eCall / ERA GLONASS

Implementation in u-blox cellular modules

Application note

Abstract

This document provides an overview of the automated emergency response systems, eCall and ERA GLONASS, integrated in wireless modules for use in IVS systems. It also describes the u-blox proprietary simulation system of an eCall-enabled Public Safety Answering Point (PSAP).

www.u-blox.com

UBX-13001924 - R10

Document information

Title	**eCall / ERA GLONASS**	
Subtitle	Implementation in u-blox cellular modules	
Document type	Application note	
Document number	UBX-13001924	
Revision and date	R10	19-Jun-2020
Disclosure restriction		

This document applies to the following products:

Product name
LEON-G1 series
SARA-G340
SARA-G350
LISA-U2 series
SARA-U201
SARA-U270

u-blox or third parties may hold intellectual property rights in the products, names, logos and designs included in this document. Copying, reproduction, modification or disclosure to third parties of this document or any part thereof is only permitted with the express written permission of u-blox.
The information contained herein is provided “as is” and u-blox assumes no liability for its use. No warranty, either express or implied, is given, including but not limited to, with respect to the accuracy, correctness, reliability and fitness for a particular purpose of the information. This document may be revised by u-blox at any time without notice. For the most recent documents, visit www.u-blox.com.
Copyright © u-blox AG.

Contents

Document information **2**
Contents **3**
1 Introduction **6**
1.1 About eCall / ERA GLONASS 7
1.2 eCall definitions 7
2 IVS system and eCall conformity **8**
2.1 eCall AT interface summary 9
2.2 Table of timings (eCall Release 2 and 3) 10
3 eCall control through AT interface **11**
3.1 AT+UECALLSTAT 12
3.1.1 Read configuration: AT+UECALLSTAT? 12
3.1.2 Force the configuration in cache: AT+UECALLSTAT=0/1/2 13
3.1.3 Restore configuration in cache: AT+UECALLSTAT=3 13
3.2 AT+UECALLTYPE 14
3.2.1 USIM not inserted / not valid eCall USIM 14
3.2.2 Test and reconfiguration eCall types 15
3.3 AT+CECALL 16
3.4 AT+UDCONF=90 17
3.4.1 eCall test number: AT+UDCONF=90,1[,<ToN>,<number>] 17
3.4.2 eCall reconfiguration number: AT+UDCONF=90,2[,<ToN>,<number>] 17
3.4.3 eCall T3242 duration: AT+UDCONF=90,11,<timer_duration> 17
3.4.4 eCall T3243 duration: AT+UDCONF=90,12,<timer_duration> 17
3.5 AT+UECALLDATA 18
3.5.1 Activation: AT+UECALLDATA=1,<push/pull mode>,<MSD data> 18
3.5.2 In-band Modem status events: +UUECALLDATA: <urc_id> 18
3.5.3 MSD update: AT+UECALLDATA=2,<update mode>,<MSD data> 19
3.5.4 Examples 19
3.6 AT+UECALLVOICE 20
3.6.1 Internal voice control 21
3.6.2 Configurable internal HLAP timers (eCall Release 4) 24
4 eCall examples **25**
4.1 eCall session dynamic view: end-to-end In-band signaling 25
4.1.1 MSD transfer in push mode 25
4.1.2 MSD update in TX idling mode 26
4.2 eCall control examples 27
4.2.1 Simple MSD transfer in push mode 27
4.2.2 .MSD update on PULL request, with transmitter reset and microphone control 28
4.2.3 Answer to PSAP callback 29
4.3 eCall configuration examples 29
4.3.1 eCall initiation (eCall Release 2 vs 3) 30

4.3.2 eCall-only mode with an eCall-enabled USIM 31
4.3.3 Force the eCall-only mode with a not eCall-enabled USIM 31
4.3.4 Force the eCall without registration restrictions with a not eCall-enabled USIM 32
5 ERA-GLONASS additional features and use cases 33
5.1 MSD transfer by SMS 33
5.1.1 MSD SMS transmission in PDU mode 33
5.2 SIM/eUICC profile switch 35
5.2.1 Example eCall transaction with temporary eUICC swap to emergency profile 35
6 eCall / ERA GLONASS In-band Modem simulation system 37
6.1 PSAP simulator 37
6.1.1 Software & hardware requirements 37
6.2 IVS system 38
6.2.1 Software & hardware requirements 38
6.3 m-center software 39
6.3.1 IVS simulator 39
6.3.2 PSAP simulator 44
6.4 eCall / ERA GLONASS system setup 45
6.4.1 PSAP simulator connecting with the PSAP GSM modem 45
6.4.2 Starting the PSAP simulator 45
6.4.3 IVS simulator connecting with the IVS GSM modem 45
6.4.4 Starting the IVS simulator 46
6.4.5 IVS In-band Modem setup without IVS simulator 47
6.5 Running the eCall simulation 47
6.5.1 eCall simulation example (without IVS simulator) 47
6.5.2 Callback example 49
Appendix 50
A Glossary 50
B PAN European eCall IVS test list 51
B.1 NAD Protocol 51
B.2 In-band modem conformance 51
B.3 High-level application protocol 52
C ERA-GLONASS IVS test list 54
C.1 IVS functional and data transfer protocols test methods 54
C.1.1 IVS tests in regard to functional requirements 54
C.1.2 IVS tests in regard to requirements of data exchange protocols 54
C.2 IVS tests for compliance with established requirements 55
C.2.1 IVS tests for compliance with established electromagnetic compatibility requirements 55
C.2.2 IVS tests for compliance with established resistance to climatic loads requirements 55
C.2.3 IVS tests for compliance with established mechanical load resistance requirements 55
C.3 IVS tests for conformity to quality requirements for in-vehicle loudspeaker communication 56
C.4 IVS tests for conformity to accident detection requirements 56
C.5 IVS tests for wireless communication modules 56

C.5.1 IVS tests in regard to implementation of GSM modem functions 56
C.5.2 IVS tests in regard to implementation of UMTS modem functions 57
C.5.3 IVS tests in regard to implementation of in-band modem functions 57
C.6 IVS tests for navigation modules 58
D eCall flag 59
Related documents 60
Revision history 61
Contact 62

1 Introduction

☞ This document applies to the following products:

- LEON-G100 (as IVS)
- SARA-G340 / SARA-G350 (as IVS)
- SARA-U201 (as IVS and PSAP)
- SARA-U270 / LISA-U2xx-xxS (as IVS and PSAP)

☞ TOBY-L4 series specific eCall application note is available on request.

☞ The u-blox eCall feature is upgraded occasionally with alignments to the latest releases of eCall-related standards, resulting in progressive u-blox eCall feature releases:

- **eCall Release 5 (2018)**
  - TOBY-L4106
- **eCall Release 4 (2015)**
  - LISA-U200-03S, LISA-U201-03S,LISA-U200-83S, LISA-U201-83S
  - SARA-G340-02S, SARA-G350-02S, SARA-G350-02A
  - SARA-U201-03B, SARA-U201-03A, SARA-U270-03S, SARA-U270-53S
- **eCall Release 3 (Q1 2014)**, supported by:
  - LEON-G100-07S-01
  - LEON-G100-08S-01
  - SARA-U270-00S / SARA-U270-00X
- **eCall Release 2 (Q1 2013)**, supported by
  - any other previous eCall-featured products

Functionalities highlighted with **eCall Release 4** tag are available in eCall Release 4 only.

Functionalities highlighted with **eCall Release 3** tag are available in eCall Release 3 only.

Functionalities highlighted with **eCall Release 2** tag are available in both releases but not recommended for use in **eCall Release 3** products.

This application note explains the eCall / ERA GLONASS solution available in the u-blox cellular modules. The presented eCall / ERA GLONASS solution is suitable for the implementation of In-Vehicle Systems (**IVS**) conforming to the European eCall Standard.

Additionally, this document describes the testing and simulation environment for the eCall / ERA GLONASS In-band Modem (**eIM**) service, which is available in u-blox cellular modules. The simulation environment enables u-blox customers to easily test and develop their eCall / ERA GLONASS products. The environment is based on a u-blox developed Public Safety Answering Point (**PSAP**) simulator integrated in m-center.

The following symbols are used to highlight important information within the document:

☞ An index finger points out key information pertaining to integration and performance.

⚠ A warning symbol indicates actions that could negatively impact or damage the module.

1.1 About eCall / ERA GLONASS

The European eCall (emergency Call) and Russian ERA GLONASS solutions combine mobile communications and satellite positioning to provide rapid assistance to motorists in the event of a collision.

In particular, eCall standardizes the transfer of a set of 140 bytes of data, called Minimum Set of Data (**MSD**) during an emergency voice call to a Public Safety Answering Point (**PSAP**). According to 3GPP specifications, the MSD is transmitted by the eCall In-band Modem (**eIM**) of the In-Vehicle System (**IVS**) immediately after the call set-up and is received by the eIM of the PSAP.

After the IVS eIM activation, the eIM receiver starts monitoring messages from the PSAP eIM. Once the link with PSAP eIM is established, the IVS eIM enters **data mode**: the IVS microphone and loudspeaker are muted and the eIM starts the MSD transfer. After the data transfer completion, either successfully or with an error, the IVS changes from **data mode to voice mode**: the microphone and loudspeaker are un-muted and the voice call between IVS and PSAP can continue normally. The IVS eIM enters **idle mode** and monitors new incoming messages from the PSAP eIM.

1.2 eCall definitions

- **IVS** – In-Vehicle System, activates the emergency call
- **PSAP** – Public Safety Answering Point, answers the emergency call
- **eIM** – eCall In-band Modem, the technology for exchanging data over the voice channel
- **eUICC / eSIM** – embedded SIM
- **MSD** – Minimum Set of Data, standard data set (140 bytes) that IVS must transmit to PSAP. The location information (GPS data) is the most relevant part of MSD
- **MSD transfer** – The act of transmitting a single MSD through eIM
- **MSD update** – The act of providing new MSD (e.g. with updated GPS position) to the IVS In-band Modem
- **PULL mode** – The IVS MSD transfer mode when the PSAP requests the transfer
- **PUSH mode** – The IVS MSD transfer mode when IVS requests PSAP to perform a PULL of the MSD (in any case, the MSD transfer is ALWAYS controlled by PSAP)
- **Voice Mode** – The emergency call phase in which the vehicle occupant and PSAP operator have a voice connection, i.e. they can talk and hear each other like during a telephone call
- **Data Mode** – The emergency call phase in which MSD transfer occurs. Vehicle occupant and PSAP operator CANNOT hear each other
- **LL-ACK** – In-band Low-Level Acknowledge from PSAP to IVS about MSD reception
- **HL-ACK** – In-band High-Level Acknowledge from PSAP to IVS about MSD reception, with additional information on call handling (e.g. PSAP instructs IVS to drop the call)
- **NAD** – Network Access Device, part of IVS system that handles the GSM/UMTS/LTE network connection
- **eCall flag** – Information about the call type initiated by IVS. It is transmitted by NAD to PSAP during GSM signaling phase:
  - Normal E112 call (eIM not available/enabled on IVS)
  - Manually triggered eCall (eIM enabled, call triggered by vehicle occupant)
  - Automatically triggered eCall (eIM enabled, call triggered by e.g. airbag sensor)
- **eCall-only configuration** – IVS configuration for which the NAD performs the network registration only when commencing an emergency call. This configuration is
  - read from USIM or
  - optionally provided to the NAD through AT interface (AT+UECALLSTAT)

2 IVS system and eCall conformity

The entire In-Vehicle System (IVS) is subject to eSafety-eCall recommendations. Figure 1 shows the three main blocks of IVS.

1. the IVS Application Processor (AP, main controller)
2. the cellular module
3. the GNSS device

The IVS CPU controls the cellular module (i.e. the Network Access Device and the eCall In-band Modem) through AT commands. Optionally, the u-blox GNSS device can also be controlled through the AT interface. The u-blox cellular modules provide the network access (NAD functionalities), eCall In-band Modem (eIM), and optionally u-blox GNSS control functionalities.

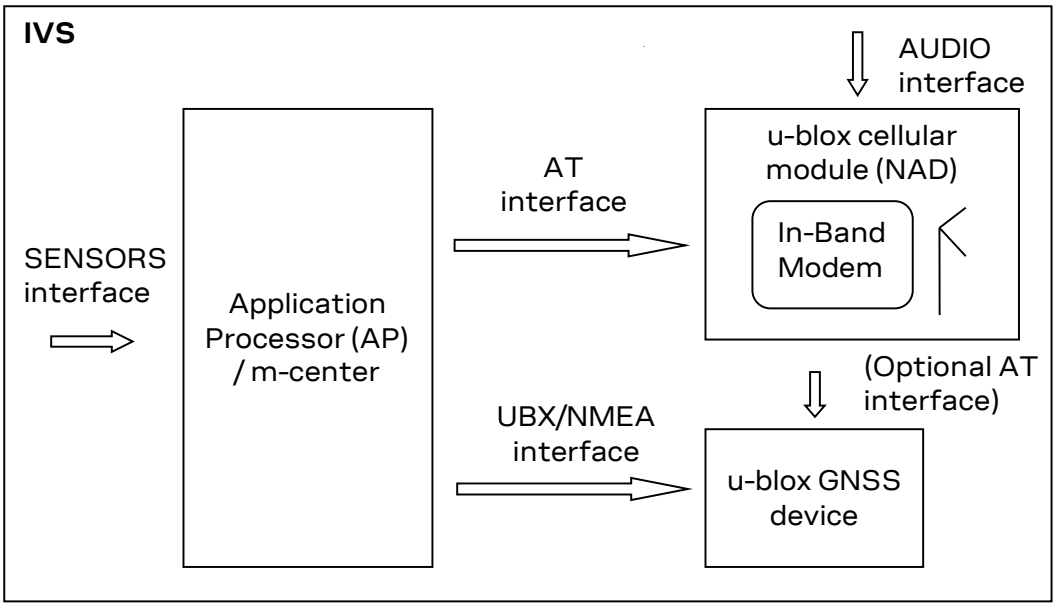


Figure 1: The IVS system

The u-blox eCall solution complies with the following recommendations:

1. NAD (Network Access Device) services and USIM eCall extensions according to ETSI/3GPP Release 10: 3GPP TS 51.010-1 [13], 3GPP TS 24.008 [14], 3GPP TS 31.102 [15] and ETSI TS 127.007 [16]
2. In-band Modem solution according to 3GPP Release 10: 3GPP TS 26.267 [2], 3GPP TS 26.268 [3] and 3GPP TS 26.269 [4]
3. eCall application protocol according to EN 16062:2011 [8] or to EN 16062:2015 [9] (**eCall Release 4**) for the applicable parts

☞ The MSD formatting is determined by the Application Processor. The MSD formatting shall follow BS EN 15722:2011 [5] or BS EN 15722:2013 [6] specification.

