }
		then { the IP_packets not visible on PO_SGi }
		}

7.1.2 Network Detachment with Previously Established IMS Registration and sessions

Interoperability Test Description	
Identifier:	**TD_IMSEPC_Network_Detachment**
Summary:	On complete network detachment, without previous termination of IMS sessions and registration, the EPC informs the IMS about the event. EPC removes all relevant bearers. IMS terminates all the ongoing IMS sessions and the IMS registration.
Configuration:	CF_IMSEPC
SUT:	IMS and EPC
Ref.:	TP_IMSEPC_Network_Attachment
Use Case Ref.:	**TP_IMSEPC_Network_Detachment**
Pre-test conditions:	• UE_A previously attached to EPC with a single attachment • UE_A previously registered to IMS • UE_A previously established SIP session with UE B

Interoperability Test Description		
Test Sequence:	**Step**	
	1	UE_A starts complete network detachment, without previously triggering IMS de-registration; or EPC starts administrative complete network detachment of UE_A.
	2	Verify that EPC removes affected SIP session and IMS signalling bearers
	3	Verify that EPC aborts all affected Rx sessions with IMS
	4	Verify that IMS performs P-CSCF-initiated call release on affected SIP session
	5	Verify that IMS performs P-CSCF-initiated administrative de-registration on affected IMS signalling session
Conformance Criteria:	**Check**	

	1	TP_EPC_6004_01
		ensure that {
		when { UE_A starts_complete_network_detachment from EPC }
		then { EPC_PCRF removes_relevant_bearers }
		then { EPC_PCRF triggers_termination of SIP_session }
		then { EPC_PCRF triggers_termination of IMS_signalling }
		}

	2	TP_EPC_6005_01
		ensure that {
		when { EPC_PCRF triggers_termination of SIP_session }
		then { EPC_PCRF sends Abort-Session-Request to IMS_P-CSCF
		containing Session-Id_AVP
		indicating session of SIP_session
		containing Abort-Cause_AVP
		indicating BEARER_RELEASED (0)
		}
		}

	3	TP_EPC_6006_01
		ensure that {
		when { IMS_P-CSCF receives Abort-Session-Request for SIP_session
		}
		then { IMS_P-CSCF sends Abort-Session-Answer to EPC_PCRF (
		containing Session-Id_AVP
		indicating value_received in Abort-Session-Request
		containing Result-Code_AVP
		indicating DIAMETER_SUCCESS(2001)
		) and
		IMS_P-CSCF sends Session-Termination-Request to EPC_PCRF (
		containing Session-Id_AVP
		indicating value_received in Abort-Session-Request
		) and
		IMS_P-CSCF triggers_call_release
		}
		}

	4	TP_EPC_6005_02
		ensure that {
		when { EPC_PCRF triggers_termination of IMS_signalling }
		then { EPC_PCRF sends Abort-Session-Request to IMS_P-CSCF
		containing Session-Id_AVP
		indicating session of SIP_session
		containing Abort-Cause_AVP
		indicating BEARER_RELEASED (0)
		}
		}

	5	TP_EPC_6006_02
		ensure that {
		when { IMS_P-CSCF receives Abort-Session-Request for
		IMS_signalling }
		then { IMS_P-CSCF sends Abort-Session-Answer to EPC_PCRF (
		containing Session-Id_AVP
		indicating value_received in Abort-Session-Request
		containing Result-Code_AVP
		indicating DIAMETER_SUCCESS(2001)
		) and
		IMS_P-CSCF sends Session-Termination-Request to EPC_PCRF (
		containing Session-Id_AVP
		indicating value_received in Abort-Session-Request
		) and
		IMS_P-CSCF triggers_call_release
		}
		}

Interoperability Test Description		

	6	TP_EPC_6009_01
		ensure that {
		when { EPC_PCRF receives Session-Termination-Request from IMS_P-CSCF
		containing Session-Id_AVP
		indicating session for SIP_session
		}
		then { EPC_PCRF sends Session-Termination-Answer to IMS_P-CSCF
		containing Session-Id_AVP
		indicating SIP_session value_received in Session-Termination-Request
		containing Result-Code_AVP
		indicating DIAMETER_SUCCESS(2001)}

	7	TP_EPC_6010_01
		ensure that {
		when { IMS_P-CSCF triggers_call_release}
		then { IMS_P-CSCF sends BYE to UE_A
		containing Request_URI
		indicating contact_address from Contact_header of UE_A and
		containing To_header
		indicating the initial 200_OK_From_value and
		containing From_header
		indicating the initial INVITE_To_value and
		containing Call-ID_header
		indicating the initial INVITE_Call_Id_value and
		containing CSeq_header
		including an incremented Sequence_Number and
		containing Route_header
		indicating specific_routing_information for UE_A and
		containing Reason_header
		indicating 503_service_unavailable
		}
		}

	8	TP_EPC_6011_01
		ensure that {
		when { IMS_P-CSCF triggers_administrative_de-registration }
		then { IMS_P-CSCF sends REGISTER to IMS_S-CSCF
		containing Request_URI
		indicating stored_domain_URI for affected_IMPU of UE_A
		containing To_header
		indicating affected_IMPU --IP Multimedia Public Identity
		containing From_header
		indicating affected_IMPU
		containing Contact_header
		indicating Contact_header_value
		containing Authorization_header
		indicating an integrity-protected_parameter
		indicating yes
		containing Expires_header
		indicating 0
		containing Reason_header
		indicating 503_service_unavailable
		}
		}

	9	TP_EPC_6003_02
		ensure that {
		when { UE_A sends media to UE_B }
		then { EPC filters the IP_packets }
		then { the IP_packets not visible on PO_SGi }
		when { UE_B sends media to UE_A }
		then { EPC filters the IP_packets }
		then { the IP_packets not visible on PO_SGi }
		}

7.2 IMS Registration and AF Signalling Bearer Operations

7.2.1 IMS Initial Registration

Besides the successful registration, a secondary abnormal case is considered, of a failed registration. The outcome will be that the signalling bearer is or is not established.

7.2.1.1 IMS Initial Registration - Successful

Interoperability Test Description		
Identifier:	**TD_IMSEPC_Registration_Initial_Successful**	
Summary:	On successful initial registration, the P-CSCF shall request at the PCRF the allocation of a bearer for SIP signalling. The PCRF should act on the request and allocate the bearer. Subsequent signalling should make use of the respective bearer's QoS and priority characteristics.	
Config.:	CF_IMSEPC	
SUT:	IMS and EPC	
Ref.:	TP_IMSEPC_Network_Attachment	
Use Case ref.:	**TP_IMSEPC_Registration_Initial**	
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 provisioned with UE_A' subscription • UE_A discovered the P-CSCF address	
Test Sequence:	**Step**	
	1	UE_A triggers IMS registration
	2	Verify that, in Diameter AA-Request/Answer, IMS included a Media Description for signalling according to UE_A.IP_Address, UE_A.SIP_Port, PCSCF.IP_Address, PCSCF.SIP_Port.
	3	Verify that IMS requested media description was found acceptable by EPC
	4	Verify that UE_A can exchange subsequent signalling with IMS
	5	Verify that UE_A subsequent signalling is transported with appropriate PCC characteristics
Conformance Criteria:	**Check**	

	1	TP_EPC_6012_01
		ensure that {
		when { IMS_P-CSCF receives 2xx_Response on REGISTER from IMS_S-CSCF }
		then { UE_A receives 2xx_Response }
		}

	2	TP_EPC_6013_01
		ensure that {
		when { IMS_P-CSCF receives 2xx_Response on REGISTER from IMS_S-CSCF }
		then { IMS_P-CSCF sends AA-Request to EPC_PCRF
		containing framed IPv4_Address AVP
		(indicating IPv4_Address of UE_A or
		containing framed IPv6_Address AVP
		indicating IPv6_Address of UE_A)
		containing one or more Media-Component-Description_AVP (
		containing Media-Component-Number_AVP
		indicating value 0
		containing Flow-Description_AVP (
		indicating permit_in_ip from (UE_A-IP_address and UE_A_port_number) to (P-CSCF-IP_address and P-CSCF_port_number) or
		indicating permit_in_udp from (UE_A-IP_address and UE_A_port_number) to (P-CSCF-IP_address and P-CSCF_port_number) or
		indicating permit_in_tcp from (UE_A-IP_address and UE_A_port_number) to (P-CSCF-IP_address and P-CSCF_port_number)
		) and
		containing Flow-Description_AVP (
		indicating permit_out_ip from (P-CSCF-IP_address P-CSCF_port_number) to UE_A-IP_address or
		indicating permit_out_udp from (P-CSCF-IP_address P-CSCF_port_number) to UE_A-IP_address or
		indicating permit_out_tcp from (P-CSCF-IP_address P-CSCF_port_number) to UE_A-IP_address
		) and
		containing Flow-Usage_AVP
		indicating AF_SIGNALING(0)
		containing Flow-Status_AVP
		indicating ENABLED(2)
		containing AF-Signalling-Protocol_AVP
		indicating SIP(1)
		)
		}
		}

Interoperability Test Description		

	3	TP_EPC_6014_01
		ensure that {
		when { EPC_PCRF receives AA-Request from IMS_P-CSCF }
		then { EPC_PCRF sends AA-Answer to IMS_P-CSCF
		containing Result-Code_AVP
		indicating DIAMETER_SUCCESS(2001) and
		containing Acceptable-Service-Info_AVP (
		containing one or more Media-Component-Description_AVP(
		containing Media-Component-Number_AVP
		indicating 0 and
		containing Flow-Description_AVP (
		indicating permit_in_ip from (UE_A-IP_address and UE_A_port_number) to (P-CSCF-IP_address and P-CSCF_port_number) or
		indicating permit_in_udp from (UE_A-IP_address and UE_A_port_number) to (P-CSCF-IP_address and P-CSCF_port_number) or
		indicating permit_in_tcp from (UE_A-IP_address and UE_A_port_number) to (P-CSCF-IP_address and P-CSCF_port_number)
		) and
		containing Flow-Description_AVP (
		indicating permit_out_ip from (P-CSCF-IP_address P-CSCF_port_number) to UE_A-IP_address or
		indicating permit_out_udp from (P-CSCF-IP_address P-CSCF_port_number) to UE_A-IP_address or
		indicating permit_out_tcp from (P-CSCF-IP_address P-CSCF_port_number) to UE_A-IP_address
		) and
		containing Flow-Usage_AVP
		indicating AF_SIGNALING(0) and
		containing Flow-Status_AVP
		indicating ENABLED(2) and
		containing AF-Signalling-Protocol_AVP
		indicating SIP(1)
		)
		) and
		containing IP-CAN_AVP
		indicating Current_IP_CAN_Type of UE_A and
		containing RAT-Type_AVP
		indicating Current_RAT_Type of UE_A
		}
		}

	4	TP_EPC_6015_01
		ensure that {
		when { UE_A sends SUBSCRIBE to IMS }
		then { EPC uses_correct_Uplink bearer }
		then { IMS receives SUBSCRIBE
		delivered over IMS_signalling bearer
		}
		when { IMS sends SUBSCRIBE to UE_A }
		then { EPC uses_correct_Downlink bearer }
		then { UE_A receives SUBSCRIBE
		delivered over IMS_signalling bearer
		}
		}

7.2.1.2 IMS Initial Registration - Failed

Interoperability Test Description	
Identifier:	**TD_IMSEPC_Registration_Initial_Failed**
Summary:	On failed UE Registration to IMS, IMS will not trigger the creation of a bearer for the transport of the subsequent SIP signalling.
Config.:	CF_IMSEPC
SUT:	IMS and EPC
Ref.:	TP_IMSEPC_Network_Attachment
Use Case Ref.:	**TP_IMSEPC_Registration_Initial**
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

