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eCall HLAP Interoperability Testing

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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).

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1 Scope

The present document defines Interoperability Test Descriptions for the 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.

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

[1] ETSI TS 122 101: "Universal Mobile Telecommunications System (UMTS); LTE; Service aspects; Service principles (3GPP TS 22.101)".

[2] ETSI TS 124 008: "Digital cellular telecommunications system (Phase 2+) (GSM); Universal Mobile Telecommunications System (UMTS); LTE; 5G; Mobile radio interface Layer 3 specification; Core network protocols; Stage 3 (3GPP TS 24.008)".

[3] EN 15722:2015: "Intelligent transport systems - eSafety - eCall minimum set of data", (produced by CEN).

[4] EN 16062:2015: "Intelligent transport systems - eSafety - eCall high level application requirements (HLAP) using GSM/UMTS circuit switched networks", (produced by CEN).

[5] EN 16072:2015: "Intelligent transport systems - eSafety - Pan-European eCall operating requirements", (produced by CEN).

[6] ETSI TS 134 123-1: "Universal Mobile Telecommunications System (UMTS); User Equipment (UE) conformance specification; Part 1: Protocol conformance specification (3GPP TS 34.123-1)".

[7] ETSI TS 151 010-1: "Digital cellular telecommunications system (Phase 2+); Mobile Station (MS) conformance specification; Part 1: Conformance specification (3GPP TS 51.010-1)".

[8] ETSI TS 122 003: "Digital cellular telecommunications system (Phase 2+) (GSM); Universal Mobile Telecommunications System (UMTS); LTE; Circuit Teleservices supported by a Public Land Mobile Network (PLMN) (3GPP TS 22.003)".

[9] ETSI TS 102 936-1: "eCall Network Access Device (NAD) conformance specification; Part 1: Protocol test specification".

[10] Commission Delegated Regulation (EU) 2017/79 of 12 September 2016 establishing detailed technical requirements and test procedures for the EC type-approval of motor vehicles with respect to their 112-based eCall in-vehicles systems, of 112-based eCall in-vehicle separate technical units and components and supplementing and amending Regulation (EU) 2015/758 of the European Parliament and of the Council with regard to the exemptions and applicable standards.

[11] TS 17234:2018: "Intelligent transport systems - eSafety - eCall: Tests to enable PSAPs to demonstrate conformance and performance", (produced by CEN).

[12] EN 15722:2020: "Intelligent transport systems - eSafety - eCall minimum set of data", (produced by CEN).

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.

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

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

[i.2] EN 16062:2011: "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".

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, (TS12) from a vehicle, supplemented with a minimum set of emergency related data (MSD)

NOTE: As defined under the EU Commission's eSafety initiative.

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

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 [1]. 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 anytime 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.

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 call-back to the vehicle

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

PSAP Pull mode: mode in which the PSAP is configured to immediately transmit the SEND-MSD (START) message without waiting for the INITIATION message send by the IVS

PSAP Push mode: mode in which the PSAP is configured to wait for the INITIATION message send by the IVS

NOTE: After reception of the INITIATION message the PSAP transmits the SEND-MSD (START) message.

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

3.2 Symbols

Void.

3.3 Abbreviations

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

3GPP	Third Generation Partnership Project
AL-ACK	Application Layer - Acknowledgement (also called HL-ACK)
ANSI-C	American National Standard Programming Language C
CEN	Comité Européen de Normalisation
CFG	Configuration
CLI	Calling Line Identity
CRC	Cyclic Redundancy Check
CS	Circuit Switch
EMC	ElectroMagnetic Compatibility
ETSI	European Telecommunications Standards Institute
EU	European Union
EUT	Equipment Under Test
GSM	Global System of Mobile telecommunications
HLAP	High Level Application Protocol
HMI	Human Machine Interface
IE	Information Element
IFS	Interoperable Functions Statement
IFS_ID	IFS Identifier
ISDN	Integrated Services Digital Network
ITS	Intelligent Transport Systems
IVS	In Vehicle System

NOTE: eCall terminal and associated sub-systems in vehicle.

KPI	Key Performance Indicators
LL-ACK	Link Layer - ACK
LV	Low Volltage
MNO	Mobile Network Operator
MSD	Minimum Set of Data
NACK	Negative Acknowledgement
NAD	Network Access Device
NEC	Network Echo Canceller
PLMN	Public Land Mobile Network
PSAP	Public Service Answering Point
R&TTE	Radio and Telecommunications Terminal Equipment
SIP	Session Initiation Protocol
TD	Test Description
TPS	Third Party Service
TPSP	Third Party Service Provider
TS11	Teleservice No 11 (Telephony)
TS12	Teleservice No 12 (Emergency Calls)
UL	Uplink
UMTS	Universal Mobile Telecommunications System

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, when a successful functional verification may result from an incorrect behaviour for instance. Detailed protocol checks are part of the conformance testing process and are thus avoided during the Interoperability tests.

The test sessions will be mainly executed between 2 devices (IVS and PSAP eCall modem-server) from different vendors.

In the present document, test description is provided to guide the test process during the test sessions.

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 events 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 conformance check method.

For the execution of the interoperability test sessions, the following conventions apply:

- Optional (check) tests should be performed using High Level Application Protocol (HLAP) monitor tools (see clause 4.2 'Tooling') and may be skipped due to time restrictions.

4.1.3 Interoperable Functions Statement (IFS)

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 an 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 an 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>	Identifier	Description
<root> = root applicability	BAS	Basic tests
	ADV	Advanced tests
	PER	Performance tests
<gr> = group	IVS	eCall terminal
	PSAP	PSAP eCall modem-server
		IVS or PSAP
<nn> = sequential number	01 to 99	Sequential numbers

4.4 Test Summary

Test scenario with a detailed test description, are provided in the present document to provide guidance to the participants and to ensure consistent testing among the different test sessions and participants. The detailed test descriptions are in the clause 7. It is recommended to conduct all test cases for all technologies supported by the IVS, e.g. a dual mode GSM and UMTS IVS should conduct all tests with both technologies.

The test scenarios are split in 3 groups:

- The basic scenarios, which shall be executed during all test sessions, covering the basic features of an eCall devices (IVS or PSAP).
- The advanced test scenarios, which are provided to do additional testing according to the time left during the test sessions. These scenarios are focusing either on IVS or PSAP features.
- The performance test scenarios, similar to a real eCall service, dedicated to check some performance issues from PSAP side. These scenarios are focusing on some performance checks relating to repetitive or parallel calls from different IVS or IVS simulator to the same PSAP.

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	Summary
TD_BAS_01	MSD transmission/reception/acknowledgement with PSAP in Pull mode
TD_BAS_02	MSD transmission/reception/acknowledgement with PSAP in Push mode
TD_BAS_03	Voice communication after receipt of AL-ACK
TD_BAS_04	Retransmission of MSD on request from PSAP
TD_BAS_05	Voice communication after retransmission of MSD
TD_BAS_06	Clear-down/PSAP initiated network clear-down
TD_BAS_07	Clear-down/PSAP initiated application layer AL-ACK clear-down
TD_BAS_08	Call Back/PSAP initiated call back to IVS and re-send MSD
TD_BAS_09	PSAP correct handling of voice call in case of in-band modem resources busy or out of service
TD_BAS_10	MSD activation type indicator set to 'Automatic'
TD_BAS_11	MSD activation type indicator set to 'Manual'
TD_BAS_12	MSD call type indicator set to 'Test Call'
TD_BAS_13	Mute IVS audio during MSD transmission and un-mute after application layer acknowledgement
TD_BAS_14	Mute PSAP audio during MSD request/MSD transfer and un-mute after application layer acknowledgement
TD_BAS_15	Format of encoded and decoded MSD in accordance with EN 15722 [3]
TD_BAS_16	MSD transmission following NEC disabling tone with PSAP in Pull mode
TD_BAS_17	MSD transmission following NEC disabling tone with PSAP in Push mode
TD_BAS_18	Format of encoded and decoded MSD in accordance with EN 15722 [12]

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

Table 3: Advanced IVS Tests

Test case ID	Summary
TD_ADV_IVS_01	Auto redial following busy during call set-up
TD_ADV_IVS_02	Auto redial following no-answer during call set-up
TD_ADV_IVS_03	IVS configured for 'eCall only' service (restricted)
TD_ADV_IVS_04	eCall deactivated during TPS call
TD_ADV_IVS_05	Fall-back to 112-based eCall when TPS is not functional
TD_ADV_IVS_06	IVS privacy protection from PSAP call-back

Table 4: Advanced PSAP Tests

Test case ID	Summary
TD_ADV_PSAP_01	Un-mute PSAP audio when Initiation Signal not received within 5 s (T4 expired)
TD_ADV_PSAP_02	PSAP handling of more than 1 eCall simultaneously
TD_ADV_PSAP_03	PSAP correct MSD additional data decoding

Table 5: Performance Tests

Test case ID	Summary
TD_PER_PSAP_01	PSAP handling a number of parallel random eCalls from different IVS
TD_PER_PSAP_02	KPI 1 Success rate of eCall
TD_PER_PSAP_03	KPI 2 Success rate of call backs using eCall
TD_PER_PSAP_04	KPI 3 Success rate of correct MSDs
TD_PER_PSAP_05	KPI 4 Success rate of correct re-transmitted MSDs
TD_PER_PSAP_06	KPI 5 Duration of voice channel blocking

5 Test Bed Architecture

5.1 Test site layout

The generic test bed used to carry out interoperability tests, is summarized in figure 1. In normal operation conditions, the IVS calls the 112 called party number and shall set the Emergency Category IE of the Emergency Setup message as defined in table 10.5.135d of ETSI TS 124 008 [2]. This call setting is then interpreted by the mobile network as a requirement to connect the IVS with the most appropriate PSAP, able to handle pan EU eCalls, accordingly to EN 16062 [4].

