ETSI TS 103 683 V2.1.1 (2023-02)

Mobile Standards Group (MSG);
Testing;
Next Generation eCall High Level Application Protocol (HLAP) Interoperability Testing

Reference
RTS/MSG-001132

Keywords
eCall, interoperability, 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 - APE 7112B
Association à but non lucratif enregistrée à la
Sous-Préfecture de Grasse (06) N° w061004871

Contents

Intellectual Property Rights

Essential patents

IPRs essential or potentially essential to normative deliverables may have been declared to ETSI. The declarations pertaining to these essential IPRs, if any, are 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 (https://ipr.etsi.org/).

Pursuant to the ETSI Directives including the ETSI IPR Policy, no investigation regarding the essentiality of IPRs, 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.

Trademarks

The present document may include trademarks and/or tradenames which are asserted and/or registered by their owners. ETSI claims no ownership of these except for any which are indicated as being the property of ETSI, and conveys no right to use or reproduce any trademark and/or tradename. Mention of those trademarks in the present document does not constitute an endorsement by ETSI of products, services or organizations associated with those trademarks.

DECT™, **PLUGTESTS™**, **UMTS™** and the ETSI logo are trademarks of ETSI registered for the benefit of its Members. **3GPP™** and **LTE™** are trademarks of ETSI registered for the benefit of its Members and of the 3GPP Organizational Partners. **oneM2M™** logo is a trademark of ETSI registered for the benefit of its Members and of the oneM2M Partners. **GSM**® and the GSM logo are trademarks registered and owned by the GSM Association.

Foreword

This Technical Specification (TS) has been produced by ETSI Technical Committee Mobile Standards Group (MSG).

Modal verbs terminology

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

"**must**" and "**must not**" are **NOT** allowed in ETSI deliverables except when used in direct citation.

1 Scope

The present document defines Interoperability Test Descriptions for the NG eCall High Level Application Protocol (HLAP).

2 References

2.1 Normative references

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

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

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

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

[1] ETSI TS 124 229 (V15.13.0): "Digital cellular telecommunications system (Phase 2+) (GSM); Universal Mobile Telecommunications System (UMTS); LTE; 5G; IP multimedia call control protocol based on Session Initiation Protocol (SIP) and Session Description Protocol (SDP); Stage 3 (3GPP TS 24.229 version 15.13.0 Release 15)".

[2] ETSI TS 123 167 (V15.7.0): "Universal Mobile Telecommunications System (UMTS); LTE; IP Multimedia Subsystem (IMS) emergency sessions (3GPP TS 23.167 version 15.7.0 Release 15)".

[3] ETSI TS 123 228 (V15.5.0): "Digital cellular telecommunications system (Phase 2+) (GSM); Universal Mobile Telecommunications System (UMTS); LTE; IP Multimedia Subsystem (IMS); Stage 2 (3GPP TS 23.228 version 15.5.0 Release 15)".

[4] TS 17184:2022: "Intelligent transport systems - eSafety - eCall High level application Protocols (HLAP) using IMS packet switched networks", produced by CEN.

[5] EENA Technical Committee Document: "Next Generation eCall".

[6] ETSI TS 123 401 (V15.12.0): "LTE; General Packet Radio Service (GPRS) enhancements for Evolved Universal Terrestrial Radio Access Network (E-UTRAN) access (3GPP TS 23.401 version 15.12.0 Release 15)".

[7] EN 16072:2022: "Intelligent transport systems - eSafety - Pan European eCall - Operating requirements", produced by CEN.

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

[9] ETSI TS 103 428 (V1.2.2): "Mobile Standards Group (MSG); eCall HLAP Interoperability Testing".

[10] EN 15722:2015: "Intelligent transport systems - ESafety - Ecall minimum set of data", produced by CEN, withdrawn.

[11] ETSI TS 122 101 (V15.7.0): "Universal Mobile Telecommunications System (UMTS); LTE; Service aspects; Service principles (3GPP TS 22.101 version 15.7.0 Release 15)".

[12] EN 15722:2020: "Intelligent transport systems - ESafety - Ecall minimum set of data", produced by CEN.

[13] prEN 17905:2022: "Intelligent transport systems - eSafety - eCall HLAP in hybrid Circuit Switched/Packet Switched network environments", produced by CEN.

[14] EN 16102:2011: "Intelligent transport systems - ECall - Operating requirements for third party support", produced by CEN.

[15] ETSI TS 103 479 (V1.1.1): "Emergency Communications (EMTEL); Core elements for network independent access to emergency services".