Interoperability Test Description		
Test Sequence:	**Step**	
	1	UE_A triggers IMS registration with invalid identity
	2	Verify that the IMS registration has been rejected
	3	Verify that an IMS signalling bearer has not been created
Conformance Criteria:	**Check**	

	1	TP_EPC_6016_01
		ensure that {
		when { IMS_P-CSCF receives 4xx_Response on REGISTER from IMS_S-CSCF }
		then { UE_A receives 4xx_Response from IMS_P-CSCF}
		}

	2	TP_EPC_6016_02
		ensure that {
		when { IMS_P-CSCF receives 4xx_Response on REGISTER from IMS_S-CSCF }
		then { IMS_P-CSCF not send AA-Request to EPC_PCRF }
		}

7.2.2 IMS De-registration

Interoperability Test Description		
Identifier:	**TD_IMSEPC_DeRegistration_UE**	
Summary:	On UE_A de-registration, P-CSCF signals to PCRF the termination of the IMS signalling session. EPC removes the IMS signalling bearer. Initial registration are still possible, but traffic will be categorized in the Default Bearer.	
Config.:	CF_IMSEPC	
SUT:	IMS and EPC	
Ref.:	TP_IMSEPC_Network_Attachment TP_IMSEPC_Registration_Initial	
Use Case Ref.:	**TP_IMSEPC_DeRegistration_UE**	
Pre-test conditions:	• UE_A previously attached to EPC • EPC established a Default Bearer allowing UE_A - P-CSCF IP communication • UE_A previously registered to IMS • EPC established an IMS signalling bearer allowing UE_A - P-CSCF IP communication with AF Signalling QoS characteristics	
Test Sequence:	**Step**	
	1	UE_A triggers IMS de-registration, removing all registered contacts at respective P-CSCF
	2	Verify that P-CSCF signals termination of IMS signalling bearer
	3	Verify that signalling between UE_A and P-CSCF is still possible, by using a registration status pull (no contacts in SIP REGISTER request). Verify that this signalling is transported in the still active Default Bearer.

Interoperability Test Description		
Conformance Criteria:	**Check**	

	1	TP_EPC_6017_01
		ensure that {
		when { UE_A sends REGISTER for de-registration to IMS_P-CSCF }
		then { UE_A receives 2xx_Response from IMS_P-CSCF }
		then { IMS_P-CSCF sends Session-Termination-Request to EPC_PCRF
		containing Session-Id_AVP
		indicating session for IMS_signalling session
		}
		}

	2	TP_EPC_6009_02
		ensure that {
		when { EPC_PCRF receives Session-Termination-Request from IMS_P-CSCF
		containing Session-Id_AVP
		indicating session for IMS_signalling session
		}
		then { EPC_PCRF sends Session-Termination-Answer to IMS_P-CSCF
		containing Session-Id_AVP
		indicating IMS_signalling value_received in Session-Termination-Request
		containing Result-Code_AVP
		indicating DIAMETER_SUCCESS(2001)
		}
		then { EPC_PCRF removes_relevant_bearers } -- IMS_signalling
		}

	3	TP_EPC_6018_01
		ensure that {
		when { UE_A sends REGISTER to IMS_P-CSCF }
		then { IMS_P-CSCF receives REGISTER
		delivered over default bearer
		containing no Contact_header
		}
		then { IMS_P-CSCF sends Response to UE_A }
		}

	4	TP_EPC_6019_01
		ensure that {
		when { IMS_P-CSCF sends Response on REGISTER to UE_A }
		then { UE_A receives Response on REGISTER from IMS_P-CSCF
		delivered over default bearer
		}
		}

7.2.3 IMS De-registration with Active Sessions

Interoperability Test Description	
Identifier:	**TD_IMSEPC_DeRegistration_UE_Active_Session**
Summary:	On UE A de-registration, the S-CSCF performs S-CSCF-initiated termination of active session. P-CSCF will act on this event and signals to PCRF termination of the SIP session bearers. EPC removes the SIP Session bearer. Media cannot be exchange any longer on previous SIP Session bearer. The S-CSCF answers to the de-registration. The P-CSCF signals to PCRF the termination of IMS signalling session. EPC removes IMS signalling bearer.
Config.:	CF_IMSEPC
SUT:	IMS and EPC
Ref.:	TP_IMSEPC_Network_Attachment TP_IMSEPC_Registration_Initial TP_IMSEPC_DeRegistration_UE
Use Case Ref.:	**TP_IMSEPC_DeRegistration_UE_Active_Session**

Interoperability Test Description		
Pre-test conditions:	• UE_A previously attached to EPC • EPC established a Default Bearer allowing UE_A - P-CSCF IP communication • UE_A previously registered to IMS • EPC established an IMS signalling bearer • UE_A initiated/received a SIP session request such that a SIP session is active with UE_B • EPC established a SIP session bearer for media • Default EPC gating policy set to “Deny”	
Test Sequence:	**Step**	
	1	Verify that media between UE_A and UE_B is successfully forwarded
	2	UE_A triggers IMS de-registration, removing all registered contacts at respective P-CSCF
	3	Verify that S-CSCF triggers S-CSCF-initiated call release
	4	Verify that P-CSCF signals termination of active SIP session media bearers
	5	Verify that EPC removes SIP session media bearers and as such media packets are no longer forwarded between UE_A and UE_B, in either direction
	6	Verify that P-CSCF signals termination of IMS signalling bearer
	7	Verify that media between UE_A and UE_B is not delivered in any direction after termination of SIP session bearers
Conformance Criteria:	**Check**	

	1	TP_EPC_6020_01
		ensure that {
		when { UE_A sends media to UE_B }
		then { UE_B receives the media
		delivered over SIP_Session media bearer
		}
		when { UE_B sends media to UE_A }
		then { UE_A receives the media
		delivered over SIP_Session media bearer
		}
		}

	2	TP_EPC_6021_01
		ensure that {
		when { UE_A sends REGISTER for de-registration to IMS_P-CSCF }
		then { IMS_S-CSCF sends BYE to IMS_P-CSCF
		containing Request_URI
		including contact_address from Contact_header of UE_B and
		containing To_header
		including From_header or To_header from initial INVITE and
		containing From_header
		including From_header or To_header from initial INVITE and
		containing Call-ID_header
		indicating the initial INVITE_Call_Id_value and
		containing CSeq_header
		including an incremented Sequence_Number and
		containing Route_header
		including specific_routing_information
		containing Reason_header
		}
		}

	3	TP_EPC_6022_01
		ensure that {
		when { IMS_P-CSCF receives BYE from IMS_S-CSCF }
		then { IMS_P-CSCF sends BYE to UE_A }
		then { IMS_P-CSCF sends Session-Termination-Request to EPC_PCRF
		containing Session-Id_AVP
		indicating session of SIP_session
		}
		}

Interoperability Test Description		

	4	TP_EPC_6009_01
		ensure that {
		when { EPC_PCRF receives Session-Termination-Request from IMS_P-CSCF
		containing Session-Id_AVP
		indicating session for SIP_session
		}
		then { EPC_PCRF sends Session-Termination-Answer to IMS_P-CSCF
		containing Session-Id_AVP
		indicating SIP_session value_received in Session-Termination-Request
		containing Result-Code_AVP
		indicating DIAMETER_SUCCESS(2001)
		}
		}

	5	TP_EPC_6023_01
		ensure that {
		when { UE_A sends media to UE_B }
		then { EPC does not send media to UE_B }
		when { UE_B sends media to UE_A }
		then { EPC does not send media to UE_A }
		}

	6	TP_EPC_6012_02
		ensure that {
		when { IMS_P-CSCF receives 2xx_Response on REGISTER from IMS_S-CSCF }
		then { IMS_P-CSCF sends 2xx_Response to UE_A }
		then { IMS_P-CSCF sends Session-Termination-Request to EPC_PCRF
		containing Session-Id_AVP
		indicating session for IMS_signalling session
		}
		}

	7	TP_EPC_6009_02
		ensure that {
		when { EPC_PCRF receives Session-Termination-Request from IMS_P-CSCF
		containing Session-Id_AVP
		indicating session for IMS_signalling session
		}
		then { EPC_PCRF sends Session-Termination-Answer to IMS_P-CSCF
		containing Session-Id_AVP
		indicating IMS_signalling value_received in Session-Termination-Request
		containing Result-Code_AVP
		indicating DIAMETER_SUCCESS(2001)
		}
		then { EPC_PCRF removes_relevant_bearers }
		}

	8	TP_EPC_6003_02
		ensure that {
		when { UE_A sends media to UE_B }
		then { EPC filters the IP_packets }
		then { the IP_packets not visible on PO_SGi }
		when { UE_B sends media to UE_A }
		then { EPC filters the IP_packets }
		then { the IP_packets not visible on PO_SGi }
		}

7.2.4 IMS Administrative De-Registration

Interoperability Test Description	
Identifier:	**TD_IMSEPC_DeRegistration_Administrative**
Summary:	On administrative de-registration, S-CSCF notifies the UE A and P-CSCF about the event. P-CSCF signals to PCRF the termination of the IMS signalling session. EPC removes the IMS signalling bearer. Initial registration are still possible, but traffic will be categorized in the Default Bearer.
Config.:	CF_IMSEPC
SUT:	IMS and EPC
Ref.:	TP_IMSEPC_Network_Attachment TP_IMSEPC_Registration_Initial
Use Case Ref.:	**TP_IMSEPC_DeRegistration_Administrative**

Interoperability Test Description		
Pre-test conditions:	• UE_A previously attached to EPC • EPC established a Default Bearer allowing UE_A - P-CSCF IP communication • UE_A previously registered to IMS • EPC established an IMS signalling bearer	
Test Sequence:	**Step**	
	1	S-CSCF/HSS triggers administrative de-registration, removing all registered contacts of UE_A
	2	Verify that S-CSCF signals de-registration to the P-CSCF
	3	Verify that P-CSCF signals termination of the IMS signalling bearer
	4	Verify that signalling between UE_A and P-CSCF is still possible, by using a registration status pull (no contacts in SIP REGISTER request). Verify that this signalling is transported in the still active Default Bearer.
Conformance Criteria:	**Check**	

	1	TP_EPC_6024_01
		ensure that {
		when { IMS_S-CSCF triggers_administrative_de-registration for UE_A }
		then { IMS_S-CSCF sends NOTIFY to IMS_P-CSCF
		containing Request_URI
		indicating IMS_P-CSCF contact_address for SUBSCRIBE dialog and
		containing Event_header
		indicating the reg_event_package and
		containing Message_Body
		indicating de-registration of all UE_A registered_public_identities
		}
		}

	2	TP_EPC_6025_01
		ensure that {
		when { IMS_P-CSCF receives NOTIFY for UE_A de-registration from IMS_S-CSCF }
		then { IMS_P-CSCF sends Session-Termination-Request to EPC_PCRF
		containing Session-Id_AVP
		indicating session for IMS_signalling session
		}
		}

	3	TP_EPC_6009_02
		ensure that {
		when { EPC_PCRF receives Session-Termination-Request from IMS_P-CSCF
		containing Session-Id_AVP
		indicating session for IMS_signalling session
		}
		then { EPC_PCRF sends Session-Termination-Answer to IMS_P-CSCF
		containing Session-Id_AVP
		indicating IMS_signalling value_received in Session-Termination-Request
		containing Result-Code_AVP
		indicating DIAMETER_SUCCESS(2001)
		}
		then { EPC_PCRF removes_relevant_bearers }
		}