However, during an eCall interoperability event, IVS will need to be connected to a given PSAP in order to carry out pairing test sessions, following the test scenario provided in the present document. The selection of the PSAP is therefore achieved by the use of the called party number, corresponding to the access where the PSAP is connected (ISDN or SIP trunk).

For the purpose of carrying out tests in more real conditions different options are available:

- Using test tool providing PLMN and PSAP simulation (connection in shield cases or with cable).
- Calling 112 in real conditions, if the local authorities allow using the 112 connection and thus reaching the real PSAP.
- The IVS device has the ability to call TPSP or 112 eCall service over PLMN.

NOTE: Tests defined in the present document are applicable for aftermarket eCall devices as well as 112-based eCall in-vehicle systems (OEM pre-installed).

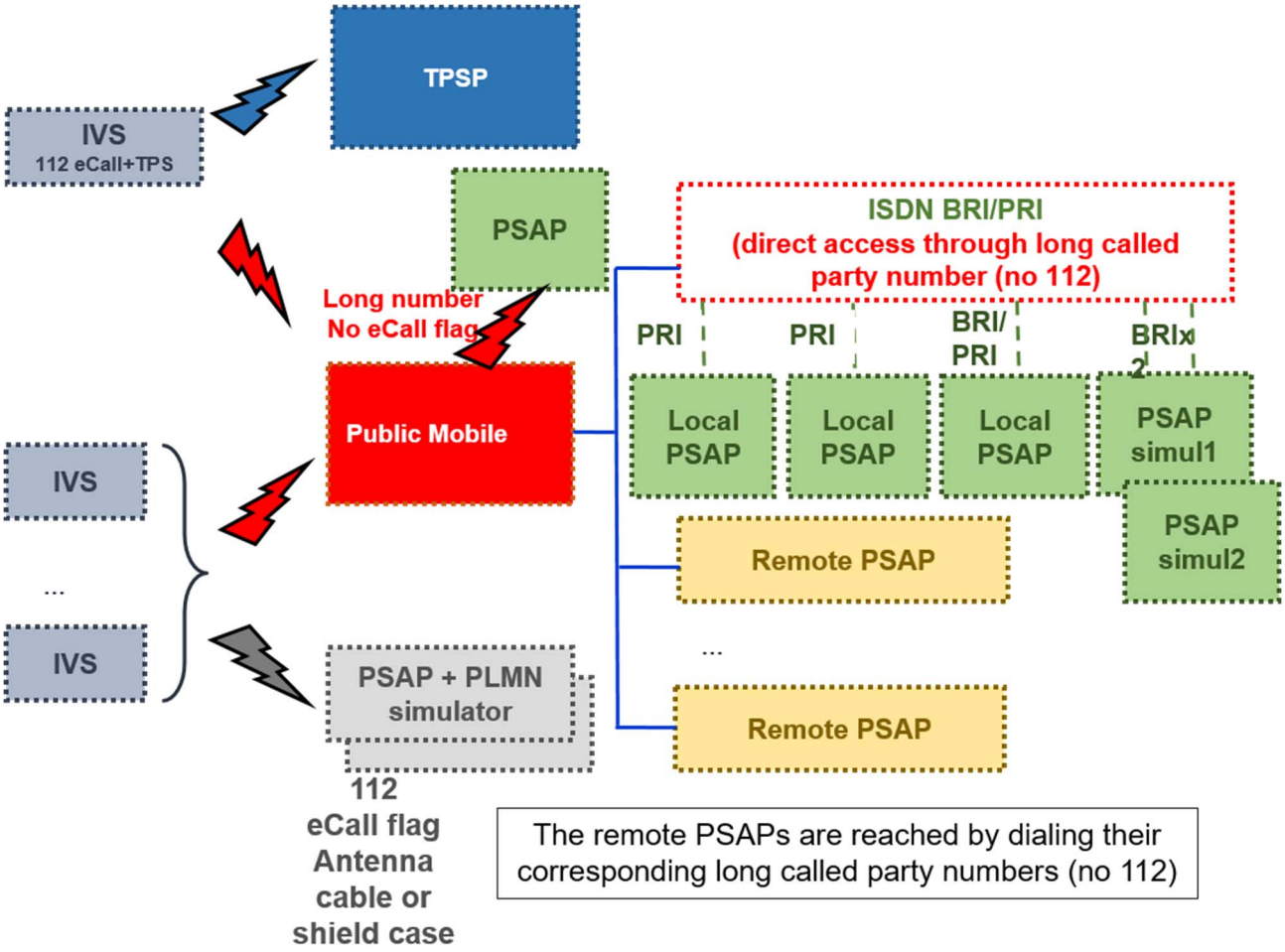

Figure 1: Test site layout

5.2 PSAP modes

Figure 6 given by EN 16062 [4] shows the overall HLAP flow diagram. It depicts the PSAP PULL and PSAP PUSH implementation variants in one diagram and requires some additional explanation for a better understanding.

In the PSAP PULL mode:

In PSAP PULL mode, the PSAP starts sending SEND-MSD (START) messages immediately after the eCall got connected, while it can optionally prepend a network echo canceller (NEC) disabler tone (typically 3,6 s). As the IVS cannot know in advance whether the PSAP is in PUSH or PULL mode, it always needs to send the PUSH-Req at the start of the eCall but should stop sending it as soon as it detects the SEND-MSD from the PSAP and then starts with the MSD transmission. Upon detection of UL sync, the PSAP should stop sending SEND-MSD and respond with NACK messages until it can decode the MSD, i.e. the flow arrow from PSAP after the first UL sync would be NACKs and not SEND-MSD in this case.

In the PSAP PUSH mode:

In PSAP PUSH mode, PSAP has to wait for UL sync of the PUSH-Req message (initiation signal) before it can start with SEND-MSD messages, i.e. the first 3 flow arrows from PSAP are not used in this case. As in the PULL mode, PSAP can optionally prepend a Network Echo Canceller (NEC) disabler tone before the SEND-MSD messages but should not do this before the initiation signal is detected.

Once the MSD transmission has started, the HLAP flow is the very same for PSAP in PULL and PUSH modes.

The application layer acknowledgement sequence is shown in figure 7 from EN 16062 [4].

6 Test Configurations

6.1 Basic Interoperability Test Configuration

Interoperability tests will be performed using the set-up shown in figure 2. Ancillary measurement and message logging equipment is not shown but may be used, with the agreement of the participants, to help identify the likely cause of any interoperability test failures that may arise.

IVS, PLMN and PSAP can be either real devices or simulators. PSAP simulators are understood to be only simulating the PSAP connected to the public network with ISDN.

Figure 2 shows the basic interoperability test configuration. IVS and PSAP can be either real equipment or simulators.

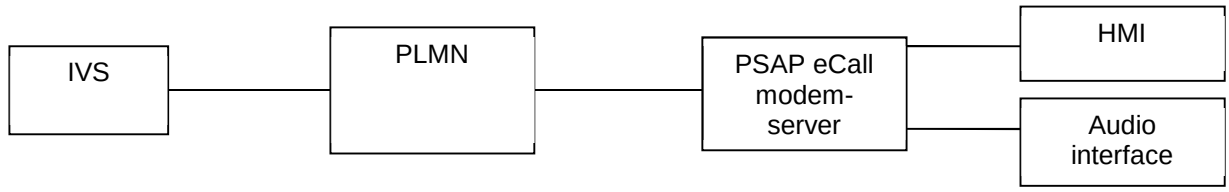

Figure 2: eCall_CFG_01 - IVS and PSAP over PLMN

6.2 Optional Interoperability Test Configurations

6.2.1 eCall_CFG_02

With the interoperability test configuration eCall_CFG_02, a TELEPHONE (only) is used to simulated a PSAP that is either not equipped with a PSAP eCall modem-server or a PSAP eCall modem server that fails to respond to the incoming Initiation Tone from the IVS for any reason.