2.1 eCall AT interface summary

The IVS AP controls the eCall feature, implemented on the cellular modules, through the following set of dedicated AT commands:

- AT+UECALLSTAT: used to check the eCall USIM configuration / force a configuration
- AT+UECALLTYPE: used to configure the eCall flag, test call, or reconfiguration call (**eCall Release 2**)
- AT+CECALL: used to trigger a manually initiated eCall, an automatically initiated eCall, a test or reconfiguration call (**eCall Release 3**)
- AT+UECALLDATA: used to
  - activate the eIM, passing the MSD data
  - update the MSD during the emergency call
  - enable the eIM feature, reserving In-band Modem audio resources for eCall
  - enable unsolicited indications
- AT+UECALLVOICE: used to
  - configure the internal microphone / speaker switching handling
  - control and monitor microphone and speaker switching
  - configure HLAP timers (**eCall Release 4**)
- +UUECALLDATA: eIM status indications
- +UUECALLVOICE: microphone/loudspeaker status indications
- AT+UDCONF=90: used for custom eCall configuration (**eCall Release 3**)

☞ The recently standardized (optional) +CECALL [ETSI TS 127 007 [16]] AT command is implemented starting from **eCall Release 3**. The required functionalities in previous releases are covered by AT+UECALLTYPE.

☞ See u-blox AT commands manual [1] for the AT command syntax.

2.2 Table of timings (eCall Release 2 and 3)

Table 1 illustrates the timing requirements to be handled according to BS EN 16062:2011 [8], emphasizing the split of responsibilities between the IVS application processor (AP) and the u-blox cellular module.

Timing Description	Requirement	Value	Handled by
T1 Manually initiated eCall (MIeC) false triggering cancellation period	Vehicle occupants may cancel a false triggering of a manually initiated eCall before call-setup.	Specified by manufacturer	IVS AP
T2 IVS Call Clear-down Fallback Timer (CCFT)	If the IVS NAD does not receive a call clear-down indication from the mobile network, or an application layer call clear-down message from the PSAP and the call clear-down timer has reached 60 min, the call shall be cleared down.	60 min	IVS AP
T3 IVS INITIATION signal duration	The IVS INITIATION signal shall not persist for longer than 2 s from when the UE receives notification that the call is first answered.	2 s	NAD (eIM)
T4 PSAP wait for INITIATION signal period	If a valid INITIATION message is not received by the PSAP modem within 2 s from when the NAD knows that the call has been answered then the call shall be routed to a PSAP operator.	2 s	PSAP
T5 IVS wait for SEND MSD period	If the IVS eCall modem, whilst sending the INITIATION message, does not receive or recognize a valid "SEND MSD" message from the PSAP eCall modem within 2 s, from the time that the IVS receives an indication that the PSAP has answered the call, it shall reconnect the IVS loudspeaker and microphone in the vehicle.	2 s	NAD (eIM)
T6 IVS wait for AL-ACK period	If an AL-ACK is not received within 5 s from the receipt of the link layer ACK, the loudspeaker and microphone in the vehicle shall be reconnected to the line in order to enable the call to revert to an E112 voice call.	5 s	IVS AP
T7 IVS MSD maximum transmission time	If the IVS does not receive a link layer ACK (LL_ACK) within 20 s from the start of MSD transmission, it shall cease transmission and the IVS audio system shall be re-connected.	20 s	IVS AP
T8 PSAP MSD maximum reception time	If the PSAP eCall modem does not send a link layer ACK (LL-ACK) within 20s after having sent the "SEND MSD" message to the IVSeCall modem, it shall route the voice call to the PSAP operator.	20 s	PSAP
T9 IVS NAD (eCall-only configuration) minimum network registration period	Following call clear-down by the PSAP the IVS NAD shall remain registered on the serving network and available to receive calls from the PSAP and rescue workers for a minimum period of one hour as defined in EN 16072.	1 hour	IVS AP
T10 IVS NAD (eCall-only configuration) network De-registration Fallback Timer (DFT)	An IVS NAD configured to make eCalls and test calls only shall, following call clear-down and maximum expiration period of the De-registration Fallback Timer (DFT) 12 h period, de-register from the serving network.	12 hours	NAD

Table 1: eCall table of timings according to EN 16062:2011 [8]

3 eCall control through AT interface

The eCall service is made up of two parts that are functionally independent:

- eCall configuration and call control, represented by:
  - AT+UECALLSTAT
  - AT+UECALLTYPE (**eCall Release 2**)
  - AT+CECALL (eCall Release 3)
  - AT+UDCONF=90 (**eCall Release 3**)
- eIM (In-band Modem) configuration and control, represented by:
  - AT+UECALLDATA
  - AT+UECALLVOICE (extended **in eCall Release 4**)

The eCall configuration is partially read from the eCall-enabled USIM (e.g. eCall-only mode) and partially done through the AT commands (e.g. eCall flag). Any configuration applied through AT commands is volatile, i.e. lost at next power cycle.

The eCall configuration is read from the USIM at boot time only and stored in local cache (eCall configuration cache). Following boot, the NAD is configured and functional according to the information in cache.

The USIM/cache content includes:

- eCall mode configuration (eCall-only, eCall without registration restrictions modes)
- Test and reconfiguration numbers

The cache content can be changed (“forced”) during run-time via the AT+UECALLSTAT or AT+UDCONF=90 commands, with some limitations and following specific procedures described later in this document.

The +UECALLSTAT and +UDCONF=90 commands, by writing to the cache, allow eCalls with invalid eCall USIMs. In general, the usage of these commands with invalid eCall USIMs shall be limited to testing purposes. The configuration achieved through those commands is deliberately volatile to prevent the creation of fake eCall USIMs.

Due to the caching mechanism, if the USIM card is removed or becomes non-functional, e.g. because of the crash impact, the eCall service is carried out according to the cached configuration.

The eIM configuration is fully volatile: the feature must be enabled and eIM configured at each power cycle.

3.1 AT+UECALLSTAT

Reports the eCall configuration read from USIM, forces the eCall mode, or restores the USIM values.

3.1.1 Read configuration: AT+UECALLSTAT?

After the boot and the USIM reading, the USIM configuration is cached and one of the following states can be returned:

- 0: no valid eCall USIM is present. It can be either a normal USIM or an eCall USIM that has been disabled e.g. by the operator
- 1: a valid eCall USIM is present, configured as eCall-only with registration restrictions
- 2: a valid eCall USIM is present, configured to provision eCalls without registration restrictions

If the value is “0”:

- Issuing AT+COPS=0, the NAD performs normal registration procedures
- In **eCall Release 2**: during emergency call set-up the eCall flag, although configured through +UECALLTYPE, will not be signalled to the network
- In **eCall Release 3**: any attempt to initiate an eCall through AT+CECALL or to setup the eCall flag though AT+UECALLTYPE returns with error
- Only speech only emergency calls are possible (ATD112;)

If the value is “1”:

- Issuing AT+COPS=0, the NAD performs the restricted registration (performs PLMN selection)
- The MS class is set to CS only (i.e. the GPRS service is not available)
- At eCall initiation, the CS registration procedure is performed, then the eCall is started (including T3242 or T3243 timers), the eCall flag signalled to the network, and the emergency call set up

If the value is “2”:

- Issuing AT+COPS=0, the NAD performs normal registration procedures
- At the eCall initiation, the eCall flag signalled to the network and the emergency call set up

The values are always read from the cache.

In the rest of this document, the eCall configuration will be referred as eCall mode “0”, “1” or “2”.

3.1.1.1 USIM not inserted/ not functional

If the USIM was not inserted or not functional at boot time, the command returns an error result code:

Command	Response	Description
AT+UECALLSTAT?	+CME ERROR: SIM not inserted	USIM was not present at boot time. The eCall is not functional.

This also means that eCalls will not be possible (speech only emergency calls will be still possible).

If the USIM card stops functioning sometime after the boot (e.g. at the car crash time), the read command will return the cached value until the USIM status has been refreshed and notified to the system (USIM status is refreshed after several seconds). Nevertheless, the eCall will still function according to the cached configuration (e.g. “1” or “2”) and the eCall flag will be transmitted to the network.

Command	Response	Description
AT+UECALLSTAT?	+UECALLSTAT: 1 OK	eCall USIM in eCall-only mode
	USIM removed/not functional	
AT+UECALLSTAT?	+UECALLSTAT: 1 OK	USIM status not refreshed yet
	time elapses (~10 s)	
AT+UECALLSTAT?	+CME ERROR: SIM not inserted	USIM not present
AT+CECALL=2	OK	**eCall is still functional using cached values**

☞ The USIM status refresh can be forced through any command accessing the SIM card, e.g. +CRSM:

Command	Response	Description
AT+UECALLSTAT?	+UECALLSTAT: 1 OK	eCall USIM in eCall-only mode
	USIM removed/not functional	
AT+CRSM=242	+CRSM: 111,0 OK	Check the USIM status (which triggers a refresh)
AT+UECALLSTAT?	+CME ERROR: SIM not inserted	USIM not present

3.1.2 Force the configuration in cache: AT+UECALLSTAT=0/1/2

The set command can be used to force the module with an invalid eCall USIM (eCall mode “0”) to eCall only (eCall mode “1”) or eCall without registration (eCall mode “2”) configuration, for example for testing purposes. The eCall mode is set in cache and lost at next boot.

For reconfigurations to “1” (eCall only mode), the NAD must be unregistered. If the NAD is registered, then the deregistration must be done first (see the example in section 4.3.3).

☞ The command should not be used with eCall-enabled USIMs (both commercial or test USIMs). The behavior is unpredictable.

If the USIM is removed, the set command is still functional. See section 4.3 for NAD reconfiguration examples.

3.1.3 Restore configuration in cache: AT+UECALLSTAT=3

This command restores the original USIM configuration to the cache. The command returns with an error result code in the reconfiguration cases described in section 3.1.2 when the NAD is in registered state (AT+COPS=0).

3.2 AT+UECALLTYPE

This command is used in the products with **eCall Release 2** to select the eCall type (e.g. configure the "eCall flag" to set the emergency call service category) for next ATD112 or to redirect the ATD112 call to test or reconfiguration numbers.

The set options for the eCall type are:

- 0: speech only TS12 (factory-programmed value)
- 1: MIeC: Emergency Service Category Value (octet 3) Bit 6=1
- 2 :AIeC: Emergency Service Category Value (octet 3) Bit 7=1
- 3: Test eCall: use eCall Test number
- 4: Reconfiguration eCall: use eCall Reconfiguration number

In **eCall Release 2**, after the ATD112 call-setup and successive call completion, the value is not cleared.

In **eCall Release 3**, after the ATD112 call completion, the value is cleared to "0". In that way AT+UECALLTYPE followed by ATD112 is functionally equivalent to AT+CECALL.

If "0" (speech only value) is set, at call set-up the eCall flag will not be transmitted to the network and thus the call will possibly not be routed to an eCall-capable PSAP.

Values "1" and "2" are used in normal eCall operation mode to provide to the network the information whether the emergency call has been initiated manually (MIeC) by the vehicle occupant or automatically (AIeC), triggered by a crash sensor (e.g. Airbag sensor).

With "3" and "4" eCall type options, when issuing ATD112, test or reconfiguration numbers will be dialed instead of an emergency number. The numbers, read at boot time from the USIM, are taken from the eCall configuration cache.

3.2.1 USIM not inserted / not valid eCall USIM

If the USIM was not present at boot time, or the USIM is not a valid eCall USIM, the command answers with an error result code:

Command	Response	Description
AT+UECALLSTAT?	+CME ERROR: SIM not inserted	USIM was not present at boot time.
AT+UECALLTYPE=1	+CME ERROR: operation not allowed	USIM was not present at boot time. eCall is not functional

Command	Response	Description
AT+UECALLSTAT?	+UECALLSTAT: 0 OK	Not valid eCall USIM present
AT+UECALLTYPE=1	+CME ERROR: operation not allowed	eCall is not enabled

If an eCall-enabled USIM card becomes non-functional at a certain time after the boot (e.g. at the car crash time), setting the eCall flag is still possible:

Command	Response	Description
AT+UECALLSTAT?	+UECALLSTAT: 1 OK	eCall USIM in eCall-only mode
	USIM removed/not functional	
AT+UECALLSTAT?	+CME ERROR: SIM not inserted	USIM not present, but eCall is functional from cached values
AT+UECALLTYPE=1	OK	eCall flag can be set

3.2.2 Test and reconfiguration eCall types

Test and reconfiguration eCall types are non-emergency calls to test and terminal reconfiguration services.

Tests and reconfiguration numbers are read from a valid, eCall-enabled USIM at the boot time and cached. When configuring the eCall type to be a test or reconfiguration call, the call is redirected to that number and the eCall flag is not sent to the network. Since **eCall Release 3**, the test number can be read for information through AT+UDCONF=90,1 command (see u-blox AT command manual [1]):

Command	Response	Description
AT+UDCONF=90,1	+UDCONF: 90,1,129,"02338456" OK	Test number is the national coded number 02338456
AT+UECALLSTAT?	+UECALLSTAT: 1 OK	eCall USIM in eCall-only mode
AT+UECALLTYPE=3	OK	Test call configured
ATD112;	OK	Test eCall initiated to 02338456 national number

If the test or reconfiguration numbers read from the USIM are wrongly encoded, or not properly configured when an invalid eCall USIM is used, the set command returns with an error result code:

Command	Response	Description
AT+UDCONF=90,1	+UDCONF: 90,1,129,"" OK	Test number not configured (e.g. not eCall USIM present)
AT+UECALLSTAT?	+UECALLSTAT: 1 OK	eCall USIM in eCall-only mode (previously forced)
AT+UECALLTYPE=3	+CME ERROR: ECALL invalid dial number	Test number is invalid. Error code 1806 if +CMEE=1

☞ The AT+UECALLTYPE command is supported in products with **eCall Release 3** for backward compatibility, but its use is not recommended: use AT+CECALL instead.