	4	TP_EPC_6018_01
		ensure that {
		when { UE_A sends REGISTER to IMS_P-CSCF }
		then { IMS_P-CSCF receives REGISTER
		delivered over default bearer
		containing no Contact_header
		}
		then { IMS_P-CSCF sends Response to UE_A }
		}

	5	TP_EPC_6019_01
		ensure that {
		when { IMS_P-CSCF sends Response on REGISTER to UE_A }
		then { UE_A receives Response on REGISTER from IMS_P-CSCF
		delivered over default bearer
		}
		}

7.2.5 IMS Registration Expiration

Interoperability Test Description		
Identifier:	**TD_IMSEPC_DeRegistration_Expiration**	
Summary:	On registration expiration, P-CSCF signals to PCRF the termination of the IMS signalling session. EPC removes the IMS signalling bearer. Initial registration are still possible, but traffic will be categorized in the Default Bearer.	
Config.:	CF_IMSEPC	
SUT:	IMS and EPC	
Ref.:	TP_IMSEPC_Network_Attachment TP_IMSEPC_Registration_Initial	
Use Case Ref.:	**TP_IMSEPC_DeRegistration_Expiration**	
Pre-test conditions:	• UE_A previously attached to EPC • EPC established a Default Bearer allowing UE_A - P-CSCF IP communication • UE_A previously registered to IMS • EPC established an IMS signalling bearer	
Test Sequence:	**Step**	
	1	UE_A registration expires at P-CSCF, for all contacts of UE_A
	2	Verify that P-CSCF signals termination of IMS signalling bearer
	3	Verify that signalling between UE_A and P-CSCF is still possible, by using a registration status pull (no contacts in REGISTER request). Verify that this signalling is transported in the still active Default Bearer.
Conformance Criteria:	**Check**	

	1	TP_EPC_6026_01
		ensure that {
		when { IMS_P-CSCF triggers_registration_expiration for UE_A }
		then { IMS_P-CSCF sends Session-Termination-Request to EPC_PCRF
		containing Session-Id_AVP
		indicating session for IMS_signalling session
		}
		}

	2	TP_EPC_6009_02
		ensure that {
		when { EPC_PCRF receives Session-Termination-Request from IMS_P-CSCF
		containing Session-Id_AVP
		indicating session for IMS_signalling session
		}
		then { EPC_PCRF sends Session-Termination-Answer to IMS_P-CSCF
		containing Session-Id_AVP
		indicating IMS_signalling value_received in Session-Termination-Request
		containing Result-Code_AVP
		indicating DIAMETER_SUCCESS(2001)
		}
		then { EPC_PCRF removes_relevant_bearers }
		}

	3	TP_EPC_6018_01
		ensure that {
		when { UE_A sends REGISTER to IMS_P-CSCF }
		then { IMS_P-CSCF receives REGISTER
		delivered over default bearer
		containing no Contact_header
		}
		then { IMS_P-CSCF sends Response to UE_A }
		}

	4	TP_EPC_6019_01
		ensure that {
		when { IMS_P-CSCF sends Response on REGISTER to UE_A }
		then { UE_A receives Response on REGISTER from IMS_P-CSCF
		delivered over default bearer
		}
		}

7.3 SIP Session and Session Bearer Operations

7.3.1 SIP Session Establishment

7.3.1.1 Originating Leg

7.3.1.1.1 With SDP Negotiation in INVITE/200 OK

Interoperability Test Description		
Identifier:	**TD_IMSEPC_Session_Establishment_Originating_1**	
Summary:	On successful call setup, the P-CSCF should derive from the SDP offer and answer, descriptions of the Service Data Flow. These are pushed towards EPC as request for creation of adequate bearers. EPC creates based on the EPC's operator policies the bearers for media. When transporting media, the EPC will employ the respective bearer's characteristics. Media transport is possible only after the successful establishment of the session. Media negotiation happens during INVITE/200 OK (UE A sends SDP-offer, UE B responds with SDP-answer)	
Config.:	CF_IMSEPC	
SUT:	IMS and EPC	
Ref.:	TP_IMSEPC_Network_Attachment TP_IMSEPC_Registration_Initial	
Use Case ref.:	**TP_IMSEPC_Session_Establishment_Originating**	
Pre-test conditions:	• UE_A previously attached to EPC • EPC established a Default Bearer allowing UE_A - P-CSCF IP communication • UE_A previously registered to IMS • EPC established an IMS signalling bearer • UE_B ready to accept the session establishment	
Test Sequence:	**Step**	
	1	Verify that media between UE_A and UE_B is not delivered in any direction before call establishment
	2	UE_A calls UE_B and establishes a communication session
	3	Verify that, in Diameter AA-Request/Answer, the IMS produced a Media Description for the session according to SDP-offer in SIP INVITE Request and SDP-answer in SIP 2xx INVITE Answer
	4	Verify that IMS requested media description was found acceptable by EPC
	5	Verify that media between UE_A and UE_B is successfully routed
	6	Verify that media between UE_A and UE_B is transported with appropriate PCC characteristics
Conformance Criteria:	**Check**	

	1	`TP_EPC_6003_02`
		`ensure that {`
		`  when { UE_A sends media to UE_B }`
		`  then { EPC filters the IP_packets }`
		`  then { the IP_packets not visible on PO_SGi }`
		`  when { UE_B sends media to UE_A }`
		`  then { EPC filters the IP_packets }`
		`  then { the IP_packets not visible on PO_SGi }`
		`}`

Interoperability Test Description		

	2	TP_EPC_6027_01
		ensure that {
		when { IMS_P-CSCF receives 2xx_response on INVITE from IMS_P-CSCF
		}
		then { IMS_P-CSCF sends AA-Request to EPC_PCRF
		(containing Framed-IP-Address_AVP
		indicating IPv4_address of UE_A or
		containing Framed-IPv6-Address_AVP
		indicating IPv6_address of UE_A) and
		containing one or more Media-Component-Description_AVP (
		containing Media-Component-Number_AVP
		indicating values_derived from SDP
		containing one or more Media-Subcomponent-Description_AVP
		indicating values_derived from SDP
		)
		}
		}

	3	TP_EPC_6028_01
		ensure that {
		when { EPC_PCRF receives AA-Request from IMS_P-CSCF }
		then { EPC_PCRF sends AA-Answer to IMS_P-CSCF
		containing Result-Code_AVP
		indicating DIAMETER_SUCCESS(2001) and
		containing Acceptable-Service-Info_AVP (
		containing one or more Media-Component-Description_AVP
		indicating values_derived from AA-Request
		) and
		containing IP-CAN_AVP
		indicating Current_IP_CAN_Type of UE_A and
		containing RAT-Type_AVP
		indicating Current_RAT_Type of UE_A
		}
		}

	4	TP_EPC_6029_01
		ensure that {
		when { IMS_P-CSCF receives AA-Answer from EPC_PCRF }
		then { IMS_P-CSCF sends 2xx_Response on INVITE to UE_A }
		}

	5	TP_EPC_6030_01
		ensure that {
		when { UE_A sends media to UE_B }
		then { EPC uses_correct_bearers for the service_data_flows }
		then { UE_B receives media }
		when { UE_B sends media to UE_A }
		then { EPC uses_correct_bearers for the service_data_flows }
		then { UE_A receives media }
		}

7.3.1.1.2 With SDP Negotiation in 200 OK/ACK

Interoperability Test Description	
Identifier:	**TD_IMSEPC_Session_Establishment_Originating_2**
Summary:	On successful call setup, the P-CSCF should derive from the SDP offer and answer, descriptions of the Service Data Flow. These are pushed towards EPC as request for creation of adequate bearers. EPC creates based on the EPC's operator policies the bearers for media. When transporting media, the EPC will employ the respective bearer's characteristics. Media transport is possible only after the successful establishment of the session. Media negotiation happens during 200 OK / ACK (UE B sends SDP-offer, UE A responds with SDP-answer)
Config.:	CF_IMSEPC
SUT:	IMS and EPC
Ref.:	TP_IMSEPC_Network_Attachment TP_IMSEPC_Registration_Initial
Use Case ref.:	**TP_IMSEPC_Session_Establishment_Originating**
Pre-test conditions:	• UE_A previously attached to EPC • EPC established a Default Bearer allowing UE_A - P-CSCF IP communication • UE_A previously registered to IMS • EPC established an IMS signalling bearer • UE_B ready to accept the session establishment

Interoperability Test Description		
Test Sequence:	**Step**	
	1	Verify that media between UE_A and UE_B is not delivered in any direction before call establishment
	2	UE_A calls UE_B and establishes a communication session
	3	Verify that, in Diameter AA-Request/Answer, IMS produced a Media Description for the session according to SDP-offer in SIP 200 OK INVITE Response and SDP-answer in SIP ACK Request
	4	Verify that IMS requested media description was found acceptable by EPC
	5	Verify that media between UE_A and UE_B is successfully routed
	6	Verify that media between UE_A and UE_B is transported with appropriate PCC characteristics
Conformance Criteria:	**Check**	

	1	TP_EPC_6003_02
		ensure that {
		when { UE_A sends media to UE_B }
		then { EPC filters the IP_packets }
		then { the IP_packets not visible on PO_SGi }
		when { UE_B sends media to UE_A }
		then { EPC filters the IP_packets }
		then { the IP_packets not visible on PO_SGi }
		}

	2	TP_EPC_6027_03
		ensure that {
		when { IMS_P-CSCF receives ACK from UE_A }
		then { IMS_P-CSCF sends AA-Request to EPC_PCRF
		(containing Framed-IP-Address_AVP
		indicating IPv4_Address of UE_A or
		containing Framed-IPv6-Address_AVP
		indicating IPv6_Address of UE_A)
		containing one or more Media-Component-Description_AVP (
		containing Media-Component-Number_AVP
		indicating values_derived from SDP
		containing one or more Media-Subcomponent-Description_AVP
		indicating values_derived from SDP)
		}
		}

	3	TP_EPC_6028_01
		ensure that {
		when { EPC_PCRF receives AA-Request from IMS_P-CSCF }
		then { EPC_PCRF sends AA-Answer to IMS_P-CSCF
		containing Result-Code_AVP
		indicating DIAMETER_SUCCESS(2001) and
		containing Acceptable-Service-Info_AVP (
		containing one or more Media-Component-Description_AVP
		indicating values_derived from AA-Request
		) and
		containing IP-CAN_AVP
		indicating Current_IP_CAN_Type of UE_A and
		containing RAT-Type_AVP
		indicating Current_RAT_Type of UE_A
		}
		}

	4	TP_EPC_6029_04
		ensure that {
		when { IMS_P-CSCF receives AA-Answer from EPC_PCRF }
		then { IMS_P-CSCF sends ACK to IMS_S-CSCF }
		}

	5	TP_EPC_6030_01
		ensure that {
		when { UE_A sends media to UE_B }
		then { EPC uses_correct_bearers for the service_data_flows }
		then { UE_B receives media }
		when { UE_B sends media to UE_A }
		then { EPC uses_correct_bearers for the service_data_flows }
		then { UE_A receives media }
		}

7.3.1.1.3 Without SDP Negotiation in the initial SIP transaction

Interoperability Test Description		
Identifier:	**TD_IMSEPC_Session_Establishment_Originating_3**	
Summary:	On successful call setup without SDP negotiation (no SDP-offer/answer in the initial SIP INVITE Request / 200 OK Response / ACK Request), there is no request for establishing media bearers from the P-CSCF towards EPC. Media transport is not possible either before or after this empty session setup.	
Config.:	CF_IMSEPC	
SUT:	IMS and EPC	
Ref.:	TP_IMSEPC_Network_Attachment TP_IMSEPC_Registration_Initial	
Use Case ref.:	**TP_IMSEPC_Session_Establishment_Originating**	
Pre-test conditions:	• UE_A previously attached to EPC • EPC established a Default Bearer allowing UE_A - P-CSCF IP communication • UE_A previously registered to IMS • EPC established an IMS signalling bearer • UE_B ready to accept the session establishment	
Test Sequence:	**Step**	
	1	Verify that media between UE_A and UE_B is not delivered in any direction before call establishment
	2	UE_A calls UE_B and establishes a communication session
	3	Verify that, as there was no SDP negotiation, there is no AA-Request/Answer exchange between P-CSCF and PCRF
	4	Verify that media between UE_A and UE_B is still not delivered in any direction
Conformance Criteria:	**Check**	