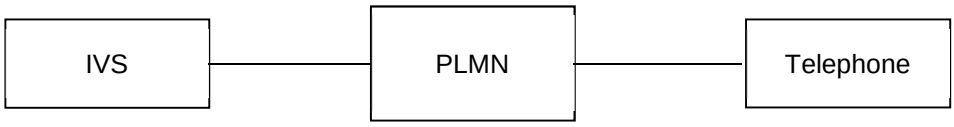

Figure 3: eCall_CFG_02 - Optional interoperability/diagnostic testing configuration

6.2.2 eCall_CFG_03

In the Interoperability test configuration eCall_CFG_03, a mobile phone is used instead of an IVS to simulate an emergency call from an IVS, that fails to transmit an eCall Initiation Signal or transmits an invalid Initiation Tone, or from a miss-routed mobile phone originated the emergency call. In all such cases, the PSAP modem-server shall not respond with a request to 'SEND MSD' (START message) but is required, after the specified time, to transfer the emergency call to a PSAP operator, so that 2-way speech can be established.

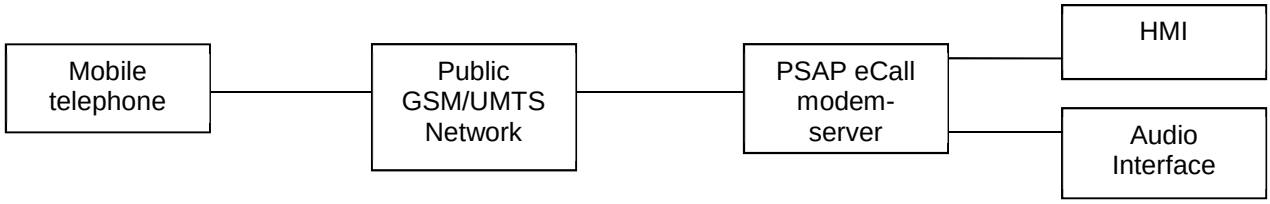

Figure 4: eCall_CFG_03 - Optional interoperability/diagnostic testing configuration

6.2.3 eCall_CFG_04

In the Interoperability test configuration eCall_CFG_04, more than one IVS will repetitively call the same PSAP to simulate a real service. The PSAP shall be able to handle a certain number of parallel emergency calls and route them to a certain number of operator phones.

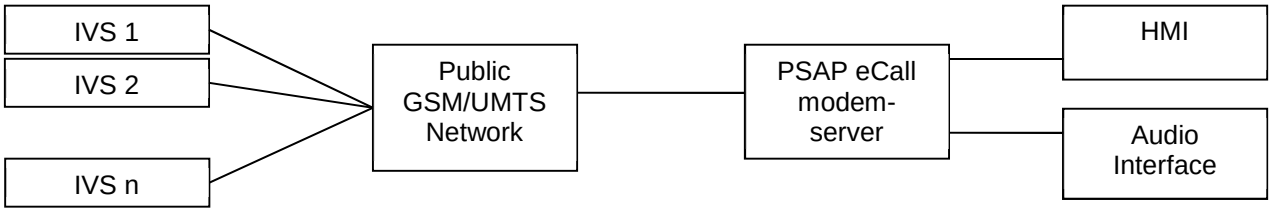

Figure 5: eCall_CFG_04 - Optional interoperability/diagnostic testing configuration

6.2.4 eCall_CFG_05

In the Interoperability test configuration eCall_CFG_05, the IVS device has the ability to call TPSP or 112 eCall service. If IVS is calling first the TPS then TPSP have the ability to forward the MSD data and call 112 eCall operator.

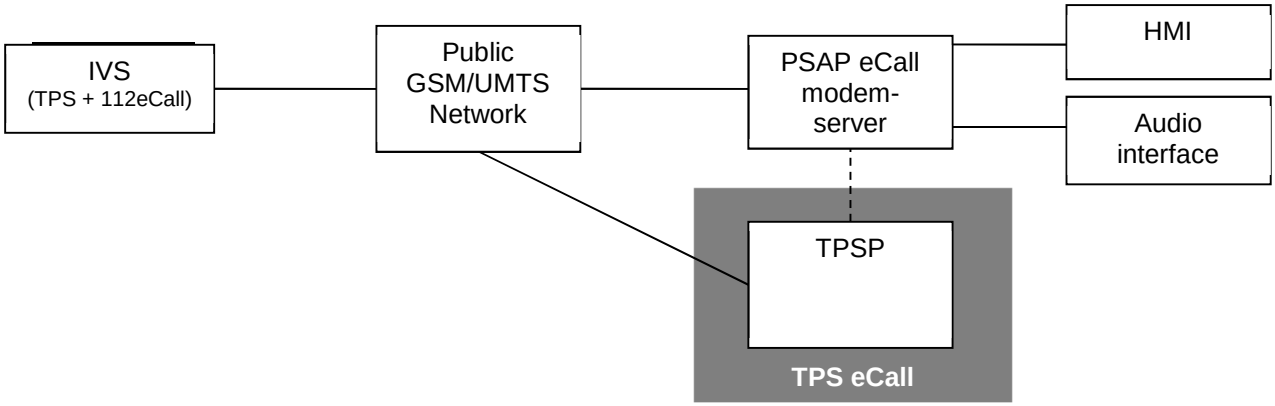

Figure 6: eCall_CFG_05 - Optional interoperability/diagnostic testing configuration

6.3 Default pre-test conditions

The following default pre-test conditions apply to all tests unless otherwise stated in the test cases description:

- Ignition is ON and IVS is in mobile network coverage.
- MNO and PSAP test points are available.
- IVS has all the information needed to compile the MSD.

6.4 Interoperable Functions Statement (IFS)

Table 6: PSAP features

Item	Entity	IFS_ID	Status	Support
1	PSAP supports sending directly SEND-MSD message without waiting for INITIATION message	PSAP_PULL	o.501 (see note)	
2	PSAP supports waiting for INITIATION Message prior to sending the SEND-MSD message	PSAP_PUSH	o.501 (see note)	
3	PSAP supports 2-way speech	PSAP_speech	m	
4	PSAP supports 2-way speech mute/unmute	PSAP_speech_mute	m	
5	PSAP supports NEC	PSAP_NEC	o	
6	PSAP supports MSD message version 2	PSAP_MSDv2	m	
7	PSAP supports MSD message version 3	PSAP_MSDv3	o	
8	PSAP supports simultaneous eCalls	PSAP_simult_eCalls	o	
NOTE: o.501: It is mandatory to support at least one feature.				

Table 7: IVS features

Item	Entity	IFS_ID	Status	Support
1	IVS supports 2-way speech	IVS_speech	m	
2	IVS supports MSD retransmission	IVS_MSD_retransmission	m	
3	IVS supports network clear-down	IVS_NW_clear-down	m	
4	IVS supports AL-ACK clear-down	IVS_AL-ACK_clear-down	m	
5	IVS supports automatic eCall activation	IVS_auto_eCall	m	
6	IVS supports manual eCall activation	IVS_man_eCall	m	
7	IVS supports test call	IVS_test_call	o	
8	IVS supports 2-way speech mute/unmute	IVS_speech_mute	o	
9	IVS supports NEC	IVS_NEC	o	
10	IVS supports MSD message version 2	IVS_MSDv2	m	
11	IVS supports MSD message version 3	IVS_MSDv3	o	
12	IVS supports additional MSD data	IVS_add_MSD_data	o	
13	IVS supports auto_redial	IVS_auto_redial	m	
14	IVS supports eCall only	IVS_eCall_only	o	
15	IVS supports 112 eCall and TPS eCall	IVS_eCall_and_TPS	o	

6.5 Test Configuration parameters

Table 8: Parameters

Item	Entity	Description	Value
1	PSAP long number	Called party number to be used to reach the selected PSAP	

7 eCall test scenarios

7.0 Introduction

The tests defined in the present document shall be performed according to the test applicability. The test applicability is defined in each test in the field 'Applicability' and is expressed with IFS statements. The tests apply to IVS and PSAP as well as to IVS or PSAP simulators.

In EN 16062 HLAP standard [i.2] the PUSH mode was mandatory and furthermore, the pull mode was not allowed.

However, following several trials, it showed that the PULL mode could significantly reduce the delay for sending the MSD and thus establishing the voice connection. Therefore **in EN 16062 [**4**], the PULL mode is mandatory**, and the PUSH is applied only when the PSAP cannot identify that the incoming call is an eCall. For more details, refer to clause 5.2.

It is recommended to conduct all test cases for all technologies supported by the IVS, e.g. a dual mode GSM and UMTS IVS should conduct all tests with both technologies.