3.3 AT+CECALL

According to ETSI TS 127 007 [16], the set command triggers an eCall to the network of a specific type.

The set options for the eCall type are:

- 0 (Test eCall): use eCall test number
- 1 (Reconfiguration eCall): use eCall reconfiguration number
- 2 (MIeC): Emergency Service Category Value (octet 3) Bit 6=1
- 3: (AIeC): Emergency Service Category Value (octet 3) Bit 7=1

The command is supported only when an eCall-enabled USIM is present, otherwise it returns with an error result code. The eCall configuration caching mechanism allows performing eCalls if a USIM becomes non-functional, for example because of a crash:

Command	Response	Description
AT+UECALLSTAT?	+UECALLSTAT: 1 OK	eCall USIM in eCall-only mode
	After car crash, USIM not functional	
AT+UECALLSTAT?	+CME ERROR: SIM not inserted	USIM not present report...
	(manual eCall is triggered)	
AT+CECALL=2	OK	...but eCall is functional

Without a functional USIM, the NAD will not be able to register to the network and thus will be unreachable by the PSAP for call back.

Test and reconfiguration eCall types are non-emergency calls to test and terminal reconfiguration services.

Test and reconfiguration numbers must be properly encoded in the eCall USIM, or configured through +UDCONF=90 for not eCall-enabled USIMs (see section 3.2.2 for +UDCONF=90 examples), otherwise the command returns with an error result code:

Command	Response	Description
AT+UDCONF=90,1	+UDCONF: 90,1,129,"" OK	Test number not configured (e.g. not eCall USIM present)
AT+UECALLSTAT?	+UECALLSTAT: 1 OK	eCall USIM in eCall-only mode (previously forced)
AT+CECALL=0	+CME ERROR: ECALL invalid dial number	Test number is invalid. Error code 1806 if +CMEE=1

3.4 AT+UDCONF=90

The AT+UDCONF=90 command is dedicated to the configuration or reconfiguration of some eCall parameters. It is available in **eCall Release 3** and implements the following services.

3.4.1 eCall test number: AT+UDCONF=90,1[,<ToN>,<number>]

With this command it is possible to set or get the eCall test number, i.e. the number of the eCall test service. Set and get operations are performed in cache. If an eCall-enabled USIM is present, the cache is filled with values retrieved at boot time. Otherwise, the cache is empty. Afterwards, it is always possible to modify the parameters in cache with the set method:

Command	Response	Description
`AT+UDCONF=90,1,129,"02338456"`	`OK`	Set the national test number 02338456
`AT+CECALL=0`	`OK`	Test eCall to 0233456 initiated, T3243 timer started

See also examples in section 3.2 and 3.3 for the get method.

3.4.2 eCall reconfiguration number: AT+UDCONF=90,2[,<ToN>,<number>]

Similar to the previous command, it allows setting or getting the eCall reconfiguration number i.e. the number of the reconfiguration service.

3.4.3 eCall T3242 duration: AT+UDCONF=90,11,<timer_duration>

This command overwrites/gets the factory-programmed T3242 timer duration. T3242 is adopted by NAD in eCall-only mode to control the switch back to eCall inactivity state after the emergency call of AleC or MIeC type, according to ETSI TS 124 008 [14].

⚠ This command affects the timing of the NAD mobility management procedures when performing eCalls (not test or reconfiguration eCalls).

3.4.4 eCall T3243 duration: AT+UDCONF=90,12,<timer_duration>

This command overwrites/gets the factory-programmed T3243 timer duration. Adopted by NAD in eCall-only mode to control the switch back to eCall inactivity state after a test or terminal reconfiguration call has been performed, according to ETSI TS 124 008 [14].

The reconfigured parameter values are retained till next power cycle.

3.5 AT+UECALLDATA

Configures and activates the eIM for a single emergency call.

AT+UECALLDATA=<op>,[.....], where <op> can assume these values:

- 0: abort; it terminates the In-band Modem
- 1: arm/activate the In-band Modem
- 2: update the MSD
- 3: enable/disable the URCs
- 4: enable/disable the eCall feature

3.5.1 Activation: AT+UECALLDATA=1,<push/pull mode>,<MSD data>

This command initiates the eIM before each eCall session. The eIM can be armed before the emergency number is called. The provided MSD is immediately prepared, while the In-band signaling and the data transmission will initiate as soon as the emergency call is set up.

It is up to the application processor (IVS AP) to format the MSD (i.e. "c5e165....") according to specifications BS EN 15722 [5], [6], [7]. The MSD is provided in ASCII hexadecimal format (a consistent MSD, e.g. "c5e165...." is a string of 140x2 characters).

The eIM does not perform any consistency check of the provided MSD. Thus, any hexadecimal string of length up to 140x2 characters is allowed. Zero-padding is performed on need e.g. AT+UECALLDATA=1,1,"ABBA" transmits 140 bytes: 0xAB 0xBA 0x00 0x00 ..... 0x00).

3.5.2 In-band Modem status events: +UUECALLDATA: <urc_id>

The eIM pair activity is reported through dedicated URCs. Two level of details can be configured through AT+UECALLDATA=3,<urc_state>.

At first level, a single URC provides the transmission report.

If the call is still on, the +UUECALDATA URC may report:

- 0: MSD is received by the PSAP and the high-level acknowledge is received from the PSAP. The HL-ACK bits are returned. According to BS EN 16062 [8] the bits are used to instruct the IVS to drop the call or not
- 1: the link with the PSAP is lost during the MSD transmission. The eIM transmitter enter idle state and the receiver in the listening state, waiting for PSAP synchronization signals
- 5, 6, 8: eIM internal errors. The eIM cannot work properly

After any of those indications, the eIM is terminated or it releases the control of the voice channel so that the call may continue in voice mode.

If the call is dropped, the eIM is terminated, which is acknowledged by +UUECALDATA: 7.

At second level, the full eIM pair activity is reported. The events are aligned to the 3GPP TS 26.268 reference software [3].

The most relevant events are:

- 11: eIM is sending the 2 s INITIATION signal. This signal is immediately generated after the call set-up if the MSD has been transmitted in PUSH mode
- 12: PULL request from PSAP. The IVS eIM decoded the "SEND MSD" signal and immediately starts the MSD transmission
- 16: Link layer ACK received. The MSD is received successfully by the PSAP, thus IVS eIM stops the MSD transmission
- 17: Higher-layer ACK received (HL-ACK). This event is concurrent with event "0"

3.5.3 MSD update: AT+UECALLDATA=2,<update mode>,<MSD data>

This command serves to update the MSD during the emergency call.

In the normal update mode (<update_mode>=1), the MSD update is immediately done only if the eIM transmitter is idling. If the transmission of the previously provided MSD is still in progress, the update is deferred to allow the completion of the transmission.

In the forced update mode, the IVS eIM transmitter is updated with the new MSD regardless of its state, which may cause a link break with the PSAP eIM if an MSD transmission is in progress. Note in fact that (according to 3GPP TS 26.267 [2]) the MSD transmission is initiated by the link layer upon the reception of a PULL request from the PSAP (see for instance Figure 3 in the section 4.1.2). That means the application processor, implementing the higher level protocol, cannot in principle synchronously update the MSD upon reception of PULL event "12".

The forced update, combined with a proper control of the voice path resources, can be used to perform synchronized MSD updates with PULL requests without causing a link break. The procedure is described in section 4.2.2.

The update procedure result is returned through the URCs:

- +UUECALDATA: 20 – The MSD update request is received. The MSD update deferred since the IVS is currently transmitting (normal update mode only)
- +UUECALDATA: 21 – The MSD update is done. The IVS transmitter is ready to send the new MSD at next PULL request
- +UUECALDATA: 22 – MSD update request cannot be processed: MSD update pending. This error occurs when an update request is issued and the notification of the previous update (20 or 21) has not yet been received

3.5.4 Examples

Description	Command	Remarks
Feature enable	`AT+UECALLDATA=4,1`	The In-band Modem engine is reserved to eCall (e.g. DTMF cannot be enabled).
eIM activation	`AT+UECALLDATA=1,<push/pull mode>,<data>`	
Send MSD in PUSH mode	`AT+UECALLDATA=1,1,"c5e165…"`	The IVS prepares the "c5e165…" MSD and sends a 2 s signal to PSAP, to request a PULL from it.
Send MSD in PULL mode	`AT+UECALLDATA=1,0,"c5e165…"`	The IVS prepares the "c5e165…" MSD and waits for the PSAP to PULL the MSD.
MSD update	`AT+UECALLDATA=2,<update mode>,<data>`	
Request the MSD update	`AT+UECALLDATA=2,0,"BEBA"`	The IVS updates the MSD buffer with "BEBA" as soon as the eIM transmitter is in idle. The PSAP gets the new MSD at next PULL request.
Force the immediate MSD update	`AT+UECALLDATA=2,1,"BEBA"`	The IVS resets the eIM transmitter and immediately updates the MSD buffer with "BEBA". If the eIM transmitter was not in idle (PSAP "pulling" an MSD), the link with PSAP is lost and possibly restored (not conformant behavior). This command, combined with a proper voice resource control allows implementation of a synchronous MSD update (at PULL request).

3.6 AT+UECALLVOICE

Configures and controls the TX and RX voice path connections to voice resources (microphone and loudspeaker) and to the In-band Modem transmitter.

Examples

Description	Command	Remarks
Configure Voice control	**AT+UECALLVOICE=1,<res_id>,<on_off_ctrl>**	
	<res_id>=0: microphone; <res_id>=1: loudspeaker	
Enable the internal control on microphone muting	AT+UECALLVOICE=1,0,1	The eIM handles the switch between microphone (voice mode) and eIM transmitter (data mode) connection to the transmission path. The microphone is muted to either send the PUSH request or the MSD data through the eIM transmitter (data mode). It is un-muted when the transmitter task is accomplished or if the link with PSAP is lost.
Enable the internal control on loudspeaker muting	AT+UECALLVOICE=1,1,1	The loudspeaker is muted as soon as the eIM receiver (PSAP transmitting) detects the In-band Modem signals, and un-muted as soon as the link with the PSAP is lost.
Disable the internal control on microphone muting	AT+UECALLVOICE=1,0,0	The host must handle the switch between microphone (voice mode) and eIM transmitter (data mode) connections to the transmission path with AT+UECALLVOICE=2,0,<on_off> command. Since the microphone switches affect the eIM end-to-end communication, the implementation of full microphone control on host is NOT recommended, due to unpredictable delays in command execution.
Disable the internal control on loudspeaker muting	AT+UECALLVOICE=1,1,0	AT+UECALLVOICE=2,1,<on_off> implements the loudspeaker muting on the host.
Perform Voice Control	**AT+UECALLVOICE=2,<res_id>,<res_state>**	
	<res_id>=0: microphone; <res_id>=1: loudspeaker	
Mute the microphone	AT+UECALLVOICE=2,0,0	The microphone is muted, and the eIM transmitter is connected to the TX path.
Un-mute the loudspeaker	AT+UECALLVOICE=2,1,1	The loudspeaker is un-muted, the downlink speech (from PSAP) is sent to the loudspeaker (according to the configured audio path). The voice control is effective also when the internal control is enabled. However, the internal control can overwrite the host settings according at any eIM event, according to the switching table.
Voice status events	**+UUECALLVOICE: <res_id>,[<res_state>]**	
Microphone un-muted	+UUECALLVOICE: 0,1	The module sends a URC. The microphone has been un-muted, and the eIM transmitter is disconnected from the TX path.
Loudspeaker muted	+UUECALLVOICE: 1,0	The module sends a URC. The loudspeaker has been muted, the downlink speech (from PSAP) is NOT sent to the loudspeaker. Voice events reports the result of both internal and external (host) control.

3.6.1 Internal voice control

If the internal voice control is enabled, the microphone/loudspeaker switching is operated by the eIM, provided that eIM has been armed (before or during the call, command AT+UECALLDATA=1).

The internal voice control implements the logic to handle mute/un-mute switches of the microphone and loudspeaker according to eCall HLAP protocols both during the first MSD transmission at call-setup and during the re-transmission of MSD at the PUSH request from PSAP.

3.6.1.1 eCall Releases 2 and 3

The switches are synchronized with IVS events. Note that:

1. The internal switches cannot be individually disabled
2. SP0 handles the T5 timer with timings according to EN 16062 [8] (not configurable)
3. Timers T6 and T7 are not handled

Event / IVS event	Microphone mute	Microphone un-mute	Loudspeaker mute	Loudspeaker un-mute
Call setup notification			Immediate	Start T5 timer (2 s), un-mute at expiration.
IVSEVENT_SENDINGSTART	Immediate			
IVSEVENT_SENDINGMSD	Immediate		Immediate	
IVSEVENT_LLACKRECEIVED		Immediate		
IVSEVENT_HLACKRECEIVED		Immediate		Start internal timer (TH), un-mute at expiration. Timer value is 1.2 s in fast modulation mode, 2.4 s in robust modulation mode.
IVSEVENT_IDLEPOSTRESET		Immediate		Immediate
IVSEVENT_IDLEPOSTSTART		Immediate		
eIM transmitter interrupts the INITIATION signal since sync has been detected (internal event)		Immediate		

Table 2: internal voice control eCall Release 2 and 3

The switching logic is based on the criteria that

- the microphone is kept muted only for the time needed by eIM to send PUSH signal or transmit MSD
- the microphone/loudspeaker are restored immediately when an abnormal case is detected (e.g. sync with PSAP lost)

3.6.1.2 eCall Release 4

This release gives flexibility in configuration of switching logic.

Switches are triggered by events and controlled by control points:

- MPn: n-th microphone control point
- SPn: n-th speaker control point
- NCF: non configurable control point

Mute/un-mute action is taken immediately except for control points SP0 and SP2, which defer the action with a timer. Note that:

1. Each control point except for NCF can be individually enabled/disabled by means of AT+UECALLVOICE=4.
2. Default control point configuration is conforming to Pan European eCall HLAP specifications provided internal T5, T6 and T7 timers are enabled (see 3.6.2) or externally implemented.
3. SP0 by default is disabled.