2.2 Informative references

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

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

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

[i.1] ETSI ETR 266: "Methods for Testing and Specification (MTS); Test Purpose style guide".

[i.2] EN 16062:2022: "Intelligent Transport Systems - eSafety - eCall - High Level Application Requirements (HLAP)", produced by CEN.

[i.3] ETSI EG 202 798 (V1.1.1): "Intelligent Transport Systems (ITS); Testing; Framework for conformance and interoperability testing".

[i.4] PlantUML: "PlantUML utility".

3 Definition of terms, symbols and abbreviations

3.1 Terms

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

base specification: specification of a protocol, telecommunication service, interface, abstract syntax, encoding rules, or information object

eCall: manually or automatically initiated emergency call, from a vehicle, supplemented with a Minimum Set of emergency related Data (MSD), as defined under the EU Commission's eSafety initiative

eCall Over IMS support (ECL): As indicated by the eCall support indicator defined in ETSI TS 123 401 [6].

implementation: instance of the reference specification for which conformity to that reference specification is claimed

IMS eCall: eCall deployed using IMS emergency call in 3GPP Release-14, instead of in-band modem and circuit switched 112

NOTE: This term is taken from EENA Technical Committee Document [5].

IMS Emergency Service support (EMS): IMS Emergency Services supported as indicated by Emergency Service Support indicator as defined in ETSI TS 123 401 [6].

in-band modem eCall: eCall deployed using in-band modem and circuit switched 112 according to EN 16062:2022 [i.2] and EN 16072:2022 [7]

NOTE: This term is based on definition in EENA Technical Committee Document [5].

IVS configured for eCall only service (restricted): eCall capable IVS that is not subscribed to other non-emergency services

NOTE: The IVS is not permitted to register on a PLMN except for the purpose of making an eCall, or a test/reconfiguration call to a designated non-emergency number, in accordance with ETSI TS 122 101 [11]. Following power-up the IVS may perform a PLMN search and maintain a list of available networks upon which to register, when an eCall or test/reconfiguration call is activated. Following an eCall or test/reconfiguration call, the IVS de-registers from the serving network within 12 hours.

IVS configured for eCall and other services (unrestricted): eCall capable IVS that has valid subscriptions to access other non-emergency services

NOTE: The IVS may register on a PLMN at any time and may remain registered on a serving network indefinitely.

Minimum Set of Data (MSD): data component of an eCall sent from a vehicle to a Public Safety Answering Point or other designated emergency call centre

NOTE: The MSD has a maximum size of 140 bytes and includes, for example, vehicle identity, location information and time-stamp, as defined in EN 15722:2015 [10].

Next Generation eCall (**NG eCall):** based on IMS eCall and offering data, multimedia and two-way data

NOTE: This term is based on the definition in EENA Technical Committee Document [5].

Plugtests: testing events, similar to a plugfest, developed and hosted by ETSI where the participants can test the interoperability or the conformance of their implementations

PSAP eCall Modem-server: PSAP equipment used to receive, validate and acknowledge the MSD sent from an IVS, to manage the voice call transfer to the PSAP operator and to facilitate callback to the vehicle

NOTE: The eCall modem-server may also support other functions.

reference specification: standard which provides a base specification, or a set of base specifications, or a profile, or a set of profiles, and for conformance to which the ICS proforma and test specifications are written

VoIMS: Voice over IMS over PS sessions support as indicated by IMS Voice over PS session supported indication as defined in ETSI TS 123 401 [6]

3.2 Symbols

Void.

3.3 Abbreviations

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

3GPP	Third Generation Partnership Project
ACK	ACKnowledgement
CEN	Comité Européen de Normalisation
CFG	ConFiGuration
CS	Circuit Switched
CSCF	Call Session Control Function
ECL	eCall Over IMS support
E-CSCF	Emergency CSCF
EMS	IMS Emergency Services
ESInet	Emergency Services IP network
ESRP	Emergency Service Routing Proxy
ETR	ETSI Technical Report
ETSI	European Telecommunications Standards Institute
EU	European Union
EUT	Equipment Under Test