7.1 Basic test scenarios

7.1.1 MSD transmission/reception/acknowledgement with PSAP in Pull mode

Interoperability Test Description			
Identifier:	TD_BAS_01		
Objective:	To verify the eCall initiation with the PSAP sending a SEND-MSG message without waiting for the INITIATION message.		
Configuration:	eCall_CFG_01		
References:	Clause 7.4.2 of EN 16062 [4]		
Applicability:	PSAP_PULL		
Pre-test conditions:	Default see clause 6.3		
Test Sequence:	Step	Type	Description
	1	stimulus	IVS initiates an eCall
	2	verify	PSAP answers call and immediately transmits SEND-MSD (START) message without waiting for the valid Initiation Signal
	3	verify	If IVS had started to send an INITIATION message then IVS stopped sending the INITIATION message on receipt of the SEND-MSD message from the PSAP
	4	verify	PSAP verifies first MSD is received
	5	verify	Verify the MSD is correctly decoded
	6	check	MSD content at PSAP is identical to content transmitted by IVS
	7	verify	PSAP sends acknowledgement
	8	verify	Verify that the IVS has stopped transmitting the MSD

7.1.2 MSD transmission/reception/acknowledgement with PSAP in Push mode

Interoperability Test Description			
Identifier:	TD_BAS_02		
Objective:	To verify the eCall initiation with the IVS sending an INITIATION message prior to receiving a SEND-MSD message (PSAP is waiting for the INITIATION message).		
Configuration:	eCall_CFG_01		
References:	Clause 7.4.2 of EN 16062 [4]		
Applicability:	PSAP_PUSH		
Pre-test conditions:	Default see clause 6.3 • PSAP being configured for the PUSH mode to wait for the INITIATION message send by the IVS		
Test Sequence:	Step	Type	Description
	1	stimulus	PSAP waits for the eCall setup and the initiation message and **does not send** the SEND-MSD message
	2	stimulus	IVS initiates an eCall and sends an initiation message within 5 s
	3	verify	PSAP transmits SEND-MSD (START) message
	4	verify	IVS stopped sending the INITIATION message
	5	verify	PSAP verifies first MSD is received
	6	verify	Verify the MSD is correctly decoded
	7	check	MSD content at PSAP is identical to content transmitted by IVS
	8	verify	PSAP sends acknowledgement
	9	verify	Verify that the IVS has stopped transmitting the MSD

7.1.3 Voice communication after receipt of AL-ACK

Interoperability Test Description			
Identifier:	TD_BAS_03		
Objective:	To verify that following transmission of the MSD and receipt of an application layer acknowledgement (AL-ACK) from the PSAP, the IVS and PSAP audio interfaces are reconnected and that 2-way speech is possible between the IVS and PSAP.		
Configuration:	eCall_CFG_01		
References:	Clause 7.5.1 of EN 16062 [4]		
Applicability:	PSAP_PULL AND IVS_speech		
Pre-test conditions:	Default see clause 6.3		
Test Sequence:	Step	Type	Description
	1	stimulus	IVS initiates an eCall
	2	verify	PSAP verifies the call is established
	3	verify	PSAP verifies first MSD is received
	4	verify	PSAP verifies the MSD is correctly decoded
	5	verify	Establishment of voice communication
	6	verify	Verify that 2-way speech can be exchanged

7.1.4 Retransmission of MSD on request from PSAP

Interoperability Test Description			
Identifier:	TD_BAS_04		
Objective:	To verify that the IVS is able to recognize and act upon a request from the PSAP, during an ongoing speech conversation, to send or re-send an updated MSD.		
Configuration:	eCall_CFG_01		
References:	Clause 7.6.2 of EN 16062 [4]		
Applicability:	PSAP_PULL AND IVS_MSD_retransmission		
Pre-test conditions:	Default see clause 6.3 • Background voice is applied at IVS prior to and during MSD transmission to verify that the IVS can recognize a request from the PSAP to re-send an MSD when a speech call is in progress		
Test Sequence:	Step	Type	Description
	1	stimulus	IVS initiates an eCall
	2	verify	PSAP verifies the call is established
	3	verify	PSAP verifies first MSD is received
	4	verify	PSAP verifies the MSD is correctly decoded (MSD ID = 1)
	5	verify	Establishment of voice communication
	6	verify	Verify that 2-way speech can be exchanged
	7	stimulus	PSAP pulls a second MSD
	8	verify	Verify the second MSD is received and correctly decoded (MSD ID = 2)

7.1.5 Voice Communication after retransmission of MSD

Interoperability Test Description			
Identifier:	TD_BAS_05		
Objective:	To verify that following retransmission of the MSD and receipt of an application layer acknowledgement (AL-ACK) from the PSAP, the IVS and PSAP audio systems are reconnected and that 2-way speech is possible between the IVS and PSAP operator.		
Configuration:	eCall_CFG_01		
References:	Clause 7.5.1 of EN 16062 [4]		
Applicability:	PSAP_PULL AND IVS_speech AND IVS_MSD_retransmission		
Pre-test conditions:	Default see clause 6.3		
Test Sequence:	Step	Type	Description
	1	stimulus	IVS initiates an eCall
	2	verify	PSAP verifies the call is established
	3	verify	PSAP verifies first MSD is received
	4	verify	PSAP verifies the MSD is correctly decoded (MSD ID = 1)
	5	verify	Establishment of voice communication
	6	verify	Verify that 2-way speech can be exchanged
	7	stimulus	PSAP pulls a second MSD
	8	verify	Verify this MSD is received and correctly decoded (MSD ID = 2)
	9	verify	Establishment of voice communication
	10	verify	Verify that 2-way speech can be exchanged

7.1.6 Clear-down/PSAP initiated network clear-down

Interoperability Test Description			
Identifier:	TD_BAS_06		
Objective:	To verify that when the PSAP clears down the eCall, the IVS also clears down following receipt of the mobile network clear-down message.		
Configuration:	eCall_CFG_01		
References:	Clause 7.9 of EN 16062 [4]		
Applicability:	PSAP_PULL AND IVS_NW_clear-down		
Pre-test conditions:	Default see clause 6.3		
Test Sequence:	Step	Type	Description
	1	stimulus	IVS initiates an eCall
	2	verify	PSAP verifies the call is established
	3	verify	PSAP verifies MSD is received and correctly decoded
	4	verify	Establishment of voice communication for 5 s
	5	stimulus	PSAP clears down the call/network clear-down
	6	verify	Verify that the IVS clears down following receipt of network clear-down message

7.1.7 Clear-down/PSAP initiated application layer AL-ACK clear-down

Interoperability Test Description			
Identifier:	TD_BAS_07		
Objective:	To verify that following the positive acknowledgment of the first MSD with AL-ACK = 0, the PSAP can request the IVS to clear-down on receipt of the second MSD with an application layer AL-ACK clear-down message from the PSAP and the IVS clears-down.		
Configuration:	eCall_CFG_01		
References:	Clause 7.9 of EN 16062 [4]		
Applicability:	PSAP_PULL AND IVS_AL-ACK_clear-down		
Pre-test conditions:	Default see clause 6.3		
Test Sequence:	Step	Type	Description
	1	stimulus	IVS initiates an eCall
	2	verify	PSAP verifies the call is established
	3	verify	PSAP verifies first MSD is received
	4	verify	PSAP verifies the MSD is correctly decoded (MSD ID = 1)
	5	stimulus	PSAP sends an AL-ACK with value 0 instructing the IVS to hold the call
	6	stimulus	PSAP pulls a second MSD
	7	verify	Verify this MSD is received and correctly decoded (MSD ID = 2)
	8	stimulus	PSAP sends an AL-ACK with value 02 instructing the IVS to clear-down the call
	9	verify	Verify that the IVS clears down following receipt of application layer AL-ACK clear-down message

7.1.8 Call Back/PSAP initiated call back to IVS and re-send MSD

Interoperability Test Description			
Identifier:	TD_BAS_08		
Objective:	To verify that if an eCall has been successfully terminated by the PSAP, then the IVS shall allow a call-back into the vehicle and re-send a MSD on request of the PSAP.		
Configuration:	eCall_CFG_01		
References:	Clauses 7.10, 7.6.3 of EN 16062 [4] Clause 7.17.3 of EN 16072 [5]		
Applicability:	PSAP_PULL AND IVS_speech AND IVS_MSD_retransmission		
Pre-test conditions:	Default see clause 6.3 • PSAP shall have received the CLI from the network		
Test Sequence:	Step	Type	Description
	1	stimulus	IVS initiates an eCall
	2	verify	PSAP verifies the call is established
	3	verify	PSAP verifies first MSD is received and correctly decoded
	4	verify	Verify that 2-way speech can be exchanged for 5 s
	5	stimulus	PSAP clears down the call/network or application layer clear-down
	6	verify	Verify that IVS has cleared down
	7	stimulus	PSAP initiates a call back using CLI
	8	verify	Verify that 2-way speech can be exchanged
	9	stimulus	PSAP pulls MSD whilst two-way conversation is in progress
	10	verify	Verify that MSD is received and correctly decoded
	11	verify	Verify that 2-way speech can be exchanged
	12	stimulus	PSAP clears down call/network or application layer clear-down
	13	verify	Verify that IVS clears down correctly following receipt of network or application layer clear down message

7.1.9 PSAP correct handling of voice call in case of in-band modem resources busy or out of service

Interoperability Test Description			
Identifier:	TD_BAS_09		
Objective:	To verify that if the PSAP does not send the SEND-MSD then the call is handled correctly for the voice connection.		
Configuration:	eCall_CFG_01		
References:	Clause 7.4.2 of EN 16062 [4]		
Applicability:	PSAP_PULL AND PSAP_speech		
Pre-test conditions:	Default see clause 6.3 • PSAP being configured to have no in-band modems available		
Test Sequence:	Step	Type	Description
	1	stimulus	IVS initiates an eCall
	2	verify	PSAP receives the call but does not transmit SEND-MSD (START Signal)
	3	verify	PSAP verifies that the call is immediately routed to Operator or Operators queue
	4	stimulus	The Operator answers the call
	5	verify	Verify that 2-way speech can be exchanged after the IVS T5 timer expires
NOTE: This test is depending on the internal PSAP architecture, anyway the concept is that the modem un-availability cannot be a blocking reason for the incoming emergency calls.			