	1	TP_EPC_6003_02
		ensure that {
		when { UE_A sends media to UE_B }
		then { EPC filters the IP_packets }
		then { the IP_packets not visible on PO_SGi }
		when { UE_B sends media to UE_A }
		then { EPC filters the IP_packets }
		then { the IP_packets not visible on PO_SGi }
		}

	2	TP_EPC_6033_01
		ensure that {
		when { IMS_P-CSCF receives INVITE with no SDP from UE_A }
		then { IMS_P-CSCF does not send AA-Request to EPC_PCRF }
		when { IMS_P-CSCF receives 200_response on INVITE with no SDP from IMS_S-CSCF }
		then { IMS_P-CSCF does not send AA-Request to EPC_PCRF }
		when { IMS_P-CSCF receives ACK with no SDP from UE_A }
		then { IMS_P-CSCF does not send AA-Request to EPC_PCRF }
		}

	3	TP_EPC_6003_02
		ensure that {
		when { UE_A sends media to UE_B }
		then { EPC filters the IP_packets }
		then { the IP_packets not visible on PO_SGi }
		when { UE_B sends media to UE_A }
		then { EPC filters the IP_packets }
		then { the IP_packets not visible on PO_SGi }
		}

7.3.1.2 Terminating Leg

7.3.1.2.1 With SDP Negotiation in INVITE/200 OK

Interoperability Test Description		
Identifier:	**TD_IMSEPC_Session_Establishment_Terminating_1**	
Summary:	On successful call setup, the P-CSCF should derive from the SDP offer and answer, descriptions of the Service Data Flow. These are pushed towards EPC as request for creation of adequate bearers. EPC creates based on the EPC's operator policies the bearers for media. When transporting media, the EPC will employ the respective bearer's characteristics. Media transport is possible only after the successful establishment of the session. Media negotiation happens during INVITE/200 OK (UE A sends SDP-offer, UE B responds with SDP-answer)	
Config.:	CF_IMSEPC	
SUT:	IMS and EPC	
Ref.:	TP_IMSEPC_Network_Attachment TP_IMSEPC_Registration_Initial	
Use Case ref.:	**TP_IMSEPC_Session_Establishment_Terminating**	
Pre-test conditions:	• UE_B previously attached to EPC • EPC established a Default Bearer allowing UE_B - P-CSCF IP communication • UE_B previously registered to IMS • EPC established an IMS signalling bearer • UE_A ready to initiate the session establishment	
Test Sequence:	**Step**	
	1	Verify that media between UE_A and UE_B is not delivered in any direction before call establishment
	2	UE_B receives a call request and establishes a communication session
	3	Verify that, in Diameter AA-Request/Answer, the IMS produced a Media Description for the session according to SDP-offer in SIP INVITE Request and SDP-answer in SIP 2xx INVITE Answer
	4	Verify that IMS requested media description was found acceptable by EPC
	5	Verify that media between UE_A and UE_B is successfully routed
	6	Verify that media between UE_A and UE_B is transported with appropriate PCC characteristics
Conformance Criteria:	**Check**	

	1	TP_EPC_6003_03
		ensure that {
		when { UE_B sends media to UE_A }
		then { EPC filters the IP_packets }
		then { the IP_packets not visible on PO_SGi }
		when { UE_A sends media to UE_B }
		then { EPC filters the IP_packets }
		then { the IP_packets not visible on PO_SGi }
		}

	2	TP_EPC_6027_02
		ensure that {
		when { IMS_P-CSCF receives 2xx_response on INVITE from UE_B }
		then { IMS_P-CSCF sends AA-Request to EPC_PCRF
		(containing Framed-IP-Address_AVP
		indicating IPv4_address of UE_B or
		containing Framed-IPv6-Address_AVP
		indicating IPv6_address of UE_B) and
		containing one or more Media-Component-Description_AVP (
		containing Media-Component-Number_AVP
		indicating values_derived from SDP
		containing one or more Media-Subcomponent-Description_AVP
		indicating values_derived from SDP)
		}
		}

Interoperability Test Description		

	3	TP_EPC_6028_02
		ensure that {
		when { EPC_PCRF receives AA-Request from IMS_P-CSCF }
		then { EPC_PCRF sends AA-Answer to IMS_P-CSCF
		containing Result-Code_AVP
		indicating DIAMETER_SUCCESS(2001) and
		containing Acceptable-Service-Info_AVP (
		containing one or more Media-Component-Description_AVP
		indicating values_derived from AA-Request
		) and
		containing IP-CAN_AVP
		indicating Current_IP_CAN_Type of UE_B and
		containing RAT-Type_AVP
		indicating Current_RAT_Type of UE_B
		}
		}

	4	TP_EPC_6029_02
		ensure that {
		when { IMS_P-CSCF receives AA-Answer from EPC_PCRF }
		then { IMS_P-CSCF sends SIP 2xx_Response on INVITE to IMS_S-CSCF }
		}

	5	TP_EPC_6030_01
		ensure that {
		when { UE_A sends media to UE_B }
		then { EPC uses_correct_bearers for the service_data_flows }
		then { UE_B receives media }
		when { UE_B sends media to UE_A }
		then { EPC uses_correct_bearers for the service_data_flows }
		then { UE_A receives media }
		}

7.3.1.2.2 With SDP Negotiation in 200 OK/ACK

Interoperability Test Description		
Identifier:	**TD_IMSEPC_Session_Establishment_Terminating_2**	
Summary:	On successful call setup, the P-CSCF should derive from the SDP offer and answer, descriptions of the Service Data Flow. These are pushed towards EPC as request for creation of adequate bearers. EPC creates based on the EPC's operator policies the bearers for media. When transporting media, the EPC will employ the respective bearer's characteristics. Media transport is possible only after the successful establishment of the session. Media negotiation happens during 200 OK / ACK (UE B sends SDP-offer, UE A responds with SDP-answer)	
Config.:	CF_IMSEPC	
SUT:	IMS and EPC	
Ref.:	TP_IMSEPC_Network_Attachment TP_IMSEPC_Registration_Initial	
Use Case ref.:	**TP_IMSEPC_Session_Establishment_Terminating**	
Pre-test conditions:	• UE_B previously attached to EPC • EPC established a Default Bearer allowing UE_B - P-CSCF IP communication • UE_B previously registered to IMS • EPC established an IMS signalling bearer • UE_A ready to initiate the session establishment	
Test Sequence:	**Step**	
	1	Verify that media between UE_A and UE_B is not delivered in any direction before call establishment
	2	UE_B receives a call request and establishes a communication session
	3	Verify that, in Diameter AA-Request/Answer, IMS produced a Media Description for the session according to SDP-offer in SIP 200 OK Response and SDP-answer in SIP ACK Response
	4	Verify that IMS requested media description was found acceptable by EPC
	5	Verify that media between UE_A and UE_B is successfully routed
	6	Verify that media between UE_A and UE_B is transported with appropriate PCC characteristics

Interoperability Test Description		
Conformance Criteria:	**Check**	

	1	TP_EPC_6003_03
		ensure that {
		when { UE_B sends media to UE_A }
		then { EPC filters the IP_packets }
		then { the IP_packets not visible on PO_SGi }
		when { UE_A sends media to UE_B }
		then { EPC filters the IP_packets }
		then { the IP_packets not visible on PO_SGi }
		}

	2	TP_EPC_6027_04
		ensure that {
		when { IMS_P-CSCF receives ACK from IMS_S-CSCF }
		then { IMS_P-CSCF sends AA-Request to EPC_PCRF
		(containing Framed-IP-Address_AVP
		indicating IPv4_Address of UE_B or
		containing Framed-IPv6-Address_AVP
		indicating IPv6_Address of UE_B)
		containing one or more Media-Component-Description_AVP (
		containing Media-Component-Number_AVP
		indicating values_derived from SDP
		containing one or more Media-Subcomponent-Description_AVP
		indicating values_derived from SDP)
		}
		}

	3	TP_EPC_6028_02
		ensure that {
		when { EPC_PCRF receives AA-Request from IMS_P-CSCF }
		then { EPC_PCRF sends AA-Answer to IMS_P-CSCF
		containing Result-Code_AVP
		indicating DIAMETER_SUCCESS(2001) and
		containing Acceptable-Service-Info_AVP (
		containing one or more Media-Component-Description_AVP
		indicating values_derived from AA-Request
		) and
		containing IP-CAN_AVP
		indicating Current_IP_CAN_Type of UE_B and
		containing RAT-Type_AVP
		indicating Current_RAT_Type of UE_B
		}
		}

	4	TP_EPC_6029_03
		ensure that {
		when { IMS_P-CSCF receives AA-Answer from EPC_PCRF }
		then { IMS_P-CSCF sends ACK to UE_B }
		}

	5	TP_EPC_6030_01
		ensure that {
		when { UE_A sends media to UE_B }
		then { EPC uses_correct_bearers for the service_data_flows }
		then { UE_B receives media }
		when { UE_B sends media to UE_A }
		then { EPC uses_correct_bearers for the service_data_flows }
		then { UE_A receives media }
		}

7.3.1.2.3 Without SDP Negotiation in the initial SIP transaction

Interoperability Test Description		
Identifier:	**TD_IMSEPC_Session_Establishment_Terminating_3**	
Summary:	On successful call setup without SDP negotiation (no SDP-offer/answer in the initial SIP INVITE Request / 200 OK Response / ACK Request), there is no request for establishing media bearers from the P-CSCF towards EPC. Media transport is not possible either before or after this empty session setup.	
Config.:	CF_IMSEPC	
SUT:	IMS and EPC	
Ref.:	TP_IMSEPC_Network_Attachment TP_IMSEPC_Registration_Initial	
Use Case ref.:	**TP_IMSEPC_Session_Establishment_Terminating**	
Pre-test conditions:	• UE_B previously attached to EPC • EPC established a Default Bearer allowing UE_B - P-CSCF IP communication • UE_B previously registered to IMS • EPC established an IMS signalling bearer • UE_A ready to initiate the session establishment	
Test Sequence:	**Step**	
	1	Verify that media between UE_A and UE_B is not delivered in any direction before call establishment
	2	UE_B receives a call request and establishes a communication session
	3	Verify that, as there was no SDP negotiation, there is no AA-Request/Answer exchange between P-CSCF and PCRF
	4	Verify that media between UE_A and UE_B is still not delivered in any direction
Conformance Criteria:	**Check**	

	1	TP_EPC_6003_03
		ensure that {
		when { UE_B sends media to UE_A }
		then { EPC filters the IP_packets }
		then { the IP_packets not visible on PO_SGi }
		when { UE_A sends media to UE_B }
		then { EPC filters the IP_packets }
		then { the IP_packets not visible on PO_SGi }
		}

	2	TP_EPC_6033_02
		ensure that {
		when { IMS_P-CSCF receives INVITE with no SDP from IMS_S-CSCF }
		then { IMS_P-CSCF does not send AA-Request to EPC_PCRF }
		when { IMS_P-CSCF receives 200_response on INVITE with no SDP from UE_B }
		then { IMS_P-CSCF does not send AA-Request to EPC_PCRF }
		when { IMS_P-CSCF receives ACK with no SDP from IMS_S-CSCF }
		then { IMS_P-CSCF does not send AA-Request to EPC_PCRF }
		}