Event / IVS event	Microphone mute	Microphone un-mute	Loudspeaker mute	Loudspeaker un-mute
Call setup notification	NCF		NCF,SP0	SP0: Start T5 timer (5 s), un-mute at expiration.
IVSEVENT_SENDINGSTART	MP0			
IVSEVENT_SENDINGMSD	MP1		SP1	
IVSEVENT_LLACKRECEIVED		MP2		
IVSEVENT_HLACKRECEIVED		MP3		SP2: Start TH timer, un-mute at expiration. Timer value is 1.2 s in fast modulation mode, 2.4 s in robust modulation mode.
IVSEVENT_IDLEPOSTRESET		MP4		SP3
IVSEVENT_IDLEPOSTSTART		MP5		
eIM transmitter interrupts the INITIATION signal since sync has been detected (internal event)		MP6		

Table 3: Internal voice control points eCall Release 4

The control points can be enabled / disabled through dedicated AT command, see examples below.

Description	Command	Remarks
Configure internal control points	**AT+UECALLVOICE=4,<res_id>,<resource_bitmask>**	
	<res_id>=0: microphone; <res_id>=1: loudspeaker	
Enable MP1,MP2 and MP3 microphone control points (default configuration eCall Release 4)	AT+UECALLVOICE=4,0,14	Rule of thumb is: MPn-th control point is n-th Bith of <resource_bitmask>, thus: b0001110 is decimal 14
Enable all microphone control points (legacy configuration)	AT+UECALLVOICE=4,1,127	Legacy configuration (eCall release 2 and 3 - like). Microphone is un-muted as soon as no longer used by eIM transmitter.
Enable SP1 and SP2 loudspeaker control points (default configuration eCall Release 4)	AT+UECALLVOICE=4,1,6	Rule of thumb is: SPn-th control point is n-th Bith of <resource_bitmask>, thus: b0110 is decimal 6
Enable all loudspeaker control points (legacy configuration)	AT+UECALLVOICE=4,1,15	Legacy configuration (eCall release 2 and 3 - like). Handle T5 timer, unmute after sync loss

☞ Disabling of NCF control point – muting at call-setup – can be achieved by arming the eIM after the call-set-up itself.

Default configuration

Default control point configuration

- microphone: +UECALLVOICE=4,0,14
- loudspeaker: +UECALLVOICE=4,1,6

is presented in the table below:

Event / IVS event	Microphone mute	Microphone un-mute	Loudspeaker mute	Loudspeaker un-mute
Call setup notification	immediate		immediate	
IVSEVENT_SENDINGSTART				
IVSEVENT_SENDINGMSD	immediate		immediate	
IVSEVENT_LLACKRECEIVED		immediate		
IVSEVENT_HLACKRECEIVED		immediate		Start TH timer, un-mute at expiration. Timer value is 1.2 s in fast modulation mode, 2.4 s in robust modulation mode.
IVSEVENT_IDLEPOSTRESET				
IVSEVENT_IDLEPOSTSTART				
eIM transmitter interrupts the INITIATION signal since sync has been detected (internal event)				

Restoring of voice communication in abnormal cases is guaranteed by HLAP timers T5, T6, and T7. The muting at call set-up notification (NCF point) has effect only if the eIM is armed before initiating the MO call (ATD112 or AT+CECALL) or answering to MT call (ATA).

Voice handling at PSAP callbacks

The call session originated by PSAP callbacks shall start in voice mode, and the IVS eIM must be ready to transmit the MSD on PULL request.

Therefore, to avoid the initial muting for T5 seconds at PSAP call-backs, the eIM can be armed in PULL mode after the call answer:

Command	Response / Indication	Description
`AT+UCALLSTAT=1`	`OK`	Enable call status notifications
	`RING`	Incoming call
`ATA`	`OK`	IVS answers to the MT call
	`+UCALLSTAT: 1,0`	Call set-up complete
`AT+UECALLDATA=1,0,"MSD data"`	`OK`	Arm eIM in PULL mode

3.6.2 Configurable internal HLAP timers (eCall Release 4)

HLAP timers are defined in EN 16062, Table A.1. Values and description are different in standard versions 2011 [8] and 2015 [9]. eCall Release 4 implements timers according to version 2015, with a small variation on STOP for T7 (in bold):

Name Origin	Description Requirements	Value
T5 IVS	**IVS wait for SEND MSD period** START: T5 starts as soon as the IVS-NAD received notification that the call is first answered STOP: T5 stops when the IVS-NAD detects a SEND MSD signal sent by the PSAP EXPIRY: Upon expiry of T5 the IVS-NAD shall reconnect the IVS audio system and terminate eCall specific behavior (i.e. it shall not proceed with the sending of MSD data) until requested to do otherwise	5 s
T6 IVS	**IVS wait for AL-ACK period** START: T6 starts as soon as the IVS-NAD has received LL-ACK STOP: T6 stops when the IVS-NAD receives an AL-ACK message EXPIRY: Upon expiry of T6 the IVS-NAD shall mark the transfer of the MSD as unsuccessful and reconnect IVS audio system and terminate eCall specific behavior until requested to do otherwise	5 s
T7 IVS	**IVS MSD maximum transmission time** START: T7starts as soon as the IVS-NAD starts sending MSD data STOP: T7 stops when the IVS-NAD receives an LL-ACK message **or AL-ACK message** EXPIRY: Upon expiry of T7 the IVS-NAD shall mark the transfer of the MSD as unsuccessful and reconnect IVS audio system and terminate eCall specific behavior until requested to do otherwise	20 s

Note that at expiry of timers T6 and T7 the MSD transfer is marked as unsuccessful, thus their scope is handling reestablishing of voice communication in abnormal cases. Note also that with respect to standard, the behavior of timer T7 has been extended to not consider a failure the case when no LL-ACKS but only AL-ACKS are sent by PSAP.

Unsuccessful MSD transfer is reported through URC, see examples below (eCall Release 4 with default control point configuration):

Scenario	Response / URC	Description
UNSUCESSFULL TRANSFER: eIM link is broken immediately after the MSD transfer but before reception of HLACKs	`+UUECALLDATA: 2`	T6 elapsed, MSD received by PSAP, IVS did not receive HLACK. Voice communication reestablished. IVS cannot possibly operate a call clear down
UNSUCESSFULL TRANSFER: eIM link is broken during sending of MSD, before any LLACK is received	`+UUECALLDATA: 2`	T7 elapsed, MSD not received by PSAP. Voice communication reestablished.
SUCCESSFUL TRANSFER: PSAP does not send LLACKs but sends HLACKs,	`+UUECALLDATA: 0`	T6 timer did not start but MSD received by PSAP. T7 timer stopped at HLACK reception. Voice communication reestablished after 5 HLACKs by TH internal timer.

By default, timers are enabled and configured with values from standard version 2015. They can be disabled or their value reprogrammed through the AT interface, examples:

Command	Response / URC	Description
`AT+UECALLVOICE=5,0,0`	`OK`	Disable timer T5
`AT+UECALLVOICE=5,1,1`	`OK`	Enable timer T6
`AT+UECALLVOICE=6,2,20000`	`OK`	Configure timer T7 expiry to 20 s

Table 4 HLAP timer configuration examples

4 eCall examples

This section provides some examples illustrating both end-to-end interactions and eCall AT interface usage.

4.1 eCall session dynamic view: end-to-end In-band signaling

Figure 2 and Figure 3 present the In-band dynamic behavior of the eIM pair. The microphone and loudspeaker status / switch indications are disabled. All the IVS events are caught and reported to AT.

4.1.1 MSD transfer in push mode

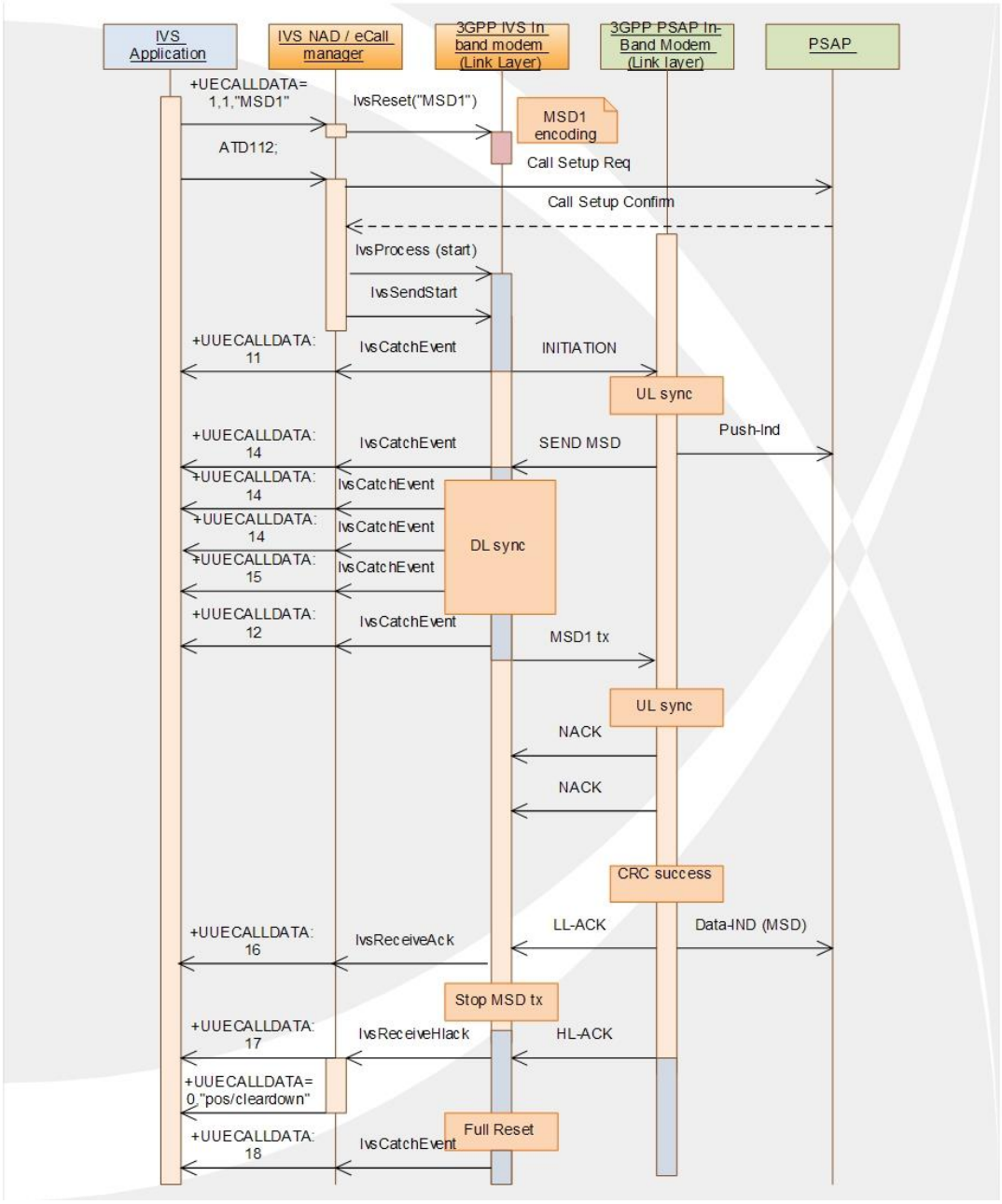


Figure 2: MSD transfer in push mode, eCall Release 2 version

Products based on later releases differ only for AT+CECALL usage instead of ATD112.

4.1.2 MSD update in TX idling mode

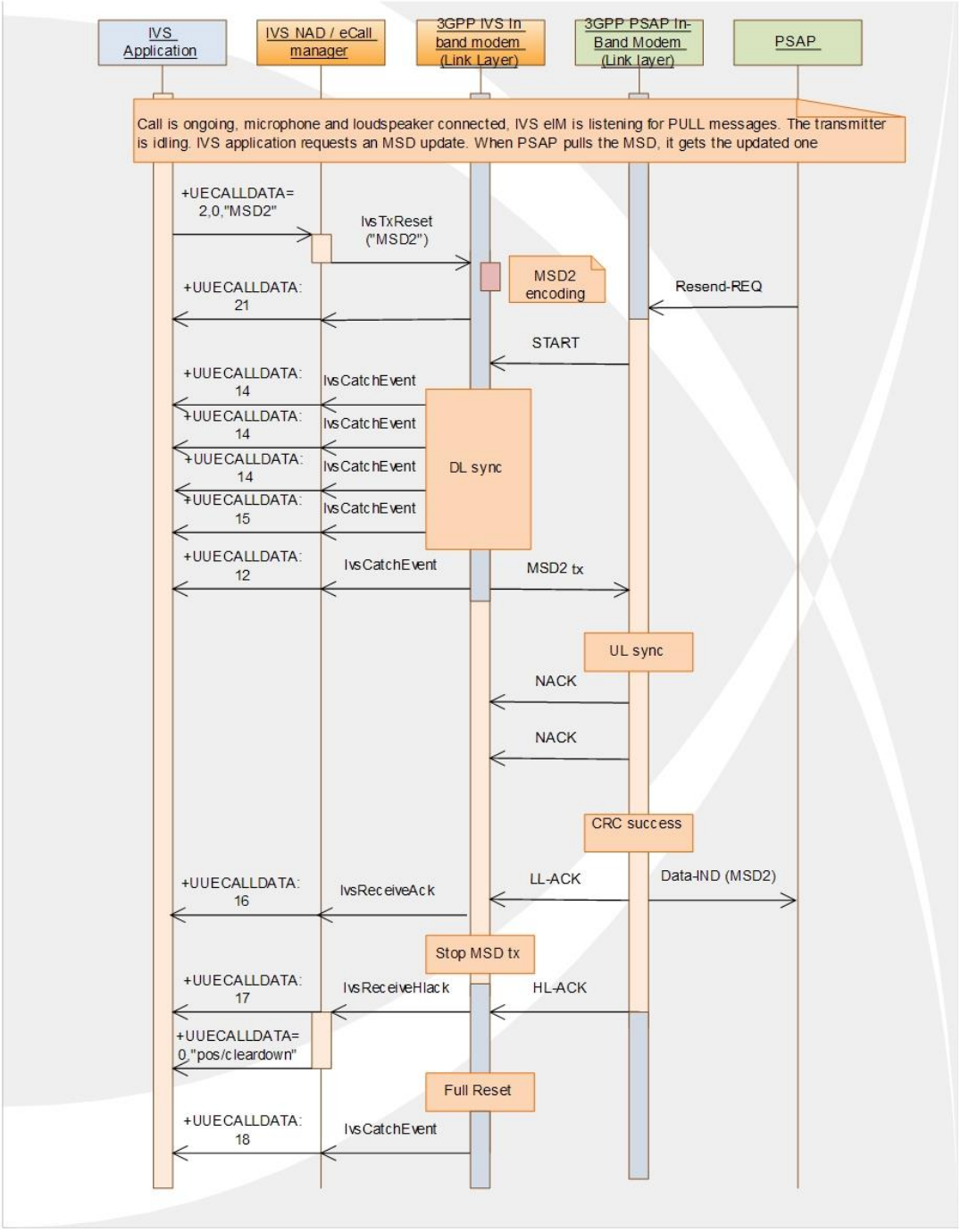


Figure 3: MSD update in TX idling mode

4.2 eCall control examples

4.2.1 Simple MSD transfer in push mode

This example describes a configuration in a simplified eCall scenario. For more details, see the u-blox AT command manual [1].