7.1.10 MSD activation type indicator set to 'Automatic'

Interoperability Test Description			
Identifier:	TD_BAS_10		
Objective:	To verify that the MSD received from the IVS contains the eCall initiation indicator for an automatic triggered eCall.		
Configuration:	eCall_CFG_01		
References:	Clause 6.3.2 of EN 15722 [3]		
Applicability:	PSAP_PULL AND IVS_auto_eCall		
Pre-test conditions:	Default see clause 6.3 • IVS has all the information needed to compile the MSD and set the MSD activation type indicator according to an automatic triggered eCall, using the emergency call teleservice (TS12) as defined in ETSI TS 122 003 [8], clause A.1.2 • If the PSAP is only reachable via long number (no TS12 available) for testing purposes TS11 may be used instead of TS12		
Test Sequence:	Step	Type	Description
	1	stimulus	IVS initiates an automatic triggered eCall, using TS12 (or TS11) according to ETSI TS 122 003 [8], clause A.1.2
	2	verify	PSAP verifies that MSD is received
	3	verify	Open the received MSD and verify that block 3 contains an indication that the eCall was automatically initiated (automaticActivation = true)

7.1.11 MSD activation type indicator set to 'Manual'

Interoperability Test Description			
Identifier:	TD_BAS_11		
Objective:	To verify that the MSD received from the IVS contains the correct eCall initiation indicator for a manually triggered eCall.		
Configuration:	eCall_CFG_01		
References:	Clause 6.3.2 of EN 15722 [3]		
Applicability:	PSAP_PULL AND IVS_man_eCall		
Pre-test conditions:	Default see clause 6.3 • IVS has all the information needed to compile the MSD and set the MSD activation type indicator according to a manually triggered eCall, using the emergency call teleservice (TS12) as defined in ETSI TS 122 003 [8], clause A.1.2 • If the PSAP is only reachable via long number (no TS12 available) for testing purposes TS11 may be used instead of TS12		
Test Sequence:	Step	Type	Description
	1	stimulus	IVS initiates a manually triggered eCall, using TS12 (or TS11) according to ETSI TS 122 003 [8], clause A.1.2
	2	verify	PSAP verifies that MSD is received
	3	verify	Open the received MSD and verify that block 3 contains an indication that the eCall was manually initiated (automaticActivation = false)

7.1.12 MSD call type indicator set to 'Test Call'

Interoperability Test Description			
Identifier:	TD_BAS_12		
Objective:	To verify that the MSD received from the IVS contains the correct test eCall indicator for a test eCall.		
Configuration:	eCall_CFG_01		
References:	Clause 6.3.2 of EN 15722 [3]		
Applicability:	PSAP_PULL AND IVS_test_call		
Pre-test conditions:	Default see clause 6.3 • IVS has all the information needed to compile the MSD and set the MSD call type indicator according to a test eCall, using the telephony teleservice (TS11) as defined in ETSI TS 122 003 [8], clause A.1.1		
Test Sequence:	Step	Type	Description
	1	stimulus	IVS triggers a test eCall, using TS11 according to ETSI TS 122 003 [8], clause A.1.1
	2	verify	PSAP verifies that MSD is received
	3	verify	Open the received MSD and verify that block 3 contains an indication that the eCall is a test eCall (testCall = true)

7.1.13 Mute IVS audio during MSD transmission and un-mute after application layer acknowledgement

Interoperability Test Description			
Identifier:	TD_BAS_13		
Objective:	To verify that when an eCall is activated the IVS audio (including entertainment audio) is muted so as not to cause interference to the call whilst the MSD is being transmitted, and is not un-muted before an MSD acknowledgement is received from the PSAP.		
Configuration:	eCall_CFG_01		
References:	Clause 7.2.1 of EN 16062 [4]		
Applicability:	PSAP_PULL AND IVS_speech AND IVS_speech_mute		
Pre-test conditions:	Default see clause 6.3 • Audio channel monitor is available (see note)		
Test Sequence:	Step	Type	Description
	1	stimulus	IVS initiates an eCall
	2	stimulus	Incoming call to PSAP test point is answered
	3	stimulus	PSAP monitors audio output from the call whilst MSD is being transmitted from the IVS
	4	stimulus	Attempt voice communication with the IVS operator
	5	verify	Verify that voice communication with the IVS operator cannot be established
	6	verify	PSAP verifies that MSD is received and decoded correctly
	7	verify	Verify that 2-way speech can be exchanged following application layer acknowledgement
NOTE: If the IVS supports an entertainment audio muting function then this should be activated when required during this test.			

7.1.14 Mute PSAP audio during MSD request/MSD transfer and un-mute after application layer acknowledgement

Interoperability Test Description			
Identifier:	TD_BAS_14		
Objective:	To verify that when an incoming eCall is answered, and when an MSD is requested during an ongoing call, the PSAP does not cause audio interference to the modem transmissions.		
Configuration:	eCall_CFG_01		
References:	Clause 7.2.1 of EN 16062 [4]		
Applicability:	PSAP_PULL AND PSAP_speech AND PSAP_speech_mute		
Pre-test conditions:	Default see clause 6.3 • Audio channel monitor is available		
Test Sequence:	Step	Type	Description
	1	stimulus	IVS initiates an eCall
	2	stimulus	Incoming call to PSAP test point is answered
	3	stimulus	Monitor audio output from the call whilst MSD is being requested and transmitted from the IVS, and until an application layer acknowledgement is sent to the IVS
	4	stimulus	PSAP operator attempt to establish voice communication with IVS
	5	verify	Verify that the there are no unwanted audio artefacts (e.g. speech) detected whilst monitoring the audio channel
	6	verify	PSAP verifies that MSD is received and decoded correctly
	7	verify	Verify that 2-way speech can be exchanged after an application layer acknowledgement

7.1.15 Format of encoded and decoded MSD in accordance with EN 15722:2015

Interoperability Test Description			
Identifier:	TD_BAS_15		
Objective:	To verify that the IVS formats the MSD in accordance EN 15722 [3] and encodes it correctly, and that the PSAP decodes and displays it correctly.		
Configuration:	eCall_CFG_01		
References:	Clause 6.3.2 of EN 15722 [3] Clauses 7.4 and 7.5 of EN 16062 [4]		
Applicability:	PSAP_PULL AND IVS_MSDv2 AND PSAP_MSDv2		
Pre-test conditions:	Default see clause 6.3 • PSAP operator knows the content of the transmitted MSD		
Test Sequence:	Step	Type	Description
	1	stimulus	IVS initiates an eCall
	2	verify	PSAP verifies the call is established
	3	verify	PSAP performs CRC check and sends (LL-ACK and HL-ACK) or (HL-ACK only) to IVS
	4	verify	IVS stops transmitting MSD
	5	check	Visually inspect format, content, logic and accuracy of MSD when decoded and displayed on screen. Check all MSD fields according to EN 15722 [3]. Mandatory MSD elements: • msdVersion (shall be set to 2) • messageIdentifier (shall be set to 1) • automaticActivation • testCall • positionCanBeTrusted • vehicleType • vehicleIdentificationNumber • gasolineTankPresent • dieselTankPresent • compressedNaturalGas • liquidPropaneGas • electricEnergyStorage • hydrogenStorage • otherStorage • timestamp • vehicleLocation • vehicleDirection Optional MSD elements: • recentVehicleLocationN1 • recentVehicleLocationN2 • numberOfPassengers • optionalAdditionalData

7.1.16 MSD transmission following NEC disabling tone with PSAP in Pull mode

Interoperability Test Description			
Identifier:	TD_BAS_16		
Objective:	To verify that the PSAP, to disable the Network Echo Canceller device, send a NEC disabling tone prior to sending the SEND-MSD message and the IVS is able to proceed the following SEND-MSD request message correctly by sending the MSD.		
Configuration:	eCall_CFG_01		
References:	Clause 7.4.2 of EN 16062 [4]		
Applicability:	PSAP_PULL AND PSAP_NEC AND IVS_NEC		
Pre-test conditions:	Default see clause 6.3 • PSAP is configured to send a NEC disabling tone • PSAP being configured for the mandatory PULL mode to immediately transmit NEC disabling tone followed by SEND-MSD (START) message		
Test Sequence:	Step	Type	Description
	1	stimulus	IVS initiates an eCall
	2	verify	PSAP answers call and immediately transmits a NEC disabling tone
	3	verify	PSAP transmits SEND-MSD (START) message without waiting for the valid Initiation Signal
	4	verify	PSAP verifies first MSD is received
	5	verify	Verify the MSD is correctly decoded
	6	check	MSD content at PSAP is identical to content transmitted by IVS
	7	verify	PSAP sends acknowledgement
	8	verify	Verify that the IVS has stopped transmitting the MSD