	3	TP_EPC_6003_02
		ensure that {
		when { UE_A sends media to UE_B }
		then { EPC filters the IP_packets }
		then { the IP_packets not visible on PO_SGi }
		when { UE_B sends media to UE_A }
		then { EPC filters the IP_packets }
		then { the IP_packets not visible on PO_SGi }
		}

7.3.2 SIP Session Modification

7.3.2.1 Originating Leg

7.3.2.1.1 With removal of SDF (e.g. Call-Hold)

Interoperability Test Description		
Identifier:	**TD_IMSEPC_Session_Modification_Originating_1**	
Summary:	On successful call hold, the P-CSCF should derive from the SDP offer and answer, updates for the Service Data Flows. These are pushed towards EPC as request for modification of the previously created bearers. EPC modifies, based on the EPC's operator policies, the bearers for media. When transporting media, the EPC will employ the respective bearer's characteristics. Media transport is possible, after the successful modification of the session, only on the remaining active Service Data Flows.	
Config.:	CF_IMSEPC	
SUT:	IMS and EPC	
Ref.:	TP_IMSEPC_Network_Attachment TP_IMSEPC_Registration_Initial TP_IMSEPC_Session_Establishment_Originating	
Use Case ref.:	**TP_IMSEPC_Session_Modification _Originating**	
Pre-test conditions:	• UE_A previously attached to EPC • EPC established a Default Bearer allowing UE_A - P-CSCF IP communication • UE_A previously registered to IMS • EPC established an IMS signalling bearer • UE_A previously established a call with UE_B, encompassing both audio and video media	
Test Sequence:	**Step**	
	1	Verify that media between UE_A and UE_B is delivered in both directions and for both media stream types after call establishment
	2	UE_A initiates Call-Hold operation and removes audio media from the communication session
	3	Verify that, in Diameter AA-Request/Answer, IMS produced a Media Description for session modification according to SDP-offer in SIP INVITE Request and SDP-answer in SIP 2xx INVITE Answer
	4	Verify that IMS requested media description update was found acceptable by EPC
	5	Verify that video media between UE_A and UE_B is still successfully exchanged
	6	Verify that audio media between UE_A and UE_B can no longer be exchanged and is filtered out by EPC
Conformance Criteria:	**Check**	

	1	`TP_EPC_6030_02`
		`ensure that {`
		`  when { UE_A sends audio_media to UE_B }`
		`  then { EPC uses_correct_bearers for the service_data_flows }`
		`  then { UE_B receives media }`
		`  when { UE_B sends audio_media to UE_A }`
		`  then { EPC uses_correct_bearers for the service_data_flows }`
		`  then { UE_A receives the media }`
		`  when { UE_A sends video_media to UE_B }`
		`  then { EPC uses_correct_bearers for the service_data_flows }`
		`  then { UE_B receives the media }`
		`  when { UE_B sends video_media to UE_A }`
		`  then { EPC uses_correct_bearers for the service_data_flows }`
		`  then { UE_A receives the media }`
		`}`

Interoperability Test Description		

	2	TP_EPC_6027_01
		ensure that {
		when { IMS_P-CSCF receives 2xx_response on INVITE from IMS_P-CSCF
		}
		then { IMS_P-CSCF sends AA-Request to EPC_PCRF
		(containing Framed-IP-Address_AVP
		indicating IPv4_address of UE_A or
		containing Framed-IPv6-Address_AVP
		indicating IPv6_address of UE_A) and
		containing one or more Media-Component-Description_AVP (
		containing Media-Component-Number_AVP
		indicating values_derived from SDP
		containing one or more Media-Subcomponent-Description_AVP
		indicating values_derived from SDP
		)
		}
		}

	3	TP_EPC_6028_01
		ensure that {
		when { EPC_PCRF receives AA-Request from IMS_P-CSCF }
		then { EPC_PCRF sends AA-Answer to IMS_P-CSCF
		containing Result-Code_AVP
		indicating DIAMETER_SUCCESS(2001) and
		containing Acceptable-Service-Info_AVP (
		containing one or more Media-Component-Description_AVP
		indicating values_derived from AA-Request
		) and
		containing IP-CAN_AVP
		indicating Current_IP_CAN_Type of UE_A and
		containing RAT-Type_AVP
		indicating Current_RAT_Type of UE_A
		}
		}

	4	TP_EPC_6029_01
		ensure that {
		when { IMS_P-CSCF receives AA-Answer from EPC_PCRF }
		then { IMS_P-CSCF sends 2xx_Response on INVITE to UE_A }
		}

	5	TP_EPC_6031_01
		ensure that {
		when { UE_A sends audio_media to UE_B }
		then { EPC filters the IP_packets }
		then { the IP_packets not visible on PO_SGi }
		when { UE_B sends audio_media to UE_A }
		then { EPC filters the IP_packets }
		then { the IP_packets not visible on UE_A }
		when { UE_A sends video_media to UE_B }
		then { EPC uses_correct_bearers for the service_data_flows }
		then { UE_B receives media }
		when { UE_B sends video_media to UE_A }
		then { EPC uses_correct_bearers for the service_data_flows }
		then { UE_A receives media }
		}

7.3.2.1.2 With addition of SDF (e.g. Call-Resume)

Interoperability Test Description	
Identifier:	**TD_IMSEPC_Session_Modification_Originating_2**
Summary:	On successful call resume, the P-CSCF should derive from the SDP offer and answer, updates for the Service Data Flows. These are pushed towards EPC as request for modification of the previously created bearers. EPC modifies, based on the EPC's operator policies, the bearers for media. When transporting media, the EPC will employ the respective bearer's characteristics. Media transport is possible, after the successful modification of the session, on any new and also on the remaining active Service Data Flows.
Config.:	CF_IMSEPC
SUT:	IMS and EPC
Ref.:	TP_IMSEPC_Network_Attachment TP_IMSEPC_Registration_Initial TP_IMSEPC_Session_Establishment_Originating
Use Case ref.:	**TP_IMSEPC_Session_Modification _Originating**

Interoperability Test Description		
Pre-test conditions:	• UE_A previously attached to EPC • EPC established a Default Bearer allowing UE_A - P-CSCF IP communication • UE_A previously registered to IMS • EPC established an IMS signalling bearer • UE_A previously established a call with UE_B, encompassing video media only	
Test Sequence:	**Step**	
	1	Verify that only video media between UE A and UE B is delivered in both directions after call establishment
	2	UE_A initiates a Call-Resume operation and adds audio media to the communication session
	3	Verify that, in Diameter AA-Request/Answer, IMS produced a Media Description for the session modification according to SDP-offer in SIP INVITE Request and SDP-answer in SIP 2xx Answer
	4	Verify that IMS requested media description update was found acceptable by EPC
	5	Verify that video media between UE A and UE B is still successfully exchanged
	6	Verify that audio media between UE A and UE B is also successfully exchanged
Conformance Criteria:	**Check**	

	1	TP_EPC_6031_01
		ensure that {
		when { UE_A sends audio_media to UE_B }
		then { EPC filters the IP_packets }
		then { the IP_packets not visible on PO_SGi }
		when { UE_B sends audio_media to UE_A }
		then { EPC filters the IP_packets }
		then { the IP_packets not visible on UE_A }
		when { UE_A sends video_media to UE_B }
		then { EPC uses_correct_bearers for the service_data_flows }
		then { UE_B receives media }
		when { UE_B sends video_media to UE_A }
		then { EPC uses_correct_bearers for the service_data_flows }
		then { UE_A receives media }
		}

	2	TP_EPC_6027_01
		ensure that {
		when { IMS_P-CSCF receives 2xx_response on INVITE from IMS_P-CSCF
		}
		then { IMS_P-CSCF sends AA-Request to EPC_PCRF
		(containing Framed-IP-Address_AVP
		indicating IPv4_address of UE_A or
		containing Framed-IPv6-Address_AVP
		indicating IPv6_address of UE_A) and
		containing one or more Media-Component-Description_AVP (
		containing Media-Component-Number_AVP
		indicating values_derived from SDP
		containing one or more Media-Subcomponent-Description_AVP
		indicating values_derived from SDP
		)
		}
		}

	3	TP_EPC_6028_01
		ensure that {
		when { EPC_PCRF receives AA-Request from IMS_P-CSCF }
		then { EPC_PCRF sends AA-Answer to IMS_P-CSCF
		containing Result-Code_AVP
		indicating DIAMETER_SUCCESS(2001) and
		containing Acceptable-Service-Info_AVP (
		containing one or more Media-Component-Description_AVP
		indicating values_derived from AA-Request
		) and
		containing IP-CAN_AVP
		indicating Current_IP_CAN_Type of UE_A and
		containing RAT-Type_AVP
		indicating Current_RAT_Type of UE_A
		}
		}

Interoperability Test Description		

	4	TP_EPC_6029_01
		ensure that {
		when { IMS_P-CSCF receives AA-Answer from EPC_PCRF }
		then { IMS_P-CSCF sends 2xx_Response on INVITE to UE_A }
		}

	5	TP_EPC_6030_02
		ensure that {
		when { UE_A sends audio_media to UE_B }
		then { EPC uses_correct_bearers for the service_data_flows }
		then { UE_B receives media }
		when { UE_B sends audio_media to UE_A }
		then { EPC uses_correct_bearers for the service_data_flows }
		then { UE_A receives the media }
		when { UE_A sends video_media to UE_B }
		then { EPC uses_correct_bearers for the service_data_flows }
		then { UE_B receives the media }
		when { UE_B sends video_media to UE_A }
		then { EPC uses_correct_bearers for the service_data_flows }
		then { UE_A receives the media }
		}

7.3.2.2 Terminating Leg

7.3.2.2.1 With removal of SDF (e.g. Call-Hold)

Interoperability Test Description		
Identifier:	**TD_IMSEPC_Session_Modification_Terminating_1**	
Summary:	On successful call hold, the P-CSCF should derive from the SDP offer and answer, updates for the Service Data Flows. These are pushed towards EPC as request for modification of the previously created bearers. EPC modifies, based on the EPC's operator policies, the bearers for media. When transporting media, the EPC will employ the respective bearer's characteristics. Media transport is possible, after the successful modification of the session, only on the remaining active Service Data Flows.	
Config.:	CF_IMSEPC	
SUT:	IMS and EPC	
Ref.:	TP_IMSEPC_Network_Attachment TP_IMSEPC_Registration_Initial TP_IMSEPC_Session_Establishment_Terminating	
Use Case ref.:	**TP_IMSEPC_Session_Modification _Terminating**	
Pre-test conditions:	• UE_B previously attached to EPC • EPC established a Default Bearer allowing UE_B - P-CSCF IP communication • UE_B previously registered to IMS • EPC established an IMS signalling bearer • UE_A or another endpoint ready to accept the session establishment • UE_B previously established a call with UE_A or another endpoint, encompassing both audio and video media	
Test Sequence:	**Step**	
	1	Verify that media between UE_A and UE_B is delivered in both directions and for both media stream types after call establishment
	2	UE_A initiates a Call-Hold operation and removes audio media from the communication session
	3	Verify that, in Diameter AA-Request/Answer, IMS produced a Media Description for the session modification according to SDP-offer in SIP INVITE Request and SDP-answer in SIP 2xx INVITE Answer
	4	Verify that IMS requested media description update was found acceptable by EPC
	5	Verify that video media between UE_A and UE_B is still successfully exchanged
	6	Verify that audio media between UE_A and UE_B can no longer be exchanged and is filtered out by EPC