Command	Response	Description
(system power-cycle)		
AT+COPS?	+COPS: 0 OK	Check the operator selection status.
AT+UECALLSTAT?	+UECALLSTAT: 1 OK	An eCall-enabled USIM is present: the USIM is configured in eCall-only mode.
AT+UECALLDATA=4,1	OK	Enable the eIM feature.
AT+UECALLDATA=3,2	OK	Enable the full URC set.
AT+UECALLVOICE=3,0,1	OK	Enable the microphone switch event URCs.
AT+UECALLVOICE=3,1,1	OK	Enable the loudspeaker switch event URCs.
AT+UCALLSTAT=1	OK	Enable call status indications.
(automatic eCall activation by e.g. sensor)		
AT+UECALLDATA=1,1,"c5e165…"	OK	Arm the eIM before the dial-up and prepare MSD for transmission in push mode.
AT+CECALL=3	OK	Initiate eCall, by setting the eCall flag to AIeC. The module performs the mobility management procedure and call setup.
	+UCALLSTAT: 1,2	Dialing (Mobile Originated call).
		(time elapsing)
	+UCALLSTAT: 1,3	Alerting (Mobile Originated call; ringing for the remote party).
		(time elapsing)
	+UCALLSTAT: 1,0	Active: call set-up is complete.
	+UUECALLVOICE: 1,0	Loudspeaker muted. **Concurrent with +UCALLSTAT: 1,0**
	+UUECALLDATA: 11	SENDINGSTART: IVS eIM starts sending the INITIATION signal.
	+UUECALLVOICE: 0,0	Microphone muted. **Concurrent with +UUECALLDATA: 11** T5 timer starts.
		(time elapsing) IVS eIM is sending the INITIATION message.
	+UUECALLDATA: 14	CONTROLSYNC: IVS receives first sync message.
	+UUECALLVOICE: 0,1	Microphone unmuted. IVS eIM detected first sync signal and stopped the INITIATION message transmission.
	+UUECALLDATA: 14 +UUECALLDATA: 14	(time elapsing, 1200 ms) IVS eIM continues synching.
	+UUECALLDATA: 15	CONTROLLOCK: IVS sync with PSAP locked.
	+UUECALLDATA: 12	SENDINGMSD: IVS received “SEND MSD” signal, stops T5 timer and starts sending MSD.
	+UUECALLVOICE: 0,0	Microphone muted. **Concurrent with +UUECALLDATA: 12**
		(time elapsing) IVS eIM is sending MSD.
	+UUECALLDATA: 16	LLACKRECEIVED – 2nd LL-ACK received, MSD sending completed. Start T6 loudspeaker un-mute timer.
	+UUECALLVOICE: 0,1	Microphone un-muted. **Concurrent with +UUECALLDATA: 16**
		(time elapsing, 2 s)

Command	Response	Description
		IVS eIM receives more LLACKs and waits for HLACK, that shall arrive in 2 s with fast modulation mode.
		(time elapsing, 2 s)
	+UUECALLDATA: 17	HLACKRECEIVED - 2nd HL-ACK received. TH timer starts.
	+UUECALLDATA: 0,"00"	MSD correctly sent, HL-ACK check bits returned. **Concurrent with +UUECALLDATA: 17**
		(time elapsing, 1.2s) IVS eIM receives 3 more HL-ACKs from PSAP. If PSAP is no longer transmitting, IVS eIM synch check fails.
	+UUECALLVOICE: 1,1	TH expires and un-mutes the loudspeaker. T6 timer stopped.
		(time elapsing, 1.2 s) If PSAP is no longer transmitting, next 3 IVS eIM synch checks fail.
	+UUECALLDATA:18	After 3 bad sync checks, IVS eIM performs the full reset.
(PSAP drops the call)		
	+UUECALLDATA:7	In-band Modem terminated due to call end.
	+UCALLSTAT: 1,6	The call is ended.
	NO CARRIER	The call is ended by remote party.

4.2.2 .MSD update on PULL request, with transmitter reset and microphone control

This example shows how the MSD update can be synchronized with the PSAP PULL request using the forced update mode. When the IVS transmitter is idling after the first MSD transmission, the internal microphone control is disabled to prevent the immediate synchronization with PSAP on its PULL request. When the PULL request is received, IVS first re-enables the internal microphone control, then forces an MSD update with transmitter reset (the IVS eIM is transmitting, but its TX path is disconnected).

Pseudo-code

Below there is an example of the MSD update procedure to be implemented on the application processor (AP).

Command	Response / URC	Description
AT+UECALLDATA=1,1,"c5e165…"	OK	Arm the eIM before the dial-up and prepare the MSD for transmission in push mode.
AT+CECALL=2	OK	Initiate an eCall with the eCall flag set to MIeC.
	(time elapsing)	AP waits for the first MSD to be sent.
	+UUECALLDATA: 17	When the first MSD is sent, the microphone is reconnected.
AT+UECALLVOICE=1,0,0	OK	Disable the internal microphone control.
	(time elapsing)	Wait for new MSD request.
	+UUECALLDATA: 12	MSD PULL command received. The IVS starts transmission, but the microphone is still connected. PSAP waiting for synch signal from IVS eIM.
AT+UECALLVOICE=1,0,1	OK	Re-enable internal microphone control. At the next +UECALLDATA command the eIM will take control over the TX voice channel.

Command	Response / URC	Description
AT+UECALLDATA=2,1,"a236e4…"	OK	Update the MSD, forcing the IVS eIM transmitter reset. The microphone is disabled, the eIM transmits on TX voice channel and syncs with PSAP.
	(time elapsing)	
	+UUECALLDATA: 17	The MSD is updated, the microphone is reconnected.

4.2.3 Answer to PSAP callback

This example shows the procedure to follow when answering to the PSAP callback. In this use case, the call starts with normal voice communication, and the MSD is transferred only on PSAP pull request.

Note that since the call-setup event occurred before the eIM activation, the internal voice control does not take any mute action on microphone and loudspeaker (see NCF control point, Table 3).

Command	Response / Indication	Description
AT+UCALLSTAT=1	OK	Enable call status notifications
	RING	Incoming call from PSAP
ATA	OK	IVS answers to the MT call
	+UCALLSTAT: 1,0	Call set-up complete
AT+UECALLDATA=1,0,"c5e165…"	OK	Arm eIM in PULL mode after the call set-up completion

4.3 eCall configuration examples

This section provides some configuration examples of the NAD part only, that include the eCall flag and the network registration restrictions configuration. The configuration must take place before the emergency call is commenced. For conformity to the operating system requirements BS EN 16072 [11] and high-level application protocol requirements BS EN 16062 [8], the application processor must take care of the correct registration procedure. In particular:

- In **eCall Release 2** products not supporting AT+CECALL, configure the eCall flag before any IVS-initiated eCall.
- Configure the IVS modem with the automatic operator selection (AT+COPS=0) also when operating in eCall-only mode, to remain registered after the call completion (according to timings requirements in BS EN 16062 [8][9], see also timing requirements T9 and T10 in the section 2.2)

☞ The eCall flag is sent to the network only if the emergency call is performed.

☞ The eCall flag is not sent to the network if the status returned by AT+UECALLSTAT? is “0”.

☞ The emergency calls ATD112 and ATD911 are always possible and are equivalent.

In the following examples, the In-band Modem configuration and activation (i.e. any +UECALLDATA and +UECALLVOICE command) are omitted.

4.3.1 eCall initiation (eCall Release 2 vs 3)

The following simple examples show how an eCall is initiated in **eCall Release 2** and **eCall Release 3** products.

The read command inside the procedure has been inserted for the sake of clarity and is optional.

4.3.1.1 Using AT+UECALLTYPE in eCall Release 2

The eCall flag is not reset after the eCall.

Command	Response	Description
AT+UECALLTYPE?	+UECALLTYPE: 0 OK	Factory-programmed value. The eCall flag is not defined/not sent to the network.
AT+UECALLTYPE=1	OK	Configure eCall flag: MIeC.
ATD112;	OK	Dial the emergency call. The eCall flag is sent to the network.
	NO CARRIER	The PSAP dropped the call.
AT+UECALLTYPE?	+UECALLTYPE: 1 OK	The eCall flag is not reset after the call.

4.3.1.2 Using AT+UECALLTYPE in eCall Release 3 (deprecated)

The eCall flag is reset after the eCall.

Command	Response	Description
AT+UECALLTYPE=1	OK	Configure the eCall flag: MIeC.
ATD112;	OK	Dial the emergency call. The eCall flag is sent to the network.
AT+UECALLTYPE?	+UECALLTYPE: 1 OK	Emergency call of MIeC type in progress.
	NO CARRIER	The PSAP dropped the call.
AT+UECALLTYPE?	+UECALLTYPE: 0 OK	The flag is reset, the eCall is completed.

4.3.1.3 Using AT+CECALL

The eCall flag is reset after the call, indicating that the emergency call has been completed.

Command	Response	Description
AT+CECALL=2	OK	Dial the emergency call. Configure the eCall flag: MIeC. eCall flag is sent to the network.
AT+CECALL?	+CECALL: 2 OK	eCall of MIeC type is in progress.
	NO CARRIER	The PSAP dropped the call.
AT+CECALL?	+CME ERROR: operation not allowed	The eCall is completed.
AT+UECALLTYPE?	+UECALLTYPE: 0 OK	The flag is reset, the eCall is completed.

☞ When initiating an eCall with AT+CECALL, the +UECALLTYPE read command (AT+UECALLTYPE?) still provides the eCall type / eCall status.

4.3.2 eCall-only mode with an eCall-enabled USIM

This example shows the eCall configuration and the setup procedure when the module is operating with the registration restrictions. The automatic operator selection may be configured after the module's power cycle. The AT+COPS command returns with an error result code, indicating that the registration will be started at the emergency call set-up when exiting the eCall registration restricted state.

Any read operation in the procedure, inserted for the sake of clarity, is optional.

Command	Response	Description
AT+CMEE?	+CMEE: 2 OK	Optionally check the format of the error result code.
AT+UECALLSTAT?	+UECALLSTAT: 1 OK	Check the eCall USIM status: a eCall-enabled USIM with registration restrictions is present.
AT+COPS=0	+CME ERROR: ECALL restriction	Register the module. The error result code is returned to indicate that the NAD will not immediately register but only when the emergency call is initiated.
AT+COPS?	+COPS: 0 OK	+COPS: 0 will assure that, after the call, the module will stay registered till maximum T10 timing requirements.
(manual eCall is triggered)		
AT+CECALL=2	OK	Set up a manually initiated eCall

After the call termination, the module will deregister automatically after 12 hours (T10 timing requirements are implemented by T3242 timer, according to ETSI TS 124 008 [14]).

☞ Instead of +CME ERROR: ECALL restriction, SARA-G340, SARA-G350 and LEON-G100 modules return +CME ERROR: unknown.

☞ To monitor the registration status, use the network registration +CREG URC.

4.3.3 Force the eCall-only mode with a not eCall-enabled USIM

The eCall-only mode can be forced if a not eCall-enabled USIM is present (only for test purposes). To enter the eCall-only mode, the module must be unregistered. Test and reconfiguration numbers can be provided via +UDCONF=90 command.

Command	Response	Description
AT+CMEE?	+CMEE: 0 OK	Optionally check the format of the error result code.
AT+UECALLSTAT?	+UECALLSTAT: 0 OK	Check the eCall USIM status: a not eCall-enabled USIM is present.
AT+COPS=2	OK	Deregister the module from the network (if registered).
AT+UECALLSTAT=1	OK	Force the eCall-only mode.
AT+COPS=0	ERROR	Register the module. An error result code is returned to indicate that the NAD will not register immediately but only when the emergency call is initiated.
AT+CECALL=2	OK	Set up a manually initiated eCall.

4.3.4 Force the eCall without registration restrictions with a not eCall-enabled USIM

To enter the eCall mode without registration restrictions, the module must be unregistered. The test and reconfiguration numbers can be provided via +UDCONF=90 command.

Command	Response	Description
AT+UECALLSTAT?	+UECALLSTAT: 0 OK	Check the eCall USIM status: a not eCall-enabled USIM is present.
AT+COPS=2	OK	Deregister the module from the network (if registered).
AT+UECALLSTAT=2	OK	Force the eCall without registration restrictions.
AT+COPS=0	OK	Register the module.
AT+CECALL=2	OK	Set up a manually initiated eCall.

5 ERA-GLONASS additional features and use cases

5.1 MSD transfer by SMS

ERA-GLONASS specifies the usage of SMS channel as fallback for MSD data transmission. The customer application (APP) must encapsulate the MSD into the SMS message text according to the transport protocol defined in [19][20] and format and transmit it in PDU mode by means of AT commands.

5.1.1 MSD SMS transmission in PDU mode

In this example, the SMS text message example to transmit is:

```
0100000b0039000000014c32000000800a0a282f0001015c0805d6ca820804085296000006044441ceee52b0
7fffffff7fffffffff80200fffff05030104010450543080005fdd
```

5.1.1.1 PDU generation

PDU is generated from the SMS text message, destination number and PDI generation coding rules. In this example:

1. The destination number is 1234
2. Coding rules as provided by PDUspy tool snapshots below.
   - Remember to launch the PDUSpy.exe with the '-enablefulllength' option.