7.1.17 MSD transmission following NEC disabling tone with PSAP in Push mode

Interoperability Test Description			
Identifier:	TD_BAS_17		
Objective:	To verify that the PSAP, to disable the Network Echo Canceller device, send a NEC disabling tone and the IVS is able to proceed the following SEND-MSD request message correctly by sending the MSD.		
Configuration:	eCall_CFG_01		
References:	Clause 7.4.2 of EN 16062 [4]		
Applicability:	PSAP_PUSH AND PSAP_NEC AND IVS_NEC		
Pre-test conditions:	Default see clause 6.3 • PSAP is configured to send a NEC disabling tone • PSAP being configured for the PUSH mode to wait for the INITIATION message send by the IVS		
Test Sequence:	Step	Type	Description
	1	stimulus	PSAP waits for the eCall setup and the initiation message and **does not send** the SEND-MSD message
	2	stimulus	IVS initiates an eCall and sends an initiation message within 5 s
	3	verify	PSAP answers the call
	4	verify	Upon detection of the initiation signal, PSAP sends the NEC tone before it transmits SEND-MSD (START) message
	5	verify	IVS stopped sending the INITIATION message
	6	verify	PSAP verifies first MSD is received
	7	verify	Verify the MSD is correctly decoded
	8	check	MSD content at PSAP is identical to content transmitted by IVS
	9	verify	PSAP sends acknowledgement
	10	verify	Verify that the IVS has stopped transmitting the MSD

7.1.18 Format of encoded and decoded MSD in accordance with EN 15722:2020

Interoperability Test Description			
Identifier:	TD_BAS_18		
Objective:	To verify that the IVS formats the MSD in accordance EN 15722 [12] and encodes it correctly, and that the PSAP decodes and displays it correctly.		
Configuration:	eCall_CFG_01		
References:	Clause 5.3.2 of EN 15722 [12] Clauses 7.4 and 7.5 of EN 16062 [4]		
Applicability:	PSAP_PULL AND IVS_MSDv3 AND PSAP_MSDv3		
Pre-test conditions:	Default see clause 6.3 • PSAP operator knows the content of the transmitted MSD		
Test Sequence:	Step	Type	Description
	1	stimulus	IVS initiates an eCall
	2	verify	PSAP verifies the call is established
	3	verify	PSAP performs CRC check and sends (LL-ACK and HL-ACK) or (HL-ACK only) to IVS
	4	verify	IVS stops transmitting MSD
	5	check	Visually inspect format, content, logic and accuracy of MSD when decoded and displayed on screen. Check all MSD fields according to EN 15722 [12]. Mandatory MSD elements: • msdVersion (shall be set to 3) • messageIdentifier (shall be set to 1) • automaticActivation • testCall • positionCanBeTrusted • vehicleType • vehicleIdentificationNumber • gasolineTankPresent • dieselTankPresent • compressedNaturalGas • liquidPropaneGas • electricEnergyStorage • hydrogenStorage • otherStorage • timestamp • vehicleLocation • vehicleDirection • recentVehicleLocationN1 • recentVehicleLocationN2 Optional MSD elements: • numberOfOccupants • optionalAdditionalData

7.2 Advanced IVS test scenarios

7.2.1 Auto redial following busy during call set-up

Interoperability Test Description			
Identifier:	TD_ADV_IVS_01		
Objective:	To verify that if the initial call set-up attempt fails for reason: busy, network congestion or PSAP out-of-service, the IVS makes automatic repeat dialling attempts to establish an emergency call.		
Configuration:	eCall_CFG_02		
References:	Clause 7.12.5 of EN 16062 [4]		
Applicability:	IVS_man_eCall AND IVS_auto_redial		
Pre-test conditions:	Default see clause 6.3 • A telephone instead of PSAP is used to answer calls and to establish 2-way voice exchange (in order to simulate a busy condition)		
Test Sequence:	Step	Type	Description
	1	stimulus	The test telephone (replacing PSAP) is off-hook 'busy'
	2	stimulus	IVS initiates a manually trigged eCall
	3	verify	Verify that the network returns call failure 'busy' indication to IVS
	4	Verify	IVS clears down the call attempt and makes a repeat dialling attempt automatically

7.2.2 Auto redial following no-answer during call set-up

Interoperability Test Description			
Identifier:	TD_ADV_IVS_02		
Objective:	To verify that if the initial call set-up attempt fails for reason: no answer, the IVS makes automatic repeat dialling attempts to establish an emergency call.		
Configuration:	eCall_CFG_02		
References:	Clause 7.12.3 of EN 16062 [4]		
Applicability:	IVS_man_eCall AND IVS_auto_redial		
Pre-test conditions:	Default see clause 6.3 • Audio channel monitor is available • Telephone (only), instead of PSAP, is used to answer calls and to establish 2-way voice exchange		
Test Sequence:	Step	Type	Description
	1	stimulus	IVS initiates an eCall
	2	stimulus	Test telephone (replacing PSAP) does not answer the call
	3	Verify	Verify that with audio monitor that IVS receives 'ring-back tone' and 'no-answer' indication from the network
	4	Verify	Verify that IVS clears down the call attempt after > 60 s and makes repeated dialling attempts automatically (without human intervention) and all redial attempts are completed within 2 minutes as defined in EN 16072 [5]
NOTE: To clarify: Usually on emergency call the "No Answer" timer is not applied by the network. Only the PSAP system, depending from the configuration, could apply a No Answer Timer. If the test is performed using a normal long number, in this case the "No Answer" timer is applied by the network.			

7.2.3 IVS configured for 'eCall only' service (restricted)

Interoperability Test Description			
Identifier:	TD_ADV_IVS_03		
Objective:	To verify that following power-up/ignition ON, an IVS configured for 'eCall only' service, and test/configuration calls, does not attempt to register on any mobile network until an eCall or test/reconfiguration call is initiated.		
Configuration:	eCall_CFG_01		
References:	ETSI TS 122 101 [1] Clauses 7.1.4 and 7.1.6 of EN 16062 [4] ETSI TS 134 123-1 [6] ETSI TS 151 010-1 [7] ETSI TS 102 936-1 [9]		
Applicability:	IVS_eCall_only		
Pre-test conditions:	Default see clause 6.3 • The IVS is **not** registered on any mobile network		
Test Sequence:	Step	Type	Description
	1	stimulus	Switch ON ignition/apply power to the IVS
	2	stimulus	Monitor IVS Mobile Network operational status
	3	Verify	Verify that the IVS is not registered, and does not attempt to register, on any mobile network
	4	stimulus	IVS initiates an eCall
	5	Verify	Verify that the IVS registers on an available PLMN and initiates eCall setup

7.2.4 eCall deactivated during TPS call

Interoperability Test Description			
Identifier:	TD_ADV_IVS_04		
Objective:	To verify that there is only one system active at a time. The 112 eCall is deactivated as long as TPS system is active.		
Configuration:	eCall_CFG_05		
References:	Commission Delegeated Regulation (EU) 2017/79 [10] (Annex IV, clause 2.3)		
Applicability:	IVS_eCall_and_TPS		
Pre-test conditions:	Default see clause 6.3		
Test Sequence:	Step	Type	Description
	1	stimulus	IVS initiates an eCall to TPSP
	2	stimulus	Incoming call to TPSP test point is answered
	3	verify	Verify that the IVS is not triggering 112 eCall (neither automatic nor manual) while TPS call is active
	4	stimulus	TPSP clears down call/network or application layer clear-down
NOTE: Passing of this test does not mean a reduction of the required test scope for an eCall type-approval, according to Regulation (EU) 2017/79 [10].			

7.2.5 Fall-back to 112-based eCall when TPS is not functional

Interoperability Test Description			
Identifier:	TD_ADV_IVS_05		
Objective:	To verify the fall-back to 112-based eCall when the TPS is triggered but is not functional.		
Configuration:	eCall_CFG_05		
References:	Commission Delegated Regulation (EU) 2017/79 [10] (Annex IV, clause 2.4)		
Applicability:	IVS_eCall_and_TPS		
Pre-test conditions:	Default see clause 6.3 • Modify the TPS system to simulate a failure		
Test Sequence:	Step	Type	Description
	1	stimulus	IVS initiates a manual TPS eCall but TPS functionality failed
	2	verify	IVS initiates a manual 112-based eCall (fall-back to 112-based eCall)
	3	verify	PSAP verifies that MSD is received
	4	verify	Open the received MSD and verify that block 3 contains an indication that the eCall was manually initiated (automaticActivation = false)
NOTE: Passing of this test does not mean a reduction of the required test scope for an eCall type-approval, according to Regulation (EU) 2017/79 [10].			