E-UTRAN	Enhanced UMTS Terrestrial Radio Access Network
GIBA	GPRS-IMS-Bundled-Authentication
GSM	Global System of Mobile telecommunications
HLAP	High Level Application Protocol
HMI	Human Machine Interface
HPLMN	Home PLMN
HSS	Home Subscriber Server
I-CSCF	Interrogating CSCF
IFS	Interoperable Functions Statement
IFS_ID	IFS Identifier
IMS	IP Multimedia Subsystem
IMSI	International Mobile Subscriber Identity
IVS	In Vehicle System
LTE	Long Term Evolution
MNO	Mobile Network Operator
MSC	Message Sequence Chart
MSD	Minimum Set of Data
NG	Next Generation
P-CSCF	Proxy CSCF
PLMN	Public Land Mobile Network
PS	Packet Switched
PSAP	Public Safety Answering Point
S-CSCF	Serving CSCF
SIP	Session Initiation Protocol
TD	Test Description
TPS	Third Party Service
TPSP	Third Party Service Provider
TSD	TPS-eCall Set of Data
UML	Unified Modelling Language
UMTS	Universal Mobile Telecommunications System
URN	Unique Resource Name
USIM	UMTS Subscriber Identity Module
VoIMS	Voice over IMS
VoLTE	Voice over LTE
VPLMN	Visited PLMN

4 Conventions

4.1 Interoperability test process

4.1.1 Principles

The goal of interoperability tests is to check that devices resulting from protocol implementations are able to work together and provide the functionalities provided by the protocols. As necessary, one message may be checked during a test, for instance, when a successful functional verification may result from an incorrect behaviour. Detailed protocol checks are part of the conformance testing process and are thus avoided during the interoperability tests.

4.1.2 The test description proforma

The test descriptions are provided in proforma tables following the format described in ETSI EG 202 798 [i.3] and ETSI ETR 266 [i.1]. The following different test event types are considered during the test execution:

- A **stimulus** corresponds to an event that enforces an EUT to proceed with a specific protocol action, like sending a message, for instance.
- A **verify** consists of verifying that the EUT behaves according to the expected behaviour (for instance, the EUT behaviour shows that it receives the expected message).

- A **configure** corresponds to an action to modify the EUT configuration.
- A **check** ensures the receipt of protocol messages on reference points, with valid content. This "check" event type corresponds to the interoperability testing with the conformance check method.

4.1.3 Interoperable Functions Statement

The "Interoperable Functions Statement" (IFS) identifies the standardized functions of an EUT. These functions can be mandatory, optional or conditional (depending on other functions), and depend on the role played by the EUT.

The IFS can also be used as a pro-forma by a vendor to identify the functions that its EUT will support when interoperating with corresponding functions from other vendors.

Item column

The item column contains a number, which identifies the item.

Item description column

The item description column describes in free text each respective item (e.g. parameters, timers, etc.). It implicitly means "is <item description> supported by the implementation?".

IFS ID column

The IFS ID column defines an identifier for this particular IFS item. The IFS ID is in the Test Description field "Applicability" to select/deselect the execution of a test.

Status column

The following notations are used for the status column:

m	mandatory - the capability is required to be supported.
o	optional - the capability may be supported or not.
n/a	not applicable - in the given context, it is impossible to use the capability.
x	prohibited (excluded) - there is a requirement not to use this capability in the given context.
o.i	qualified optional - for mutually exclusive or selectable options from a set. "i" is an integer which identifies a unique group of related optional items and the logic of their selection, which is defined immediately following the table.
c.i	conditional - the requirement on the capability ("m", "o", "x" or "n/a") depends on the support of other optional or conditional items. "i" is an integer identifying a unique conditional status expression which is defined immediately following the table.
i	irrelevant (out-of-scope) - capability outside the scope of the reference specification. No answer is requested from the supplier.

NOTE: This use of "i" status is not to be confused with the suffix "i" to the "o" and "c" statuses above.

Support column

The support column shall be filled in by the supplier of the implementation using the following notations:

Y or y	supported by the implementation.
N or n	not supported by the implementation.
N/A or n/a	no answer required (allowed only if the status is n/a, directly or after evaluation of a conditional status).

4.2 Tooling

Message monitoring solutions, including audio recording and event logging, where supported, may be used to facilitate the resolution of any interoperability and/or performance issues that may be encountered during interoperability testing.

4.3 Test Description naming convention

Table 1: TD naming convention

TD_<root>_[gr]_<nn>		
<root> = root applicability	BAS	Basic test
	ADV	Advanced test
[gr] = group	IVS	IVS eCall terminal
	PSAP	PSAP eCall server
		IVS or PSAP
<nn> = sequential number	01 to 99	Sequential numbers

4.4 Test Summary

The detailed test descriptions are defined in clause 7. It is recommended to conduct all test cases supported by PSAP and IVS. Some of the test cases require a fallback to CS (legacy) eCall. The interoperability test cases for CS domain are specified in ETSI TS 103 428 [9].