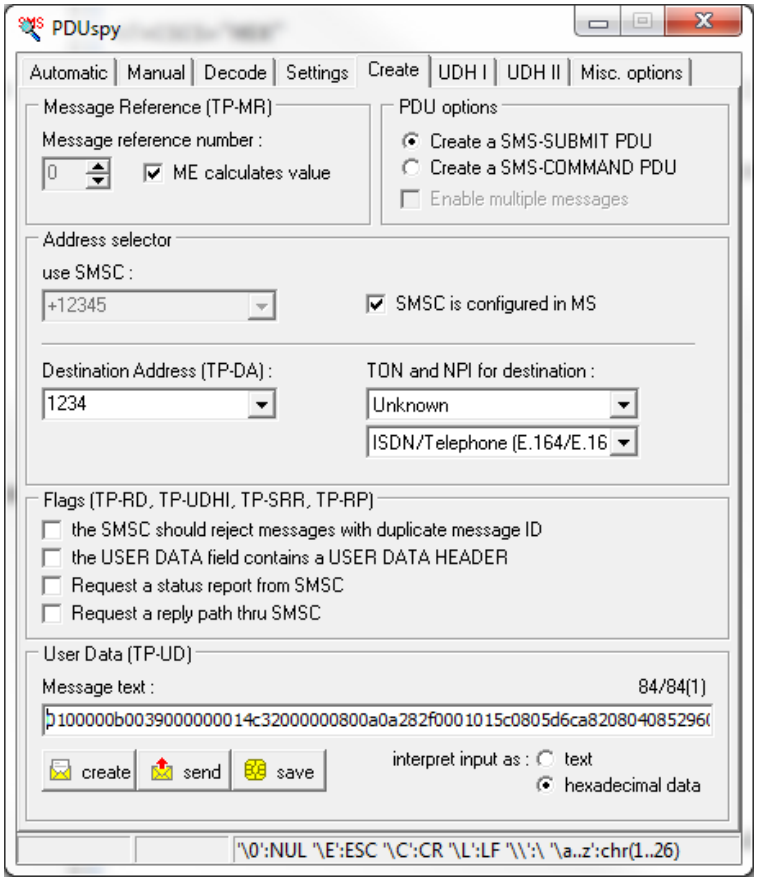
The resulting PDU-encoded message is

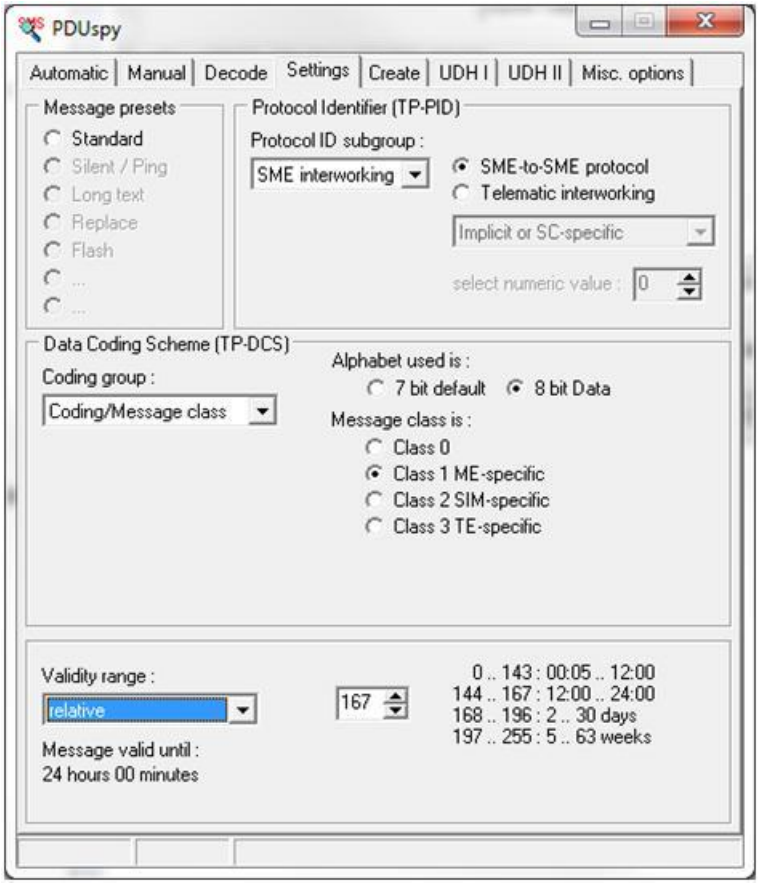
```
00110004812143 00F5A746 0100000B0039000000014C32000000800A0A282F0001015C0805D6CA820804085
2960000060444 1CEEE52B07FFFFFFF7FFFFFFFFF80200FFFFF05030104010450543080005FDD
```

where the highlighted data in yellow is the PDU header and the highlighted data in green is the SMSC coding part (the latter not to count as PDU length).

5.1.1.2 PDU transmission

Command	Response	Description
AT+CMGF=0	OK	Set PDU mode
AT+CSCS="HEX"	OK	Set hexadecimal representation mode
AT+CSCA="0815654321"	OK	Set the Service Center SMSC, configure in MS
AT+CMGS=80<CR> >00110004812143 00F5A7460100000B0039000000014C32000000800A0A282F0 001015C0805D6CA820804085296000006044 41CEEE52B07FFFFFFF7FFFFFFFFF 80200FFFFF05030104010450543080005FDD<Ctrl-Z>	+CMGS: n OK	Specify the PDU length excluding the SMSC part (first 00 byte) and send the PDU after the '>' sign


PDUspy
Automatic
Manual
Decode
Settings
Create
UDH I
UDH II
Misc. options
Message Reference (TP-MR)
Message reference number :
0
ME calculates value
PDU options
Create a SMS-SUBMIT PDU
Create a SMS-COMMAND PDU
Enable multiple messages
Address selector
use SMSC :
+12345
SMSC is configured in MS
Destination Address (TP-DA) :
1234
TON and NPI for destination :
Unknown
ISDN/Telephone (E.164/E.16
Flags (TP-RD, TP-UDHI, TP-SRR, TP-RP)
the SMSC should reject messages with duplicate message ID
the USER DATA field contains a USER DATA HEADER
Request a status report from SMSC
Request a reply path thru SMSC
User Data (TP-UD)
Message text :
84/84(1)
b100000b0039000000014c32000000800a0a282f0001015c0805d6ca8208040852960
create
send
save
interpret input as :
text
hexadecimal data
'\0':NUL '\E':ESC '\C':CR '\L':LF '\\':\ '\a..z':chr(1..26)


PDUspy
Automatic
Manual
Decode
Settings
Create
UDH I
UDH II
Misc. options
Message presets
Standard
Silent / Ping
Long text
Replace
Flash
Protocol Identifier (TP-PID)
Protocol ID subgroup :
SME interworking
SME-to-SME protocol
Telematic interworking
Implicit or SC-specific
select numeric value :
0
Data Coding Scheme (TP-DCS)
Coding group :
Coding/Message class
Alphabet used is :
7 bit default
8 bit Data
Message class is :
Class 0
Class 1 ME-specific
Class 2 SIM-specific
Class 3 TE-specific
Validity range :
relative
167
0 .. 143 : 00:05 .. 12:00
144 .. 167 : 12:00 .. 24:00
168 .. 196 : 2 .. 30 days
197 .. 255 : 5 .. 63 weeks
Message valid until :
24 hours 00 minutes

5.2 SIM/eUICC profile switch

ERA-GLONASS standard requires the support of multi-profile eUICC cards [21] in which a profile is dedicated to ERA-GLONASS emergency calls. The salient profile switch scenarios are:

1. IVS switches the profile in the eUICC from the active commercial profile to the ERA-GLONASS emergency profile
2. IVS switches the profile back in the eUICC to the previously active commercial profile

Switches shall be controlled by AP as specified by ERA-GLONASS protocol, e.g.

- At Road Traffic Accident (RTA) event the eUICC is in the commercial profile.
- AP instructs eUICC to operate the profile switch through AT+CSIM command.
- AP activates the emergency call transaction.
- When the emergency situation is over, the AP requests the multi-profile eUICC to swap back to commercial subscription.

An example is given in next section.

5.2.1 Example eCall transaction with temporary eUICC swap to emergency profile

Precondition of this example is that +UUSIMSTAT indications are enabled in NVM:

Command	Response	Description
AT+USIMSTAT=5	OK	Enable URC +UUSIMSTAT reporting. Reports the (U)SIM initialization status (<state>'s from 0 to 6 may be reported) and reports the USIM toolkit REFRESH proactive command execution result (<state>'s from 9 to 10 may be reported).
AT+CPWROFF	OK	Power down the NAD to store +USIMSTAT setting in NVM.

At NAD boot, the URC on the SIM status is received and the actual profile can be checked

Command	Response	Description
(NAD power-cycle occurred)		
	+UUSIMSTAT: 6	(U)SIM operational in commercial profile (registration may be initiated).
AT+UECALLSTAT?	+UECALLSTAT: 0 OK	(Optional check) not eCall-enabled SIM present (confirms the commercial profile).

AT RTA event, operate the eCall transaction. Note that a profile switch automatically resets silently the NAD device

Command	Response	Description
(manual eCall is triggered)		
AT+CSIM=20,"80C2000005EE03EF0120"	+CSIM: 4,"910B" OK	Switch to ERA-GLONASS emergency profile (ACTIVATE PROFILE in USAT Mode on Oberthur's eUICC card). Response is successful, proactive command pending (length 0x0B).
	+UUSIMSTAT: 0	SIM card not present. In this scenario due to the REFRESH of type UICC reset being executed.
	+UUSIMSTAT: 9	(U)SIM toolkit REFRESH proactive command successfully concluded.
(NAD silent reset occurred: all configurations not saved in NVM restored to default settings)		

Command	Response	Description
	+UUSIMSTAT: 5	Emergency profile now is active. (U)SIM in restricted use (FDN or BDN active). In this scenario due to an eCall only SIM (FDN service enabled).
AT+UECALLSTAT?	+UECALLSTAT: 1 OK	(Optional check) eCall only with registration restriction. Confirms the emergency profile is active
Configure eCall feature:		
AT+UECALLDATA=4,1	OK	Enable the eIM feature. Not saved in NVM
AT+UECALLDATA=3,2	OK	Enable the full URC set. Not saved in NVM
AT+UECALLVOICE=3,0,1	OK	Enable the microphone switch event URCs. Not saved in NVM
AT+UECALLVOICE=3,1,1	OK	Enable the loudspeaker switch event URCs. Not saved in NVM
AT+UCALLSTAT=1	OK	Enable call status indications. Not saved in NVM
Start eCall transaction:		
AT+UECALLDATA=1,1,"c5e165…"	OK	Arm the eIM before the dial-up and prepare MSD for transmission in push mode.
AT+CECALL=2	OK	Initiate eCall, by setting the eCall flag to MIeC. The NAD performs the mobility management procedure and call setup.
...	...	...
(emergency situation is over)		
AT+CSIM=20,"80C2000005EE03EF0124"	+CSIM: 4,"910B" OK	Switch back to initial commercial profile (DEACTIVATE PROFILE in USAT Mode on Oberthur's eUICC card). Response is successful, proactive command pending (length 0x0B)
	+UUSIMSTAT: 0	SIM card not present. In this scenario due to the REFRESH of type UICC reset being executed
	+UUSIMSTAT: 9	(U)SIM toolkit REFRESH proactive command successfully concluded
(NAD silent reset occurred: all configurations not saved in NVM restored to default settings, e.g. eIM feature disabled)		
	+UUSIMSTAT: 6	(U)SIM operational in commercial profile (registration may be initiated)
AT+UECALLSTAT?	+UECALLSTAT: 0 OK	(Optional check) not eCall-enabled SIM present (confirms the commercial profile)

☞ The SIM commands transmitted to eUICC through AT+CSIM (e.g. "80C2000005EE03EF0120") are card vendor-specific.

6 eCall / ERA GLONASS In-band Modem simulation system

The eCall simulation system allows testing the In-band Modem functionality implemented in the cellular modules.

Performing such a test requires:

- A u-blox PSAP simulator for reception of a simulated eCall
- An eCall IVS simulation system with the device under test (eCall-featured u-blox module)

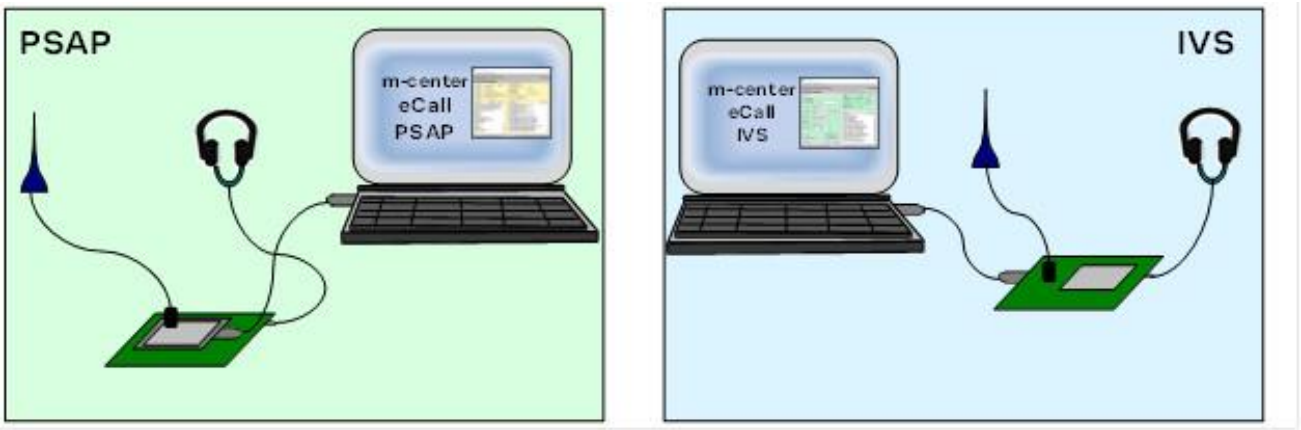


Figure 4: Connection scheme

⚠ eCall In-band modem does not operate with WB speech. Before running the simulation, configure the PSAP simulator to exclude WB codecs from allowed codecs set through the +UDCONF=30 AT command.