7.2.6 IVS privacy protection from PSAP call-back

Interoperability Test Description			
Identifier:	TD_ADV_IVS_06		
Objective:	To verify that 112 eCall IVS system is not available for communication with the PSAP if the PSAP test point initiates the communication during normal operation when there is no accident. (Vehicle in normal driving mode).		
Configuration:	eCall_CFG_01		
References:	Commission Delegated Regulation (EU) 2017/79 [10] (Annex VIII, Part I)		
Applicability:			
Pre-test conditions:	Default see clause 6.3 • The eCall is completed and terminated • The timer T9 (IVS NAD minimum network registration period) is expired		
Test Sequence:	Step	Type	Description
	1	stimulus	PSAP tries to initiate an PSAP call-back with IVS
	2	verify	Verify the call is not established from PSAP to IVS
NOTE: Passing of this test does not mean a reduction of the required test scope for an eCall type-approval, according to Regulation (EU) 2017/79 [10].			

7.3 Advanced PSAP test scenarios

7.3.1 Un-mute PSAP audio when Initiation Signal not received within 5 s (T4 expired)

Interoperability Test Description			
Identifier:	TD_ADV_PSAP_01		
Objective:	Verify that PSAP audio is un-muted and call is routed to an operator within 5 s following receipt of answering call, if a valid Initiation Signal is not received and T4 has expired.		
Configuration:	eCall_CFG_03		
References:	Clauses 7.4.2 and table A.1 of EN 16062 [4]		
Applicability:	PSAP_PULL AND PSAP_speech		
Pre-test conditions:	Default see clause 6.3 • Mobile phone is programmed with PSAP test call number		
Test Sequence:	Step	Type	Description
	1	stimulus	Mobile phone initiates a call to the PSAP test call number
	2	stimulus	PSAP answers call and listens for valid Initiation Signal
	3	verify	Verify that the incoming voice call is routed to the PSAP operator > 5 s and < 30 s from the call being answered and un-muted
	4	verify	Verify that 2-way speech can be exchanged between the mobile phone and PSAP operator
	5	stimulus	PSAP clears down call/network clear-down

7.3.2 PSAP handling of more than 1 eCall simultaneously

Interoperability Test Description			
Identifier:	TD_ADV_PSAP_02		
Objective:	Verify that a PSAP (modem-server) system can receive and process more than 1 eCall simultaneously from different IVS devices.		
Configuration:	eCall_CFG_01		
References:	Clause 7.1 of EN 16072 [5]		
Applicability:	PSAP_PULL AND PSAP_simult_eCalls		
Pre-test conditions:	Default see clause 6.3 • PSAP modem-server has the ability to answer and process more than 1 eCall simultaneously		
Test Sequence:	Step	Type	Description
	1	stimulus	Both IVSs initiates an eCall to the same PSAP (using their allocated numbers)
	2	verify	PSAP verifies the both calls are established
	3	verify	PSAP verifies that both MSDs is correctly received and acknowledged
	4	stimulus	The eCalls are queued for PSAP operator or routed to 2 different operators
	5	stimulus	Both eCalls are answered either in-turn or simultaneously
	6	verify	Establishment of voice communication between the PSAP operator(s) and the IVS(s), and that the correct MSD information is displayed for each call
	7	stimulus	PSAP operator(s) clears down both calls /application layer clear-down
	8	verify	Verify that both IVSs clear-down following receipt of application layer AL-ACK clear-down message

7.3.3 PSAP correct MSD additional data decoding

Interoperability Test Description			
Identifier:	TD_ADV_PSAP_03		
Objective:	Check the capability of MSD additional data decoding from PSAP side.		
Configuration:	eCall_CFG_01		
References:	Clause 6.1.5 of EN 15722 [3] Clause 7.7.2 of EN 16072 [5]		
Applicability:	PSAP_PULL AND PSAP_MSDv2 AND IVS_MSDv2 AND IVS_add_MSD_data		
Pre-test conditions:	Default see clause 6.3 • IVS and PSAP need to agree on a coding scheme for the additional MSD data		
Test Sequence:	Step	Type	Description
	1	stimulus	IVS initiates an eCall using a MSD containing additional data
	2	verify	Verify the MSD is correctly decoded
	3	check	MSD additional data content at PSAP is identical to content transmitted by IVS

7.4 Performance test scenarios

7.4.0 Introduction

Test scenario TD_PER_PSAP_01 is checking the capability of a PSAP to handle parallel repetitive calls as in a real PSAP environment and it is **only applicable if the PSAP is connected to a network providing more than one B channel for simultaneous calls.** Other test scenarios from TD_PER_PSAP_02 to TD_PER_PSAP_06 are related to Key Performance Indicators (KPIs) defined within TS 17234 [11]. KPIs are defined to evaluate the performance of the individual PSAPs with measurable values. As the requirements for the performance of PSAP may in this part vary between member states, four profiles are defined (High Quality, Standard, Basic, Sub-Standard). The category 'Sub-Standard' means that the PSAP did not meet the lowest requirements of the specified test.

7.4.1 PSAP handling a number of parallel random eCalls from different IVS

Interoperability Test Description			
Identifier:	TD_PER_PSAP_01		
Objective:	PSAP handling a number of parallel random eCalls from different IVS evaluating the voice connection and MSD reception rate and timing.		
Configuration:	eCall_CFG_04		
References:	Clause 7.1 of EN 16072 [5]		
Applicability:	PSAP_PULL AND PSAP_simult_eCalls		
Pre-test conditions:	Default see clause 6.3 • All involved IVS with ignition are ON and in mobile network coverage • PSAP being configured for the mandatory PULL mode • PSAP Operator/s ready to receive calls • PSAP ready to collect MSD information and timing		
Test Sequence:	Step	Type	Description
	1	stimulus	All involved IVS initiate an eCall
	2	stimulus	A PSAP Operator answer the call
	3	verify	Check the bidirectional voice connection
	4	stimulus	PSAP Operator disconnect the call
	5	stimulus	After the disconnection each IVS starts a new call
	6		Each IVS repeat the sequence from step 1 to 5 for a predefined time window
	7	check	Check if 100 % of calls had a bidirectional voice connection
	8	check	Check if 100 % of MSD are correctly received by PSAP
	9	check	Evaluate the MSD reception time average
NOTE: The PSAP shall be able to collect the information about the MSD success reception and related timing to be used on evaluations. The PSAP shall be able to queue multiple calls until an Operator answer.			

7.4.2 KPI 1 Success rate of eCall

KPI 1 according to TS 17234 [11] describes the relationship between the numbers of initiated CS eCalls at a given period of time versus the number of successful completed eCalls while the 112 is used as telephone number for the emergency call:

Unit: [%]

Definition for KPI 1:
"eCall success rate" = ("successful eCalls"/"all established eCalls") × 100

"successful eCalls" means that the voice call path was established, and MSD data transfer was acknowledged. Mathematically "successful eCalls" = "initiated eCalls" - "failed eCalls".

"established eCall": Number of all eCalls where the end to end connectivity has been established.

"Failed eCall": No stable connection, no voice call possible or no MSD transmission or faulty MSD transmitted:

Defined thresholds

High Quality threshold: 98,5 %

Standard threshold: 97 %

Basic threshold: 95,5 %

Sub-standard threshold: below 95,5 %

Interoperability Test Description			
Identifier:	TD_PER_PSAP_02		
Objective:	Verify the eCall success rate, according to KPI 1 in accordance TS 17234 [11].		
Configuration:	eCall_CFG_01		
References:	Clause 12.2.2.2 of TS 17234 [11]		
Applicability:	PSAP_PULL AND IVS_NW_clear-down		
Pre-test conditions:	Default see clause 6.3		
Test Sequence:	Step	Type	Description
	1	stimulus	IVS initiates an eCall
	2	verify	PSAP verifies the call is established
	3	verify	PSAP verifies MSD is received and correctly decoded
	4	verify	Establishment of voice communication for 5 s
	5	stimulus	PSAP clears down the call/network clear-down
	6	verify	Verify that the IVS clears down following receipt of network clear-down message
	7	stimulus	Each IVS repeats the sequence from step 1 to 6 several times
	8	check	Calculate eCall success rate and check if the result meets the defined thresholds
NOTE: Test TD_BAS_06 can be performed with more iterations to achieve the result.			

7.4.3 KPI 2 Success rate of call backs using eCall

KPI 2 according to TS 17234 [11] refers to the number of successful call-backs from PSAP to IVS, compared with the number of attempted call-backs:

Unit: [%]

Definition for KPI 2:
"success rate of call-backs" = ("successful call-backs"/"all initiated call-backs") × 100

"successful call-backs" = "initiated call-backs" – "failed call-backs".

"failed call-back" = The PSAP Operator cannot confirm bi-directional voice connection during call-back.