Interoperability Test Description		
Conformance Criteria:	**Check**	

	1	TP_EPC_6030_02
		ensure that {
		when { UE_A sends audio_media to UE_B }
		then { EPC uses_correct_bearers for the service_data_flows }
		then { UE_B receives media }
		when { UE_B sends audio_media to UE_A }
		then { EPC uses_correct_bearers for the service_data_flows }
		then { UE_A receives the media }
		when { UE_A sends video_media to UE_B }
		then { EPC uses_correct_bearers for the service_data_flows }
		then { UE_B receives the media }
		when { UE_B sends video_media to UE_A }
		then { EPC uses_correct_bearers for the service_data_flows }
		then { UE_A receives the media }
		}

	2	TP_EPC_6027_07
		ensure that {
		when { IMS_P-CSCF receives 2xx_Response on INVITE from UE_B }
		then { IMS_P-CSCF sends AA-Request to EPC_PCRF
		(containing Framed-IP-Address_AVP
		indicating IPv4_Address of UE_A or
		containing Framed-IPv6-Address_AVP
		indicating IPv6_Address of UE_A)
		containing one or more Media-Component-Description_AVP (
		containing Media-Component-Number_AVP
		indicating values_derived from SDP
		containing one or more Media-Subcomponent-Description_AVP
		indicating values_derived from SDP)
		}
		}

	3	TP_EPC_6028_02
		ensure that {
		when { EPC_PCRF receives AA-Request from IMS_P-CSCF }
		then { EPC_PCRF sends AA-Answer to IMS_P-CSCF
		containing Result-Code_AVP
		indicating DIAMETER_SUCCESS(2001) and
		containing Acceptable-Service-Info_AVP (
		containing one or more Media-Component-Description_AVP
		indicating values_derived from AA-Request
		) and
		containing IP-CAN_AVP
		indicating Current_IP_CAN_Type of UE_B and
		containing RAT-Type_AVP
		indicating Current_RAT_Type of UE_B
		}
		}

	4	TP_EPC_6029_02
		ensure that {
		when { IMS_P-CSCF receives AA-Answer from EPC_PCRF }
		then { IMS_P-CSCF sends SIP 2xx_Response on INVITE to IMS_S-CSCF }
		}

	5	TP_EPC_6031_01
		ensure that {
		when { UE_A sends audio_media to UE_B }
		then { EPC filters the IP_packets }
		then { the IP_packets not visible on PO_SGi }
		when { UE_B sends audio_media to UE_A }
		then { EPC filters the IP_packets }
		then { the IP_packets not visible on UE_A }
		when { UE_A sends video_media to UE_B }
		then { EPC uses_correct_bearers for the service_data_flows }
		then { UE_B receives media }
		when { UE_B sends video_media to UE_A }
		then { EPC uses_correct_bearers for the service_data_flows }
		then { UE_A receives media }
		}

7.3.2.2.2 With addition of SDF (e.g. Call-Resume)

Interoperability Test Description		
Identifier:	**TD_IMSEPC_Session_Modification_Terminating_2**	
Summary:	On successful call resume, the P-CSCF should derive from the SDP offer and answer, updates for the Service Data Flows. These are pushed towards EPC as request for modification of the previously created bearers. EPC modifies, based on the EPC's operator policies, the bearers for media. When transporting media, the EPC will employ the respective bearer's characteristics. Media transport is possible, after the successful modification of the session, on any new and also on the remaining active Service Data Flows.	
Config.:	CF_IMSEPC	
SUT:	IMS and EPC	
Ref.:	TP_IMSEPC_Network_Attachment TP_IMSEPC_Registration_Initial TP_IMSEPC_Session_Establishment_Terminating	
Use Case ref.:	**TP_IMSEPC_Session_Modification _Terminating**	
Pre-test conditions:	• UE_B previously attached to EPC • EPC established a Default Bearer allowing UE_B - P-CSCF IP communication • UE_B previously registered to IMS • EPC established an IMS signalling bearer • UE_B previously established a call with UE A, encompassing video media only	
Test Sequence:	**Step**	
	1	Verify that only video media between UE_A and UE_B is delivered in both directions after call establishment
	2	UE_A initiates a call-resume operation and adds audio media to the communication session
	3	Verify that, in Diameter AA-Request/Answer, IMS produced a Media Description for the session modification according to SDP-offer in SIP INVITE Request and the SDP-answer in SIP 2xx INVITE Answer
	4	Verify that the IMS requested media description update was found acceptable by EPC
	5	Verify that the video media between UE_A and UE_B is still successfully exchanged
	6	Verify that the audio media between UE_A and UE_B is also successfully exchanged
Conformance Criteria:	**Check**	

	1	TP_EPC_6031_01
		ensure that {
		when { UE_A sends audio_media to UE_B }
		then { EPC filters the IP_packets }
		then { the IP_packets not visible on PO_SGi }
		when { UE_B sends audio_media to UE_A }
		then { EPC filters the IP_packets }
		then { the IP_packets not visible on UE_A }
		when { UE_A sends video_media to UE_B }
		then { EPC uses_correct_bearers for the service_data_flows }
		then { UE_B receives media }
		when { UE_B sends video_media to UE_A }
		then { EPC uses_correct_bearers for the service_data_flows }
		then { UE_A receives media }
		}

	2	TP_EPC_6027_02
		ensure that {
		when { IMS_P-CSCF receives 2xx_response on INVITE from UE_B }
		then { IMS_P-CSCF sends AA-Request to EPC_PCRF
		(containing Framed-IP-Address_AVP
		indicating IPv4_address of UE_B or
		containing Framed-IPv6-Address_AVP
		indicating IPv6_address of UE_B) and
		containing one or more Media-Component-Description_AVP (
		containing Media-Component-Number_AVP
		indicating values_derived from SDP
		containing one or more Media-Subcomponent-Description_AVP
		indicating values_derived from SDP)
		}
		}

Interoperability Test Description		

	3	TP_EPC_6028_02
		ensure that {
		when { EPC_PCRF receives AA-Request from IMS_P-CSCF }
		then { EPC_PCRF sends AA-Answer to IMS_P-CSCF
		containing Result-Code_AVP
		indicating DIAMETER_SUCCESS(2001) and
		containing Acceptable-Service-Info_AVP (
		containing one or more Media-Component-Description_AVP
		indicating values_derived from AA-Request
		) and
		containing IP-CAN_AVP
		indicating Current_IP_CAN_Type of UE_B and
		containing RAT-Type_AVP
		indicating Current_RAT_Type of UE_B
		}
		}

	4	TP_EPC_6029_01
		ensure that {
		when { IMS_P-CSCF receives AA-Answer from EPC_PCRF }
		then { IMS_P-CSCF sends 2xx_Response on INVITE to UE_A }
		}

	5	TP_EPC_6030_02
		ensure that {
		when { UE_A sends audio_media to UE_B }
		then { EPC uses_correct_bearers for the service_data_flows }
		then { UE_B receives media }
		when { UE_B sends audio_media to UE_A }
		then { EPC uses_correct_bearers for the service_data_flows }
		then { UE_A receives the media }
		when { UE_A sends video_media to UE_B }
		then { EPC uses_correct_bearers for the service_data_flows }
		then { UE_B receives the media }
		when { UE_B sends video_media to UE_A }
		then { EPC uses_correct_bearers for the service_data_flows }
		then { UE_A receives the media }
		}

7.3.3 SIP Session Release

7.3.3.1 Originating Leg

Interoperability Test Description		
Identifier:	**TD_IMSEPC_Session_Release_Originating**	
Summary:	On call release, the P-CSCF should trigger the removal of all relevant previously created bearers. EPC removes the bearers for media. Media transport is no longer possible, after the session release.	
Config.:	CF_IMSEPC	
SUT:	IMS and EPC	
Ref.:	TP_IMSEPC_Network_Attachment TP_IMSEPC_Registration_Initial TP_IMSEPC_Session_Establishment_Originating	
Use Case ref.:	**TP_IMSEPC_Session_Release _Originating**	
Pre-test conditions:	• UE_A previously attached to EPC • EPC established a Default Bearer allowing UE_A - P-CSCF IP communication • UE_A previously registered to IMS • EPC established an IMS signalling bearer • UE_A previously established a call with UE_B	
Test Sequence:	**Step**	
	1	Verify that media between UE_A and UE_B is delivered in both directions and for both media stream types after the call establishment
	2	UE_A initiates a Call-Release operation, ending the session
	3	Verify that P-CSCF terminates the Rx session, triggering removal of all session related bearers
	4	Verify that EPC removes all session related bearers

Interoperability Test Description		
	5	Verify that media between UE_A and UE_B can no longer be exchanged and is filtered out by EPC
Conformance Criteria:	**Check**	

	1	TP_EPC_6030_01
		ensure that {
		when { UE_A sends media to UE_B }
		then { EPC uses_correct_bearers for the service_data_flows }
		then { UE_B receives media }
		when { UE_B sends media to UE_A }
		then { EPC uses_correct_bearers for the service_data_flows }
		then { UE_A receives media }
		}

	2	TP_EPC_6034_01
		ensure that {
		when { IMS_P-CSCF receives SIP BYE Response from UE_A }
		then { IMS_P-CSCF sends Session-Termination-Request to EPC_PCRF
		containing Session-Id_AVP
		indicating session for SIP_session
		}
		}

	3	TP_EPC_6009_03
		ensure that {
		when { EPC_PCRF receives AA-Request from IMS_P-CSCF }
		then { EPC_PCRF sends Session-Termination-Answer to IMS_P-CSCF
		containing Session-Id_AVP
		indicating session for IMS_signalling session
		containing Result-Code_AVP
		indicating DIAMETER_SUCCESS(2001)
		}
		}

	4	TP_EPC_6003_02
		ensure that {
		when { UE_A sends media to UE_B }
		then { EPC filters the IP_packets }
		then { the IP_packets not visible on PO_SGi }
		when { UE_B sends media to UE_A }
		then { EPC filters the IP_packets }
		then { the IP_packets not visible on PO_SGi }
		}

7.3.3.2 Terminating Leg

Interoperability Test Description	
Identifier:	**TD_IMSEPC_Session_Release_Terminating**
Summary:	On call release, the P-CSCF should trigger the removal of all relevant previously created bearers. EPC removes the bearers for media. Media transport is no longer possible, after the session release.
Config.:	CF_IMSEPC
SUT:	IMS and EPC
Ref.:	TP_IMSEPC_Network_Attachment TP_IMSEPC_Registration_Initial TP_IMSEPC_Session_Establishment_Terminating
Use Case ref.:	**TP_IMSEPC_Session_Release _Terminating**
Pre-test conditions:	• UE_B previously attached to EPC • EPC established a Default Bearer allowing UE_B - P-CSCF IP communication • UE_B previously registered to IMS • EPC established an IMS signalling bearer • UE_B previously established a call with UE_A, encompassing both audio and video media

Interoperability Test Description		
Test Sequence:	**Step**	
	1	Verify that media between UE_A and UE_B is delivered in both directions and for both media stream types after call establishment
	2	UE_B receives a Call-Release operation, ending the session
	3	Verify that P-CSCF terminates the Rx session, triggering the removal of all session related bearers
	4	Verify that EPC removes all session related bearers
	5	Verify that the media between UE_A and UE_B can no longer be exchanged and is filtered out by EPC
Conformance Criteria:	**Check**	

	1	TP_EPC_6030_01
		ensure that {
		when { UE_A sends media to UE_B }
		then { EPC uses_correct_bearers for the service_data_flows }
		then { UE_B receives media }
		when { UE_B sends media to UE_A }
		then { EPC uses_correct_bearers for the service_data_flows }
		then { UE_A receives media }
		}