6.1 PSAP simulator

The PSAP simulator consists of:

- A PC running m-center evaluation software
- A PSAP GSM modem (e.g. LISA-U200-02S)
- An evaluation kit (EVK) on which the PSAP GSM modem is mounted

Connect the EVK to the PC, using a standard USB cable.

Connect a headset to the PSAP GSM modem (optional).

The PSAP eIM runs in m-center evaluation software (eIM is based on 3GPP PSAP reference code) and exchanges PCM audio data with the PSAP GSM modem via the USB connection.

6.1.1 Software & hardware requirements

6.1.1.1 PC

Minimum requirements recommended: 2.00 GHz Core with 1 GB DDR2-800 SDRAM

- OS: Windows XP or above

The following software components must be installed on the PC:

- m-center evaluation software
- u-blox_High_Speed_Modem USB driver

6.1.1.2 PSAP GSM modem module

The module to be used as the PSAP GSM modem.

6.1.1.3 PSAP GSM modem evaluation kit

The kit includes a GSM antenna, power supply and headset.

6.1.1.4 USB cable

A standard USB Type A to 5 Pin mini-B cable is used to connect the PSAP GSM modem to the PC.

6.2 IVS system

The IVS system consists of:

- A PC running the m-center evaluation software
- The device under test (DUT) (see section 1) implementing parts of IVS as described in this application note
- An evaluation kit (EVK) on which the DUT is mounted

Connect the EVK to the PC, using a standard USB cable.

Connect a headset to the DUT (optional).

m-center evaluation software can be used to

- directly control the DUT through AT commands
- run the IVS simulator, that controls the DUT and GNSS through AT commands.

6.2.1 Software & hardware requirements

6.2.1.1 PC

Minimum recommended requirements: 2.00 GHz Core with 1 GB DDR2-800 SDRAM.

- OS: Windows XP or above

The following software components must be installed on the PC:

- m-center evaluation software v1.0.0 or above
- u-blox USB driver

6.2.1.2 Device under test

The u-blox module under test (the DUT that acts as IVS eIM). See section 1.

6.2.1.3 Module evaluation kit

The kit includes the evaluation platform, a GSM antenna, power supply and headset.

6.2.1.4 USB cable

A standard USB Type A to 5 Pin mini-B cable connects the DUT to the PC.

6.3 m-center software

m-center evaluation software is available free-of-charge and can be downloaded from the u-blox website (http://www.u-blox.com/en/evaluation-tools-a-software/u-center/m-center.html).

The software includes an executable m-center.exe file and a mc-atlist.dat data file.

The downloaded m-center installer automatically installs m-center and the necessary USB drivers on the PC.

Two instances of m-center can be started on the same PC: one controlling the DUT, the other running the PSAP simulator.

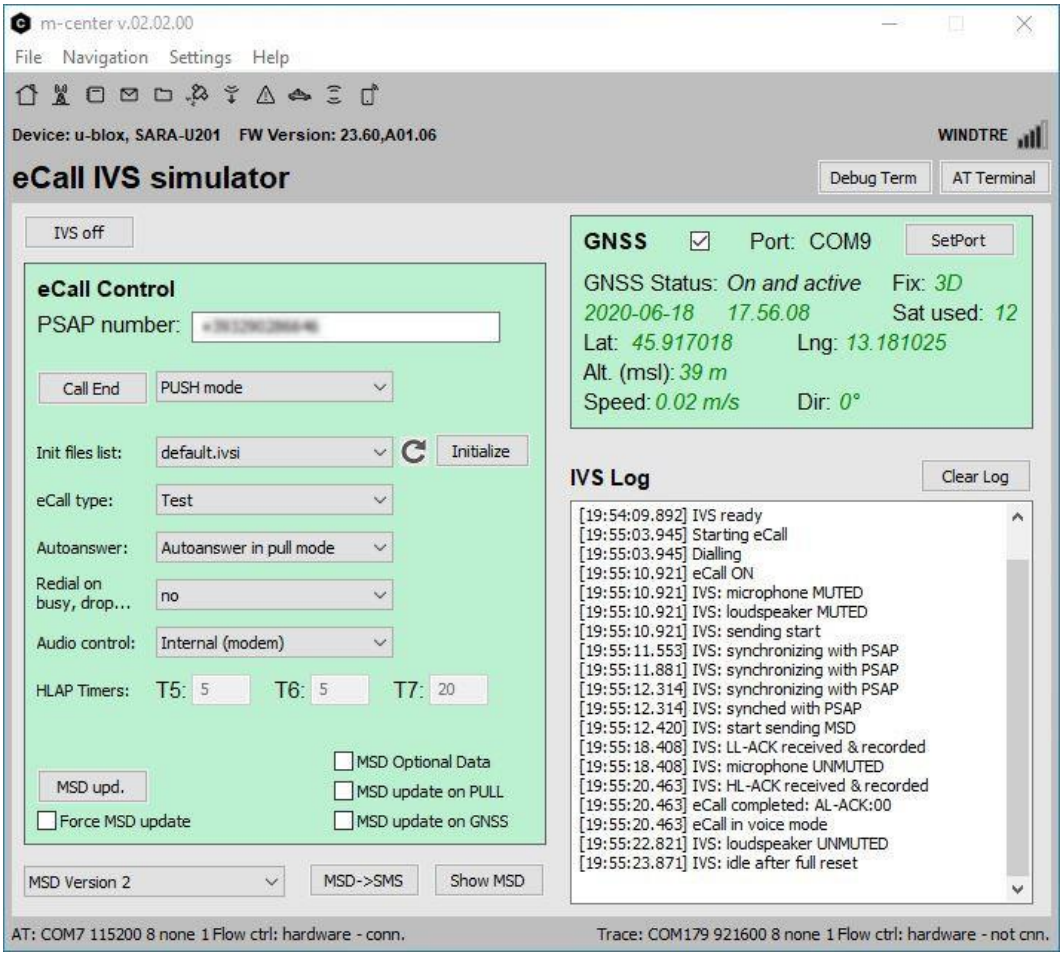
To visualize the IVS and PSAP panels, the mc-ubx.dat file has to be created in the installation folder with the following text line:

```
ecall_mode | full
```

6.3.1 IVS simulator

The IVS simulator is an application on m-center implementing those parts of IVS generally running on the application processor. The IVS simulator controls the u-blox EVK with modem and GNSS through the AT command interface. In particular, the GNSS is controlled through the wireless position AT interface. Main responsibilities of the IVS application are:

1. It controls and gathers data of the GNSS module (on EVK board).
2. It prepares the MSD for first MSD sending and for MSD updates on PSAP pulls.
3. It answers to PSAP call backs.
4. (Optionally) it controls the voice switching with HLAP timers (external audio control).



6.3.1.1 IVS on / IVS off button

This button initializes and enables the eCall feature in the modem. Initialization includes the execution of AT commands specified in the eCall control: Init file list (see section 6.3.1.4).

6.3.1.2 eCall control panel

The panel is active when IVS is on.

6.3.1.3 eCall control: Call Start

Button that triggers the emergency call and MSD sending towards the PSAP number, in either PUSH or PULL mode.

6.3.1.4 eCall control: Init file list / Initialize button

The drop-down menu shows the option of initialization scripts, while the Initialize button executes the currently selected script. Custom scripts can be stored in “mcenter\par\ivs”, with extension .ivsi.

6.3.1.5 eCall control: eCall type

Selection of MieC (manually triggered), AieC (automatically triggered) or test emergency call. This information is provided both to the network (eCall flag) and to PSAP (encapsulated in the MSD).

6.3.1.6 eCall control: Autoanswer

With this option is possible to enable and configure (PUSH/PULL) the auto answer at PSAP call backs.

6.3.1.7 eCall control: Redial on busy, drop…

Redial feature according to PAN EU eCall.

6.3.1.8 eCall control: Audio control

Selection for internal or external voice switching. Recommended usage of internal switching with default values.

6.3.1.9 eCall control: HLAP timers

Configuration of HLAP timers when external voice switching is enabled.

☞ It does not configure the DUT T5/T6 and T6 timers.

6.3.1.10 eCall control: MSD update on PULL

If “MSD update on PULL” is selected, IVS simulator implements the MSD update according to 4.2.2. Note that upon reception of PULL request, the transmission is delayed for the time needed to IVS simulator to provide the new MSD.

6.3.1.11 eCall control: MSD update on GNSS

With this option, the MSD update is continuous at GNSS fix rate. Updates are requested continuously regardless of the eIM transmitter status. Upon reception of new update request, the transmission of the previous MSD is not interrupted and the update of the eIM transmit buffer occurs once the current transmission is completed. Thus the new MSD is possibly sent at next PULL request.

6.3.1.12 eCall control: Manual MSD update

Manual trigger of an MSD update is possible by pressing the “MSD upd.” button. If “Force MSD update” is selected and the update is requested while eIM is transmitting and MSD, the transmission is interrupted, eIM transmitter reset and re-started with the new MSD.

6.3.1.13 eCall control: MSD optional data

With this option, the optional data will be included in the MSD.

6.3.1.14 MSD Version listbox

In this listbox, an MSD version option can be selected: MDS version 2 or MSD version 1 – ERA GLONASS. The MSD version 2 choice formats the MSD according to the eCall BS EN 15722:2011 [5] specification, the MSD version 1 – ERA GLONASS choice formats the MSD according to the GOST R 54620–2011 [21] specification.

6.3.1.15 MSD->SMS button

Pressing this button, the MSD is sent through an SMS. If the Version 1 – ERA GLONASS option is selected, the MSD is encapsulated into the SMS message text according to the transport protocol defined in [19][20].

6.3.1.16 GNSS panel

The GNSS panel controls the GNSS sub-system and presents the acquired GNSS data. m-center configures the GNSS on EVK through AT commands, and receives data from GNSS (NMEA, ubx messages) through the dedicated USB/UART port.

6.3.1.17 GNSS panel: Port

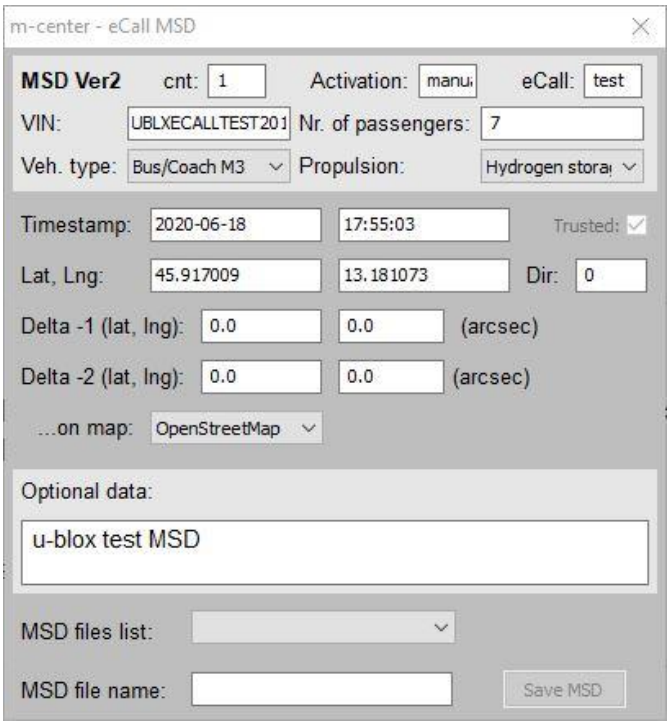
To receive data from GNSS, GNSS tunneling on dedicated serial port has to be configured. See 6.4.4 for more details.

6.3.1.18 GNSS panel: GNSS checkbox

GNSS is activated by enabling the “GNSS” checkbox.

6.3.1.19 Show MSD button: eCall MSD window

Pressing the “Show MSD” button, the eCall MSD window appears:



This window shows the decoded content of the MSD sent to the remote PSAP. The window is updated when MSD transfer starts.

The window is divided in three parts: Top Blue (TP) panel, Middle Green (MG) panel and Bottom Blue (BB) panel.

TP panel: MSD cnt

This MSD field (message identifier) counts the MSDs sent during each eCall transaction. The field is automatically updated by IVS simulator according to [7].

TP panel: Activation

This field shows the MieC/AieC field sent in the MSD according to the configuration in eCall control: eCall type (see 6.3.1.5).

TP panel: eCall

This field shows the emergency/test field sent in the MSD according to the configuration in eCall control: eCall type (see 6.3.1.5)

TP panel: VIN, Nr of passengers, Veh. Type, Propulsion

These MSD fields must be manually configured through this window.

The VIN field can be filled with fake data (string). The VIN code syntax is checked at transfer time. VIN code is cropped if not supported chars are entered.

6.3.1.20 MG panel

This panel shows the GNSS location data. If the GNSS is switched on, the fields are automatically updated when MSD transfer starts. If the GNSS is switched off, the fields can be edited with fake location data except for the Timestamp. The timestamp in this case is captured from host when MSD transfer starts.

BB panel: Optional data

The Optional data text box can be activated with the MSD optional data checkbox in the eCall control panel.

With this edit box it is possible to manually add optional data in the MSD.

In the case that the MSD Version 1 – ERA GLONASS option is used, the optional data is formatted according to the GOST R 54620–2011 [21] specification and represents the RTA severity estimation. Three hex numbers separated by commas can be written in the optional data textbox (eg. 1, 18c, 1a). These numbers specify three bitmasks relative to Severe crash estimation (1 flag), Test Results Def (21 bits) and Crash Def (6 bits).