"initiated call-back" = The PSAP Operator has confirmed bi-directional voice connection for the initial call and has initiated a call-back after sending CLEARDOWN to the IVS:

High Quality threshold: 93 %

Standard threshold: 90 %

Basic threshold: 87 %

Sub-standard threshold: below 87 %

Interoperability Test Description			
Identifier:	TD_PER_PSAP_03		
Objective:	Verify success rate of call backs according to KPI 2 in accordance TS 17234 [11].		
Configuration:	eCall_CFG_01		
References:	Clause 12.2.2.4 of TS 17234 [11]		
Applicability:	PSAP_PULL AND IVS_speech AND IVS_MSD_retransmission		
Pre-test conditions:	Default see clause 6.3 • PSAP shall have received the CLI from the network		
Test Sequence:	Step	Type	Description
	1	stimulus	IVS initiates an eCall
	2	verify	PSAP verifies the call is established
	3	verify	PSAP verifies first MSD is received and correctly decoded
	4	verify	Verify that 2-way speech can be exchanged for 5 s
	5	stimulus	PSAP clears down the call/network or application layer clear-down
	6	verify	Verify that IVS has cleared down
	7	stimulus	PSAP initiates a call back using CLI
	8	verify	Verify that 2-way speech can be exchanged
	9	stimulus	PSAP pulls MSD whilst two-way conversation is in progress
	10	verify	Verify that MSD is received and correctly decoded
	11	verify	Verify that 2-way speech can be exchanged
	12	stimulus	PSAP clears down call/network or application layer clear-down
	13	verify	Verify that IVS clears down correctly following receipt of network or application layer clear down message
	14	stimulus	Each IVS repeats the sequence from Step 1 to 13 several times
	15	check	Calculate success rate of call-backs and check if the result meets the defined thresholds
NOTE: Test TD_BAS_08 can be performed with more iterations to achieve the result.			

7.4.4 KPI 3 Success rate of correct MSDs

KPI 3 according to TS 17234 [11] describes the relationship between the numbers of initiated MSD transmissions versus the number of successfully presented MSD content at the operator's desk:

Unit: [%]

Definition for KPI 3:
"MSD success rate" = ("successful MSD"/"all initiated MSDs") × 100

"successful MSDs" = "initiated MSDs" – "failed MSDs"; General definition of successful MSD: Content is presented correctly at operator's desk in PSAP.

"initiated MSD": Start of MSD transmission in from IVS.

"failed MSD": No MSD data transmission or faulty transmission: voice call started without content of MSD is presented at the operator's desk in PSAP or MSD transmission is not successfully completed:

High Quality threshold: 98,5 %

Standard threshold: 97 %

Basic threshold: 95,5 %

Sub-standard threshold: below 95,5 %

Interoperability Test Description			
Identifier:	TD_PER_PSAP_04		
Objective:	Verify success rate of correct MSDs according to KPI 3 in accordance TS 17234 [11].		
Configuration:	eCall_CFG_01		
References:	Clause 12.2.2.6 of TS 17234 [11]		
Applicability:	PSAP_PULL		
Pre-test conditions:	Default see clause 6.3		
Test Sequence:	Step	Type	Description
	1	stimulus	IVS initiates an eCall
	2	verify	PSAP answers call and immediately transmits SEND-MSD (START) message without waiting for the valid Initiation Signal
	3	verify	If IVS had started to send an INITIATION message then IVS stopped sending the INITIATION message on receipt of the SEND-MSD message from the PSAP
	4	verify	PSAP verifies first MSD is received
	5	verify	Verify the MSD is correctly decoded
	6	check	MSD content at PSAP is identical to content transmitted by IVS
	7	verify	PSAP sends acknowledgement
	8	verify	Verify that the IVS has stopped transmitting the MSD
	9	stimulus	Each IVS repeats the sequence from Step 1 to 8 several times
	10	check	Calculate eCall success rate and check if the result meets the defined thresholds
NOTE: Test TD_BAS_01 can be performed with more iterations to achieve the result.			

7.4.5 KPI 4 Success rate of correct re-transmitted MSDs

KPI 4 according to TS 17234 [11] describes the relationship between the numbers of initiated MSD transmissions using CS GSM/UMTS versus the number of successfully presented MSD content at the operator's desk for the case that the PSAP operator requests a new MSD from the IVS:

Unit: [%]

Definition for KPI 4:
"resubmitted MSD success rate" = ("successful resubmitted MSD"/"all attempts to request new MSD") × 100

"successful resubmitted MSD" = "number of resubmitted MSDs" – "failed resubmitted MSDs".

"failed resubmitted MSD": No MSD data transmission or faulty transmission: voice call started without content of MSD is presented at operator's desk in PSAP or MSD transmission is not successfully completed:

High Quality threshold: 96 %

Standard threshold: 94 %

Basic threshold: 92 %

Sub-standard threshold: below 92 %

Interoperability Test Description			
Identifier:	TD_PER_PSAP_05		
Objective:	Verify success rate of re-transmitted MSDs according to KPI 4 in accordance TS 17234 [11].		
Configuration:	eCall_CFG_01		
References:	Clause 12.2.2.7 of TS 17234 [11]		
Applicability:	PSAP_PULL AND IVS_MSD_retransmission		
Pre-test conditions:	Default see clause 6.3 • Background voice is applied at IVS prior to and during MSD transmission to verify that the IVS can recognize a request from the PSAP to re-send an MSD when a speech call is in progress		
Test Sequence:	Step	Type	Description
	1	stimulus	IVS initiates an eCall
	2	verify	PSAP verifies the call is established
	3	verify	PSAP verifies first MSD is received
	4	verify	PSAP verifies the MSD is correctly decoded (MSD ID = 1)
	5	verify	Establishment of voice communication
	6	verify	Verify that 2-way speech can be exchanged
	7	stimulus	PSAP pulls a second MSD
	8	verify	Verify the second MSD is received and correctly decoded (MSD ID = 2)
	9	stimulus	Each IVSs repeat the sequence from step 1 to 8 several times
	10	check	Calculate resubmitted MSD success rate and check if the result meets the defined thresholds
NOTE: Test TD_BAS_04 can be performed with more iterations to achieve the result.			

7.4.6 KPI 5 Duration of voice channel blocking

KPI 5 TS 17234 [11] represents the time the transmission of MSD blocks the voice channel, it applies only to circuit switched GSM/UMTS 112-eCalls. The time the voice channel is blocked can be defined as the time between successful call setup ("connected" is reported by the network) and the opening of voice communication in both directions after the MSD has been transmitted successfully or the MSD transmission has been abandoned (after time out) and the voice communication has been opened on both sides in both directions:

Unit: [s]

Definition for KPI 5:

"duration of voice channel blocking" = $T_{Voice\ transmission} - T_{start\ of\ MSD\ transmission}$

The "voice transmission" signal is defined as the point of time when the IVS and the PSAP have both opened the voice communication channel after the transmission of MSD.

"start of $MSD\ transmission$" can be defined as a point of time when the IVS attached to a GSM or UMTS PLMN moves from state "alerting" to state "call established" or "connected":

High Quality threshold: 6,5 s

Standard threshold: 8 s

Basic threshold: 9,5 s

Sub-standard threshold: longer than 9,5 s

Interoperability Test Description			
Identifier:	TD_PER_PSAP_06		
Objective:	Verify duration of voice channel blocking according to KPI 5 in accordance with CEN TS 17234 [11].		
Configuration:	eCall_CFG_01		
References:	Clause 12.2.2.9 of TS 17234 [11]		
Applicability:	PSAP_PULL AND IVS_speech		
Pre-test conditions:	Default see clause 6.3		
Test Sequence:	Step	Type	Description
	1	stimulus	IVS initiates an eCall
	2	verify	PSAP verifies the call is established
	3	verify	PSAP verifies first MSD is received
	4	verify	PSAP verifies the MSD is correctly decoded
	5	verify	Establishment of voice communication
	6	verify	Verify that 2-way speech can be exchanged
	7	verify	Verify how much time is needed for MSD transmission
	8	stimulus	Each IVSs repeat the sequence from step 1 to 7 several times
	9	check	Calculate duration of voice channel blocking and check if the result meets the defined thresholds
NOTE: Test TD_BAS_03 can be performed with more iterations to achieve the result.			

Annex A (normative): HLAP timers

The timer values defined in table A.1 of EN 16062 [4] shall apply for the eCall transactions defined in the present document.

Annex B (informative): Bibliography

- EN 16454:2015: "Intelligent transport systems - eSafety - eCall end to end conformance testing", (produced by CEN).
- ETSI TS 126 267: "Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); eCall data transfer; In-band modem solution; General description (3GPP TS 26.267)".
- ETSI TS 126 268: "Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); eCall data transfer; In-band modem solution; ANSI-C reference code (3GPP TS 26.268)".
- ETSI TS 126 269: "Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); eCall data transfer; In-band modem solution; Conformance testing (3GPP TS 26.269)".
- ETSI TR 126 969: "Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); eCall data transfer; In-band modem solution; Characterization report (3GPP TR 26.969)".
- ISO EN 24978: "Intelligent transport systems - ITS Safety and emergency messages using any available wireless media - Data registry procedures".
- ETSI TR 102 937: "eCall communications equipment; Conformance to EU vehicle regulations, R&TTE, EMC & LV Directives, and EU regulations for eCall implementation".

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