The test scenarios of the present document are split into 5 groups:

1) The basic scenarios, which shall be executed during all interoperability test sessions, covering the mandatory features of an NG eCall device (IVS and PSAP).

2) The advanced test scenarios, to do additional testing which goes beyond the basic test scenarios. These scenarios are focusing on IVS and PSAP features.

3) The advanced IVS test scenarios, to do additional testing which goes beyond the basic test scenarios. These scenarios are focusing only on IVS features.

4) The advanced PSAP test scenarios, to do additional testing which goes beyond the basic test scenarios. These scenarios are focusing only on PSAP features.

5) The advanced test scenarios for TPS, to do additional testing which goes beyond the basic test scenarios. These scenarios are focusing only on TPS features.

The basic test scenarios in Table 2 are foreseen to be executed during all interoperability test sessions, either with real IVS and PSAP but also with testing devices simulating an IVS or a PSAP.

Table 2: Basic Tests

Test case ID	Title
TD_BAS_01	Initiation of manual eCall
TD_BAS_02	Initiation of automatic eCall
TD_BAS_03	Initiation of test eCall
TD_BAS_04	MSD transfer to PSAP supporting IMS eCall
TD_BAS_05	MSD transfer to PSAP supporting IMS eCall in a roaming scenario
TD_BAS_06	PSAP initiated callback to IVS
TD_BAS_07	PSAP initiated call clear-down
TD_BAS_08	IVS initiated call clear-down not allowed
TD_BAS_09	Verification of audio interfaces of IVS and PSAP
TD_BAS_10	MSD update on request from PSAP
TD_BAS_11	Void
TD_BAS_12	Void
TD_BAS_13	Format of encoded and decoded MSD in accordance with EN 15722:2015 [10]
TD_BAS_14	Void
TD_BAS_15	Negative acknowledgement for the initial MSD
TD_BAS_16	Format of encoded and decoded MSD in accordance with EN 15722:2020 [12]

The advanced test scenarios in Tables 3, 4, 5 and 6 are foreseen to do additional testing which goes beyond the basic test scenarios.

Table 3: Advanced Tests for PSAP and IVS

Test case ID	Title
TD_ADV_01	MSD transfer to PSAP supporting IMS eCall over IPv4
TD_ADV_02	MSD transfer to PSAP supporting IMS eCall over IPv6
TD_ADV_03	Void
TD_ADV_04	MSD transfer to PSAP not supporting IMS eCall
TD_ADV_05	IMS eCall establishment with IMS emergency registration
TD_ADV_06	IMS eCall establishment without IMS emergency registration
TD_ADV_07	IMS eCall establishment without IMS emergency registration GIBA supported
TD_ADV_08	MSD transfer via in-band modem after negative acknowledgement for the MSD
TD_ADV_09	MSD transfer via in-band modem after missing acknowledgement for the MSD
TD_ADV_10	MSD transfer via in-band modem after missing MSD in INVITE request
TD_ADV_11	MSD update during PSAP initiated callback

Table 4: Advanced Tests for IVS

Test case ID	Title
TD_ADV_IVS_01	Fallback to legacy eCall following busy during call setup
TD_ADV_IVS_02	Fallback to legacy eCall following unavailable response during call setup
TD_ADV_IVS_03	Fallback to legacy eCall following no-answer during call setup
TD_ADV_IVS_04	Dropped eCall after MSD has been acknowledged
TD_ADV_IVS_05	Dropped eCall before call has been established - reattempt to CS
TD_ADV_IVS_06	IVS configured for 'eCall only' service (restricted)
TD_ADV_IVS_07	eCall is attempted when no networks are available (limited service condition with forbidden PLMN on SIM/USIM)
TD_ADV_IVS_08	MSD transfer to PSAP supporting IMS eCall via PLMN without VoIMS support
TD_ADV_IVS_09	Termination of manually triggered eCall by vehicle occupant
TD_ADV_IVS_10	Termination of automatically triggered eCall by vehicle occupant not allowed/not possible
TD_ADV_IVS_11	Ongoing eCall shall not be disconnected if new trigger is received
TD_ADV_IVS_12	No Fallback to legacy eCall following busy during call setup
TD_ADV_IVS_13	No Fallback to legacy eCall following unavailable response during call setup
TD_ADV_IVS_14	Dropped eCall after call has been established - reattempt to PS
TD_ADV_IVS_15	Dropped eCall before call has been established - reattempt to PS
TD_ADV_IVS_16	Test eCall is not attempted when no networks are available (limited service condition with forbidden PLMN on SIM/USIM)
TD_ADV_IVS_17	Reattempt of eCall following no-answer during call setup