	2	TP_EPC_6034_01
		ensure that {
		when { IMS_P-CSCF receives SIP BYE Response from UE_A }
		then { IMS_P-CSCF sends Session-Termination-Request to EPC_PCRF
		containing Session-Id_AVP
		indicating session for SIP_session
		}
		}

	3	TP_EPC_6009_03
		ensure that {
		when { EPC_PCRF receives AA-Request from IMS_P-CSCF }
		then { EPC_PCRF sends Session-Termination-Answer to IMS_P-CSCF
		containing Session-Id_AVP
		indicating session for IMS_signalling session
		containing Result-Code_AVP
		indicating DIAMETER_SUCCESS(2001)
		}
		}

	4	TP_EPC_6003_02 ensure that { when { UE_A sends media to UE_B } then { EPC filters the IP_packets } then { the IP_packets not visible on PO_SGi } when { UE_B sends media to UE_A } then { EPC filters the IP_packets } then { the IP_packets not visible on PO_SGi }

7.3.4 SIP Session Abort/Reject

7.3.4.1 SIP Session Abort

7.3.4.1.1 Originating Leg

Interoperability Test Description	
Identifier:	**TD_IMSEPC_Session_Abort_Originating**
Summary:	On session abort, the P-CSCF should trigger the removal of all relevant previously created early-media bearers. EPC removes the bearers for early-media. Media transport is no longer possible, after the session abort.
Config.:	CF_IMSEPC
SUT:	IMS and EPC
Ref.:	TP_IMSEPC_Network_Attachment TP_IMSEPC_Registration_Initial TP_IMSEPC_Session_Establishment_Originating
Use Case ref.:	**TP_IMSEPC_Session_Abort _Originating**

Interoperability Test Description		
Pre-test conditions:	• UE_A previously attached to EPC • EPC established a Default Bearer allowing UE_A - P-CSCF IP communication • UE_A previously registered to IMS • EPC established an IMS signalling bearer	
Test Sequence:	**Step**	
	1	Verify that media between UE_A and UE_B is not delivered in any direction
	2	UE_A initiates a session establishment operation
	3	UE_B answers with SIP 180 Ringing INVITE Response and starts sending early-media
	4	Verify that early-media is delivered from UE_B to UE_A
	5	UE_A cancels the session establishment
	6	Verify that P-CSCF terminates the Rx session, triggering removal of all early-media related bearers
	7	Verify that EPC removes all early-media related bearers
	8	Verify that media between UE_B and UE_A can no longer be exchanged and is filtered out by EPC
Conformance Criteria:	**Check**	

	1	TP_EPC_6003_02
		ensure that {
		when { UE_A sends media to UE_B }
		then { EPC filters the IP_packets }
		then { the IP_packets not visible on PO_SGi }
		when { UE_B sends media to UE_A }
		then { EPC filters the IP_packets }
		then { the IP_packets not visible on PO_SGi }
		}

	2	TP_EPC_6027_06
		ensure that {
		when { IMS_P-CSCF receives SIP 180_response from IMS_S-CSCF }
		then { IMS_P-CSCF sends AA-Request to EPC_PCRF
		(containing Framed-IP-Address_AVP
		indicating IPv4_Address of UE_A or
		containing Framed-IPv6-Address_AVP
		indicating IPv6_Address of UE_A)
		containing one or more Media-Component-Description_AVP (
		containing Media-Component-Number_AVP
		indicating values_derived from SDP
		containing one or more Media-Subcomponent-Description_AVP
		indicating values_derived from SDP)
		}
		}

	3	TP_EPC_6028_01
		ensure that {
		when { EPC_PCRF receives AA-Request from IMS_P-CSCF }
		then { EPC_PCRF sends AA-Answer to IMS_P-CSCF
		containing Result-Code_AVP
		indicating DIAMETER_SUCCESS(2001) and
		containing Acceptable-Service-Info_AVP (
		containing one or more Media-Component-Description_AVP
		indicating values_derived from AA-Request
		) and
		containing IP-CAN_AVP
		indicating Current_IP_CAN_Type of UE_A and
		containing RAT-Type_AVP
		indicating Current_RAT_Type of UE_A
		}
		}

	4	TP_EPC_6029_05
		ensure that {
		when { IMS_P-CSCF receives AA-Answer from EPC_PCRF }
		then { IMS_P-CSCF sends 180_Response to UE_A }
		}

Interoperability Test Description		

	5	TP_EPC_6032_01
		ensure that {
		when { UE_A sends media to UE_B }
		then { EPC filters the IP_packets }
		then { the IP_packets not visible on PO_SGi }
		when { UE_B sends early_media to UE_A }
		then { EPC uses_correct_bearers for service_data_flows }
		then { UE_A receives media }
		}

	6	TP_EPC_6034_02
		ensure that {
		when { IMS_P-CSCF receives CANCEL from UE_A }
		then { IMS_P-CSCF sends Session-Termination-Request to EPC_PCRF
		containing Session-Id_AVP
		indicating session for SIP_session
		}
		}

	7	TP_EPC_6009_03
		ensure that {
		when { EPC_PCRF receives AA-Request from IMS_P-CSCF }
		then { EPC_PCRF sends Session-Termination-Answer to IMS_P-CSCF
		containing Session-Id_AVP
		indicating session for IMS_signalling session
		containing Result-Code_AVP
		indicating DIAMETER_SUCCESS(2001)
		}
		}

	8	TP_EPC_6003_02
		ensure that {
		when { UE_A sends media to UE_B }
		then { EPC filters the IP_packets }
		then { the IP_packets not visible on PO_SGi }
		when { UE_B sends media to UE_A }
		then { EPC filters the IP_packets }
		then { the IP_packets not visible on PO_SGi }
		}

7.3.4.1.2 Terminating Leg

Interoperability Test Description		
Identifier:	**TD_IMSEPC_Session_Abort_Terminating**	
Summary:	On session abort, the P-CSCF should trigger the removal of all relevant previously created early-media bearers. EPC removes the bearers for early-media. Media transport is no longer possible, after the session abort.	
Config.:	CF_IMSEPC	
SUT:	IMS and EPC	
Ref.:	TP_IMSEPC_Network_Attachment TP_IMSEPC_Registration_Initial TP_IMSEPC_Session_Establishment_Terminating	
Use Case ref.:	**TP_IMSEPC_Session_Abort _Terminating**	
Pre-test conditions:	• UE_B previously attached to EPC • EPC established a Default Bearer allowing UE_B - P-CSCF IP communication • UE_B previously registered to IMS • EPC established an IMS signalling bearer	
Test Sequence:	**Step**	
	1	Verify that media between UE_A and UE_B is not delivered in any direction
	2	UE_A initiates a session establishment operation
	3	UE_B answers with SIP 180 Ringing INVITE Response and starts sending early-media
	4	Verify that early-media is delivered from UE_B to UE_A
	5	UE_A cancels the session establishment
	6	Verify that P-CSCF terminates the Rx session, triggering removal of all early-media related bearers
	7	Verify that EPC removes all early-media related bearers
	8	Verify that media between UE_B and UE_A can no longer be exchanged and is filtered out by EPC

Interoperability Test Description		
Conformance Criteria:	**Check**	

	1	TP_EPC_6003_02
		ensure that {
		when { UE_A sends media to UE_B }
		then { EPC filters the IP_packets }
		then { the IP_packets not visible on PO_SGi }
		when { UE_B sends media to UE_A }
		then { EPC filters the IP_packets }
		then { the IP_packets not visible on PO_SGi }
		}

	2	TP_EPC_6027_05
		ensure that {
		when { IMS_P-CSCF receives 180_response from UE_B }
		then { IMS_P-CSCF sends AA-Request to EPC_PCRF
		(containing Framed-IP-Address_AVP
		indicating IPv4_Address of UE_B or
		containing Framed-IPv6-Address_AVP
		indicating IPv6_Address of UE_B)
		containing one or more Media-Component-Description_AVP (
		containing Media-Component-Number_AVP
		indicating values_derived from SDP
		containing one or more Media-Subcomponent-Description_AVP
		indicating values_derived from SDP)
		}
		}

	3	TP_EPC_6028_02
		ensure that {
		when { EPC_PCRF receives AA-Request from IMS_P-CSCF }
		then { EPC_PCRF sends AA-Answer to IMS_P-CSCF
		containing Result-Code_AVP
		indicating DIAMETER_SUCCESS(2001) and
		containing Acceptable-Service-Info_AVP (
		containing one or more Media-Component-Description_AVP
		indicating values_derived from AA-Request
		) and
		containing IP-CAN_AVP
		indicating Current_IP_CAN_Type of UE_B and
		containing RAT-Type_AVP
		indicating Current_RAT_Type of UE_B
		}
		}

	4	TP_EPC_6029_06
		ensure that {
		when { IMS_P-CSCF receives AA-Answer from EPC_PCRF }
		then { IMS_P-CSCF sends 180_Response to IMS_S-CSCF }
		}

	5	TP_EPC_6032_01
		ensure that {
		when { UE_A sends media to UE_B }
		then { EPC filters the IP_packets }
		then { the IP_packets not visible on PO_SGi }
		when { UE_B sends early_media to UE_A }
		then { EPC uses_correct_bearers for service_data_flows }
		then { UE_A receives media }
		}

	6	TP_EPC_6034_03
		ensure that {
		when { IMS_P-CSCF receives CANCEL from IMS_S-CSCF }
		then { IMS_P-CSCF sends Session-Termination-Request to EPC_PCRF
		containing Session-Id_AVP
		indicating session for SIP_session
		}
		}

	7	TP_EPC_6009_03
		ensure that {
		when { EPC_PCRF receives AA-Request from IMS_P-CSCF }
		then { EPC_PCRF sends Session-Termination-Answer to IMS_P-CSCF
		containing Session-Id_AVP
		indicating session for IMS_signalling session
		containing Result-Code_AVP
		indicating DIAMETER_SUCCESS(2001)
		}
		}

Interoperability Test Description		

	8	TP_EPC_6003_02
		ensure that {
		when { UE_A sends media to UE_B }
		then { EPC filters the IP_packets }
		then { the IP_packets not visible on PO_SGi }
		when { UE_B sends media to UE_A }
		then { EPC filters the IP_packets }
		then { the IP_packets not visible on PO_SGi }
		}

7.3.4.2 SIP Session Reject

7.3.4.2.1 Originating Leg

Interoperability Test Description		
Identifier:	**TD_IMSEPC_Session_Reject _Originating**	
Summary:	On session reject, the P-CSCF should trigger the removal of all relevant previously created early-media bearers. EPC removes the bearers for early-media. Media transport is no longer possible, after the session reject.	
Config.:	CF_IMSEPC	
SUT:	IMS and EPC	
Ref.:	TP_IMSEPC_Network_Attachment TP_IMSEPC_Registration_Initial TP_IMSEPC_Session_Establishment_Originating	
Use Case ref.:	**TP_IMSEPC_Session_Reject _Originating**	
Pre-test conditions:	• UE_A previously attached to EPC • EPC established a Default Bearer allowing UE_A - P-CSCF IP communication • UE_A previously registered to IMS • EPC established an IMS signalling bearer	
Test Sequence:	**Step**	
	1	Verify that media between UE_A and UE_B is not delivered in any direction
	2	UE_A initiates a session establishment operation
	3	UE_B answers with SIP 180 Ringing INVITE Response and starts sending early-media
	4	Verify that early-media is delivered from UE_B to UE_A
	5	UE_B rejects session establishment
	6	Verify that P-CSCF terminates the Rx session, triggering the removal of all early-media related bearers
	7	Verify that EPC removes all early-media related bearers
	8	Verify that media between UE_B and UE_A can no longer be exchanged and is filtered out by EPC
Conformance Criteria:	**Check**	