Table 5: Advanced Tests for PSAP

Test case ID	Title
TD_ADV_PSAP_01	PSAP handling of more than one eCall simultaneously
TD_ADV_PSAP_02	PSAP correct MSD additional data decoding
TD_ADV_PSAP_03	Rerouting to another PSAP/emergency control centre
TD_ADV_PSAP_04	PSAP operator user interface
TD_ADV_PSAP_05	Invalid MSD

Table 6: Advanced Tests for TPS

Test case ID	Title
TD_ADV_TPS_01	TPSP and rerouting to national PSAP
TD_ADV_TPS_02	Conference call between TPS IVS, TPSP and national PSAP

4.5 Overview of Related IVS Tests

Table 7 provides an overview of related IVS tests. The tests on the left verify the IVS behaviour in case of a hybrid network environment (including the CS and PS domain) based on the current ETSI requirements, while the tests on the right side verify the IVS behaviour in case of a PS-only environment based on the updated CEN requirements in TS 17184:2022 [4].

Table 7: Related IVS Tests

ETSI (PS & CS domain)		CEN (PS domain)	
Test case ID	**Configuration(s)**	**Test case ID**	**Configuration(s)**
TD_ADV_IVS_01	NG_eCall_CFG_02	TD_ADV_IVS_12	NG_eCall_CFG_01 or NG_eCall_CFG_07
TD_ADV_IVS_02	NG_eCall_CFG_02	TD_ADV_IVS_13	NG_eCall_CFG_01 or NG_eCall_CFG_07
TD_ADV_IVS_03	NG_eCall_CFG_02	TD_ADV_IVS_17	NG_eCall_CFG_01 or NG_eCall_CFG_07
TD_ADV_IVS_05	NG_eCall_CFG_02	TD_ADV_IVS_15	NG_eCall_CFG_01 or NG_eCall_CFG_07

5 Test Bed Architecture

5.1 Test site layout

The generic test bed used to carry out interoperability tests, is summarized in the below Figure 1.

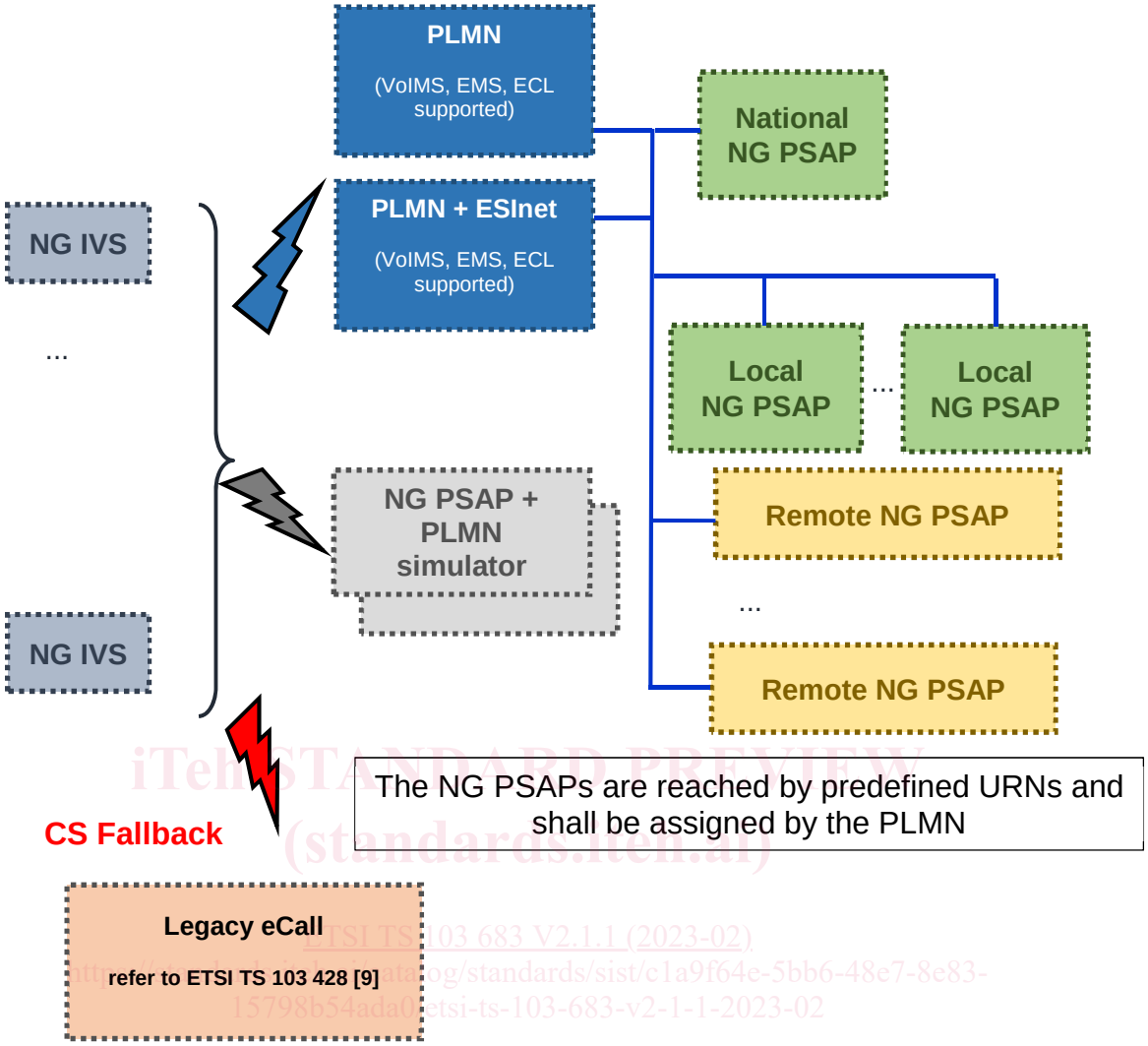

Figure 1: Architecture

In normal operation conditions, the NG IVS establishes an NG eCall via the correct URN. This call setting is then interpreted by the mobile network (PLMN) or combined network with PLMN and ESInet as a requirement to connect the NG IVS with the most appropriate NG PSAP, able to handle NG eCalls, accordingly to TS 17184:2022 [4]. ESInet and core elements for network independent access to emergency services are specified in ETSI TS 103 479 [15].

However, during an NG eCall interoperability event, an NG IVS needs to be connected to a given NG PSAP in order to carry out pairing test sessions, following the test scenarios provided in the present document. The selection of the NG PSAP is therefore achieved by the use of the pre-defined URNs (see Table 6), if supported (configured) by the PLMN operator.

For the purpose of carrying out tests under real conditions, different options are available:

- Using test systems providing PLMN and NG PSAP simulation (connection in shielded cases or via cable).
- Using different non-standardized URNs, if the local authorities do not allow using the standardized URNs connections and thus reaching the real PSAP.

Table 8: NG eCall Types and related URNs

NG eCall Type	NG eCall URNs IETF RFC 8147 [8]	Proposed Plugtests URNs
Manual	urn:service:sos.ecall.manual	urn:service:test.sos.ecall.manual.psap1 urn:service:test.sos.ecall.manual.psap2 .. urn:service:test.sos.ecall.manual.psapn
Automatic	urn:service:sos.ecall.automatic	urn:service:test.sos.ecall.automatic.psap1 urn:service:test.sos.ecall.automatic.psap2 .. urn:service:test.sos.ecall.automatic.psapn
Test	urn:service:test.sos.ecall	urn:service:test.sos.ecall.psap1 urn:service:test.sos.ecall.psap2 .. urn:service:test.sos.ecall.psapn
NOTE: Not every IVS may support proposed Plugtests URNs.		

5.2 NG eCall HLAP flow diagram

An NG IVS should register to the network by performing the attach procedure. NG IVS may perform IMS registration if used for other services then eCall. When NG eCall is triggered, an NG IVS will perform the IMS emergency registration procedure as shown in Figure 2.

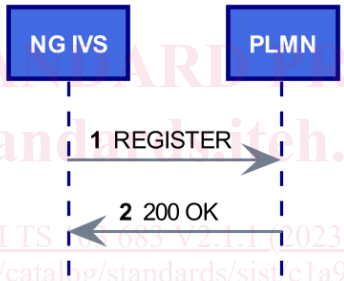

Figure 2: IMS emergency registration

1) NG IVS sends REGISTER to the PLMN.

2) NG IVS receives 200 OK from the PLMN.

After the IMS emergency registration procedure, the NG IVS initiates an IMS eCall, as shown in Figure 3.