	1	TP_EPC_6003_02
		ensure that {
		when { UE_A sends media to UE_B }
		then { EPC filters the IP_packets }
		then { the IP_packets not visible on PO_SGi }
		when { UE_B sends media to UE_A }
		then { EPC filters the IP_packets }
		then { the IP_packets not visible on PO_SGi }
		}

Interoperability Test Description		

	2	TP_EPC_6027_06
		ensure that {
		when { IMS_P-CSCF receives SIP 180_response from IMS_S-CSCF }
		then { IMS_P-CSCF sends AA-Request to EPC_PCRF
		(containing Framed-IP-Address_AVP
		indicating IPv4_Address of UE_A or
		containing Framed-IPv6-Address_AVP
		indicating IPv6_Address of UE_A)
		containing one or more Media-Component-Description_AVP (
		containing Media-Component-Number_AVP
		indicating values_derived from SDP
		containing one or more Media-Subcomponent-Description_AVP
		indicating values_derived from SDP)
		}
		}

	3	TP_EPC_6028_01
		ensure that {
		when { EPC_PCRF receives AA-Request from IMS_P-CSCF }
		then { EPC_PCRF sends AA-Answer to IMS_P-CSCF
		containing Result-Code_AVP
		indicating DIAMETER_SUCCESS(2001) and
		containing Acceptable-Service-Info_AVP (
		containing one or more Media-Component-Description_AVP
		indicating values_derived from AA-Request
		) and
		containing IP-CAN_AVP
		indicating Current_IP_CAN_Type of UE_A and
		containing RAT-Type_AVP
		indicating Current_RAT_Type of UE_A
		}
		}

	4	TP_EPC_6029_05
		ensure that {
		when { IMS_P-CSCF receives AA-Answer from EPC_PCRF }
		then { IMS_P-CSCF sends 180_Response to UE_A }
		}

	5	TP_EPC_6032_01
		ensure that {
		when { UE_A sends media to UE_B }
		then { EPC filters the IP_packets }
		then { the IP_packets not visible on PO_SGi }
		when { UE_B sends early_media to UE_A }
		then { EPC uses_correct_bearers for service_data_flows }
		then { UE_A receives media }
		}

	6	TP_EPC_6034_04
		ensure that {
		when { IMS_P-CSCF receives 486_response on INVITE from UE_B }
		then { IMS_P-CSCF sends Session-Termination-Request to EPC_PCRF
		containing Session-Id_AVP
		indicating session for SIP_session
		}
		}

	7	TP_EPC_6009_03
		ensure that {
		when { EPC_PCRF receives AA-Request from IMS_P-CSCF }
		then { EPC_PCRF sends Session-Termination-Answer to IMS_P-CSCF
		containing Session-Id_AVP
		indicating session for IMS_signalling session
		containing Result-Code_AVP
		indicating DIAMETER_SUCCESS(2001)
		}
		}

	8	TP_EPC_6003_02
		ensure that {
		when { UE_A sends media to UE_B }
		then { EPC filters the IP_packets }
		then { the IP_packets not visible on PO_SGi }
		when { UE_B sends media to UE_A }
		then { EPC filters the IP_packets }
		then { the IP_packets not visible on PO_SGi }
		}

7.3.4.2.2 Terminating Leg

Interoperability Test Description		
Identifier:	**TD_IMSEPC_Session_Reject _Terminating**	
Summary:	On session reject, the P-CSCF should trigger the removal of all relevant previously created early-media bearers. EPC removes the bearers for early-media. Media transport is no longer possible, after the session reject.	
Config.:	CF_IMSEPC	
SUT:	IMS and EPC	
Ref.:	TP_IMSEPC_Network_Attachment TP_IMSEPC_Registration_Initial TP_IMSEPC_Session_Establishment_Terminating	
Use Case ref.:	**TP_IMSEPC_Session_Reject _Terminating**	
Pre-test conditions:	• UE_B previously attached to EPC • EPC established a Default Bearer allowing UE_B - P-CSCF IP communication • UE_B previously registered to IMS • EPC established an IMS signalling bearer	
Test Sequence:	**Step**	
	1	Verify that media between UE_A and UE_B is not delivered in any direction
	2	UE_A initiates a session establishment operation
	3	UE_B answers with SIP 180 Ringing INVITE Response and starts sending early-media
	4	Verify that early-media is delivered from UE_B to UE_A
	5	UE_B rejects the session establishment
	6	Verify that P-CSCF terminates the Rx session, triggering removal of all early-media related bearers
	7	Verify that EPC removes all early-media related bearers
	8	Verify that the media between UE_B and UE_A can no longer be exchanged and is filtered out by EPC
Conformance Criteria:	**Check**	

	1	`TP_EPC_6003_02`
		`ensure that {`
		`  when { UE_A sends media to UE_B }`
		`  then { EPC filters the IP_packets }`
		`  then { the IP_packets not visible on PO_SGi }`
		`  when { UE_B sends media to UE_A }`
		`  then { EPC filters the IP_packets }`
		`  then { the IP_packets not visible on PO_SGi }`
		`}`

	2	`TP_EPC_6027_05`
		`ensure that {`
		`  when { IMS_P-CSCF receives 180_response from UE_B }`
		`  then { IMS_P-CSCF sends AA-Request to EPC_PCRF`
		`  (containing Framed-IP-Address_AVP`
		`  indicating IPv4_Address of UE_B or`
		`  containing Framed-IPv6-Address_AVP`
		`  indicating IPv6_Address of UE_B)`
		`  containing one or more Media-Component-Description_AVP (`
		`  containing Media-Component-Number_AVP`
		`  indicating values_derived from SDP`
		`  containing one or more Media-Subcomponent-Description_AVP`
		`  indicating values_derived from SDP)`
		`  }`
		`}`

Interoperability Test Description		

	3	TP_EPC_6028_02
		ensure that {
		when { EPC_PCRF receives AA-Request from IMS_P-CSCF }
		then { EPC_PCRF sends AA-Answer to IMS_P-CSCF
		containing Result-Code_AVP
		indicating DIAMETER_SUCCESS(2001) and
		containing Acceptable-Service-Info_AVP (
		containing one or more Media-Component-Description_AVP
		indicating values_derived from AA-Request
		) and
		containing IP-CAN_AVP
		indicating Current_IP_CAN_Type of UE_B and
		containing RAT-Type_AVP
		indicating Current_RAT_Type of UE_B
		}
		}

	4	TP_EPC_6029_06
		ensure that {
		when { IMS_P-CSCF receives AA-Answer from EPC_PCRF }
		then { IMS_P-CSCF sends 180_Response to IMS_S-CSCF }
		}

	5	TP_EPC_6032_01
		ensure that {
		when { UE_A sends media to UE_B }
		then { EPC filters the IP_packets }
		then { the IP_packets not visible on PO_SGi }
		when { UE_B sends early_media to UE_A }
		then { EPC uses_correct_bearers for service_data_flows }
		then { UE_A receives media }
		}

	6	TP_EPC_6034_04
		ensure that {
		when { IMS_P-CSCF receives 486_response on INVITE from UE_B }
		then { IMS_P-CSCF sends Session-Termination-Request to EPC_PCRF
		containing Session-Id_AVP
		indicating session for SIP_session
		}
		}

	7	TP_EPC_6009_03
		ensure that {
		when { EPC_PCRF receives AA-Request from IMS_P-CSCF }
		then { EPC_PCRF sends Session-Termination-Answer to IMS_P-CSCF
		containing Session-Id_AVP
		indicating session for IMS_signalling session
		containing Result-Code_AVP
		indicating DIAMETER_SUCCESS(2001)
		}
		}

	8	TP_EPC_6003_02
		ensure that {
		when { UE_A sends media to UE_B }
		then { EPC filters the IP_packets }
		then { the IP_packets not visible on PO_SGi }
		when { UE_B sends media to UE_A }
		then { EPC filters the IP_packets }
		then { the IP_packets not visible on PO_SGi }
		}

7.3.5 EPC Initiated Bearer Modification

Interoperability Test Description	
Identifier:	**TD_IMSEPC_Bearer_Modification**
Summary:	On removal of all bearers, EPC PCRF will notify IMS P-CSCF that Rx session should be aborted. IMS will take action and terminate all ongoing SIP sessions and the IMS registration.
Configuration:	CF_IMSEPC
SUT:	IMS and EPC
Ref.:	TP_IMSEPC_Network_Attachment TP_IMSEPC_Registration_Initial TP_IMSEPC_Session_Establishment_Originating TP_IMSEPC_Session_Establishment_Terminating
Use Case Ref.:	**TP_IMSEPC_Bearer_Modification**

Interoperability Test Description		
Pre-test conditions:	• UE_A previously attached to EPC with a single attachment • UE_A previously registered to IMS • UE_A previously established SIP session with UE_B	
Test Sequence:	**Step**	
	1	EPC triggers removal of all bearers for a given SIP session
	2	Verify that EPC aborts affected Rx sessions with IMS
	3	Verify that IMS performs P-CSCF-initiated call release on affected SIP session
	4	Verify that media is no longer exchanged after these procedures
	5	Verify that media between UE and other endpoint can no longer be exchanged and is filtered out by EPC
Conformance Criteria:	**Check**	

	1	TP_EPC_6004_02
		ensure that {
		when { EPC removes_relevant_bearers for SIP_session}
		then { EPC_PCRF triggers_termination of SIP_session }
		}

	2	TP_EPC_6005_01
		ensure that {
		when { EPC_PCRF triggers_termination of SIP_session }
		then { EPC_PCRF sends Abort-Session-Request to IMS_P-CSCF
		containing Session-Id_AVP
		indicating session of SIP_session
		containing Abort-Cause_AVP
		indicating BEARER_RELEASED (0)
		}
		}

	3	TP_EPC_6006_01
		ensure that {
		when { IMS_P-CSCF receives Abort-Session-Request for SIP_session
		}
		then { IMS_P-CSCF sends Abort-Session-Answer to EPC_PCRF (
		containing Session-Id_AVP
		indicating value_received in Abort-Session-Request
		containing Result-Code_AVP
		indicating DIAMETER_SUCCESS(2001)
		) and
		IMS_P-CSCF sends Session-Termination-Request to EPC_PCRF (
		containing Session-Id_AVP
		indicating value_received in Abort-Session-Request
		) and
		IMS_P-CSCF triggers_call_release
		}
		}

	4	TP_EPC_6010_01
		ensure that {
		when { IMS_P-CSCF triggers_call_release}
		then { IMS_P-CSCF sends BYE to UE_A
		containing Request_URI
		indicating contact_address from Contact_header of UE_A and
		containing To_header
		indicating the initial 200_OK_From_value and
		containing From_header
		indicating the initial INVITE_To_value and
		containing Call-ID_header
		indicating the initial INVITE_Call_Id_value and
		containing CSeq_header
		including an incremented Sequence_Number and
		containing Route_header
		indicating specific_routing_information for UE_A and
		containing Reason_header
		indicating 503_service_unavailable
		}
		}

Interoperability Test Description		

	5	TP_EPC_6003_02
		ensure that {
		when { UE_A sends media to UE_B }
		then { EPC filters the IP_packets }
		then { the IP_packets not visible on PO_SGi }
		when { UE_B sends media to UE_A }
		then { EPC filters the IP_packets }
		then { the IP_packets not visible on PO_SGi }
		}

Annex A (normative): zip file with TPLan code

The test purposes used in the present document have been originally generated in the TPLan text files in the archive file ts_103029v030101p0.zip which accompanies the present document.

History

Document history		
V3.1.1	November 2011	Publication