BB panel: MSD files list

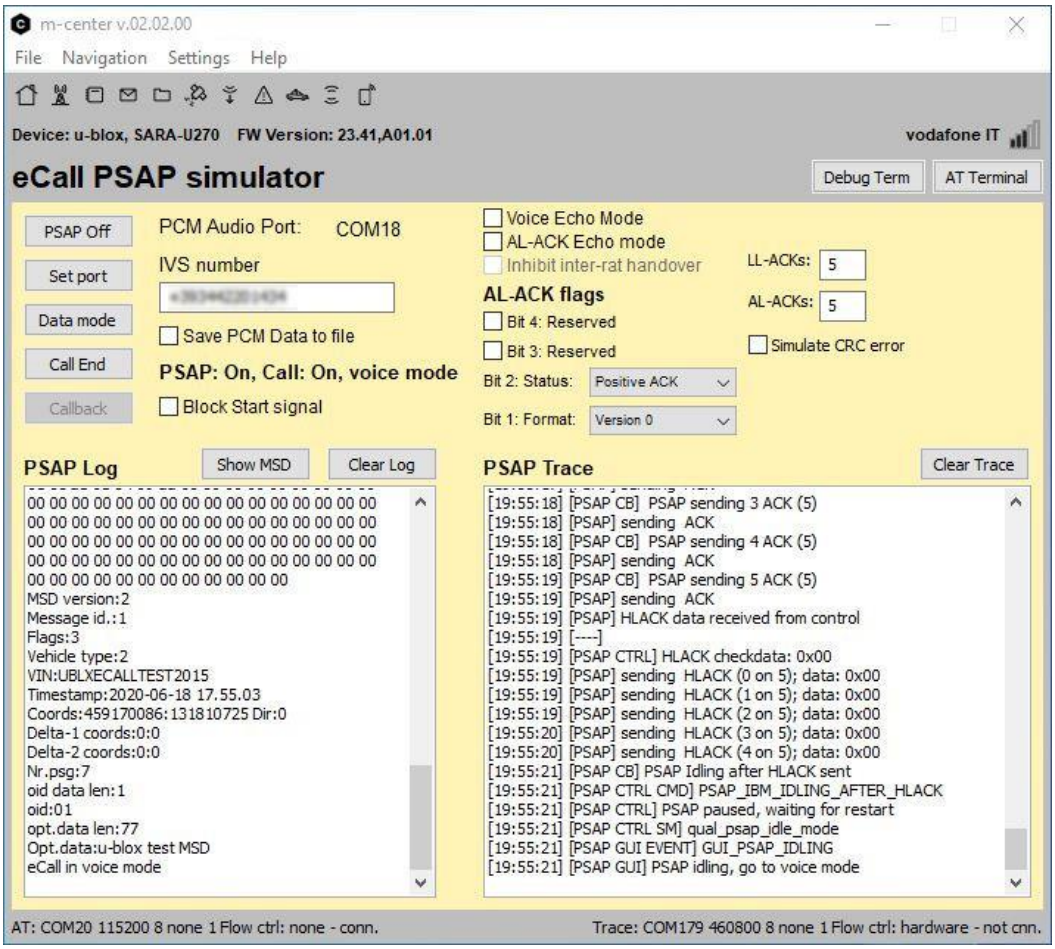
This drop-down menu explores the \par\ivs directory for the selection of pre-formatted binary MSDs or textually-described MSDs (.msd).

BB panel: MSD file name and Save MSD

The content of the eCall MSD window can be saved on a file of .msd file. Do not provide .msd file extension in the MSD file name dialog box.

6.3.2 PSAP simulator

The PSAP simulator window appears as follow:



6.3.2.1 Voice mode/ Data mode button (MSD pull)

This button automatically changes the label depending on the PSAP state.

1. Data mode: PSAP is in voice mode. Pressing this button, PSAP pulls an MSD.
2. Voice mode: PSAP is in data mode, e.g. receiving the MSD. Pressing this button, the voice mode is forced (useful for manual testing of behavior of IVS HLAP timers)

6.3.2.2 Call end

PSAP ends the call.

6.3.2.3 Callback

Call is off. PSAP calls back the IVS.

6.3.2.4 Block start signal

- If the “Block start signal” checkbox is selected, then during activation of PSAP eIM the “SEND MSD” signal (pull) is not sent.

6.3.2.5 Inhibit inter-RAT handover

- If the “Inhibit Inter-rat handover” checkbox is selected, then during activation of PSAP the module will be set to use the fixed RAT.

6.3.2.6 Application Layer Acknowledge (AL-ACK flags)

- If the “AL-ACK Echo mode” checkbox is unselected, it is possible to define four flags, to be used in high-level acknowledge. The AL-ACK is sent to IVS after the MSD reception.
- If the “AL-ACK Echo mode” checkbox is selected, the lower four bits of the first MSD byte will be used for the AL-ACK.

6.3.2.7 Voice Echo Mode

- If the “Voice Echo mode” checkbox is selected, then during voice mode the audio signal coming from IVS will be echoed back by PSAP.

6.4 eCall / ERA GLONASS system setup

6.4.1 PSAP simulator connecting with the PSAP GSM modem

- Before connecting the PSAP GSM modem (on the PSAP block) to the PC USB port, click the “Set port” button in the **Home** window, and check the visible ports in the **Com Port Settings** dialog.
- After connecting the PSAP GSM modem (on the PSAP block) to the USB port, a set of six new ports appears in the **Com Port Settings** dialog. Select a port of AT type (e.g. “u-blox Modem USB2 AT and Data”)
- Click the “Connect” and the “Initialization” buttons. If the PSAP GSM modem is correctly switched on, the module information such as Manufacturer id and Device model should appear.

6.4.2 Starting the PSAP simulator

- Move to the eCall PSAP window: if the module was correctly connected with m-center, then the message “Modem device connected” appears in the PSAP Log window.
- Click the “Set port” button to select the PCM audio port.
- In the **Com Port Settings** dialog, select the “cocdcam3” device; it corresponds to the “u-blox Modem USB4 GPS” COM port.

☞ Before PSAP activation, check if the module is registered on the network (e.g. using the `AT+COPS?` command in the AT Terminal window).

```
AT+COPS?
+COPS: 0,0,"vodafone IT",0
OK
```

- Activate the PSAP Simulator by pressing the PSAP ON button. In the PSAP Status window the messages `"PSAP activated"` and `"PCM port opened"` should appear. If, otherwise, the message `"Modem PSAP function not available"` appears, and the modem used by PSAP simulator does not embed the In-band Modem feature and cannot be used for eCall. If the `"PSAP activated"` message is followed by the `"PCM port open error"` message, a wrong PCM port has been selected.
- Now, the PSAP simulator is activated and ready for a simulated eCall / ERA GLONASS call.

6.4.3 IVS simulator connecting with the IVS GSM modem

- Before connecting the IVS GSM modem (on the IVS block) to the PC port, click the “Set port” button in the **Home** window, and check the visible ports in the **Com Port Settings** dialog.
- **SARA-G modems:** select VCP0 port (“USB Serial Port” in the Device Manager)
- **3G modems:** after connecting the IVS GSM modem (on the IVS block) to the USB port, a set of six new ports appears in the **Com Port Settings** dialog. Select a port of AT type (e.g. “u-blox Modem USB2 AT and Data”)
- Click the “Connect” and the “Initialization” buttons. If the IVS GSM modem is correctly switched on, the module information such as Manufacturer id and Device model should appear.

6.4.4 Starting the IVS simulator

Move to the eCall IVS window.

6.4.4.1 Start IVS

- Click “IVS on” button. If the module was correctly connected with m-center, then the following messages appear in the IVS Log window:

```
[12:45:30.304] Starting IVS
[12:45:30.386] IVS initialization
[12:45:31.178] IVS ready
```

6.4.4.2 Starting GNSS on 3G modules

- In the GNSS panel, click the “Set port” button to select the GNSS port.
- In the **Com Port Settings** dialog, select the “cocdcam3” device; it corresponds to the “u-blox Modem USB4 GPS” COM port.

6.4.4.3 Starting GNSS on 2G modules

To enable the GNSS tunneling on serial port VCP1, the EVK must be configured properly (just once):

- From AT terminal, change the serial port configuration to support the GNSS tunneling and save the setting in NVM

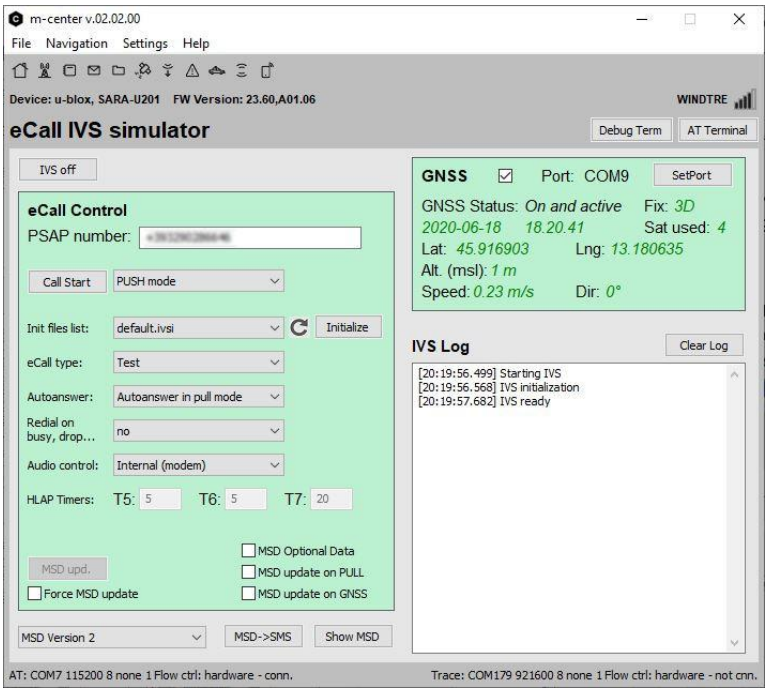
```
AT+USIO=3
AT+CPWROFF
Power on the module again and reconnect the m-center and IVS
```

Port configuration:

- In the GNSS panel, click the “Set port” button to select the GNSS port.
- In the **Com Port Settings** dialog, select the “VCP1 USB serial Port” device (COM9 in the snapshot below).

Start GNSS:

- Select the GNSS checkbox. In the AT command window, you can see a series of AT+UGUBX issued by the simulator to configure GNSS. GNSS starts acquiring data and the GNSS panel is updated with location data every second:



6.4.5 IVS In-band Modem setup without IVS simulator

On the same or on another PC, connect the IVS In-band Modem device under test (DUT) and start another m-center instance (see section 1 for the list of available DUTs).

Modem setup:

- Connect the DUT to the PC USB or serial port.
- In the **Home** window of m-center, select the appropriate AT COM port and establish the connection.

☞ Check if the module is registered on the network (e.g. using the `AT+COPS?` command in the **AT Terminal** window).

```
AT+COPS?
+COPS: 0,0,"vodafone IT",0
OK
```

- In the **AT Terminal** window select the “eCall IVS“ section.
- Enable the IVS In-band Modem feature by clicking on the command `AT+UECALLDATA=4,1`.

```
AT+UECALLDATA=4,1
OK
```

- The DUT is now ready to perform a simulated eCall.

6.5 Running the eCall simulation

6.5.1 eCall simulation example (without IVS simulator)

In this example, IVS is controlled directly through AT commands

On IVS side:

- Enable the URCs (reduced set):

```
AT+UECALLDATA=3,1
OK
```

- Activate the eIM in PUSH mode and provide the MSD using the command: `AT+UECALLDATA=1,1,"…"`, e.g.:

```
AT+UECALLDATA=1,1,"c5e165df6a789b4aaaa46ee4a651820daaf625803735d9dfd5c7067927d821a43d4b
64b74cd2116dc582aabc6f4e45cdf9cbe2f74eb1aaf69cb4ef86cde48f86e02147d6c49ea22587144bbfdaa
8ef92c04afeb0c4e93ba93453561e65acd5065bbe12abde11819d86434039cf4e619124d5f308240ab0ea11
635aef2edfc8bc39e77768d784b67f6f7cb603"
```

- If using ATD, set the eCall flag (optional with u-blox PSAP simulator) and make a call to PSAP using dial command: `ATDpsapnumber;`

```
AT+UECALLTYPE=2
OK
ATD1234;
```

- or if using AT+CECALL, configure test number and perform a test call (see 3.4.1 for more info on test number configuration)

```
AT+UDCONF=90,1,129,"1234"
OK
AT+CECALL=0;
OK
```

- Now the IVS calls the PSAP.

On PSAP side:

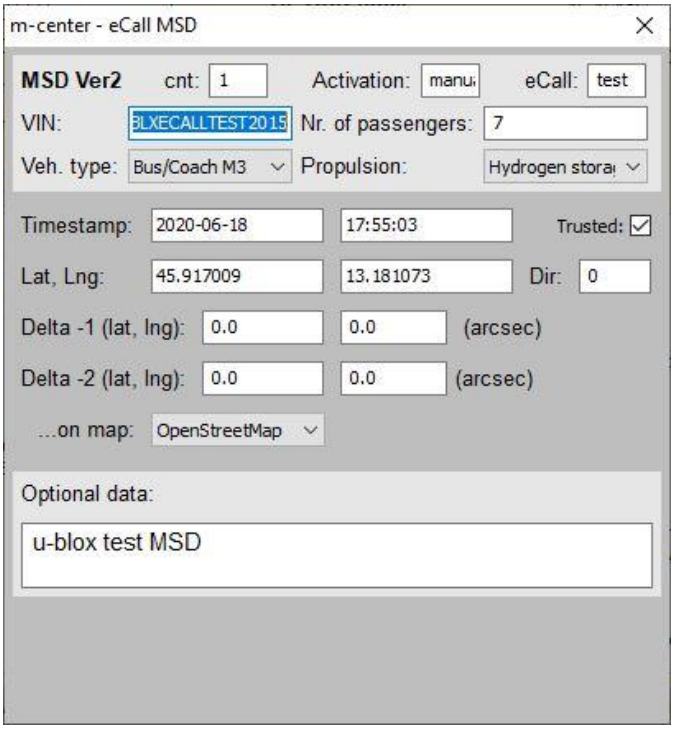
- When the m-center-PSAP detects the incoming call, the call is soon answered.
- In the **PSAP Log** window, the messages are displayed as follows:

```
Incoming call
Incoming call nr: +xx1234
InBM prepared in data mode
Call active
```

- In normal network conditions the IVS synchronizes with PSAP, and after some seconds the MSD is received.
- The messages and the MSD in binary format are displayed as follows:

```
MSD received:
c5 e1 65 df 6a 78 9b 4a aa a4 6e e4 a6 51 82 0d
aa f6 25 80 37 35 d9 df d5 c7 06 79 27 d8 21 a4
3d 4b 64 b7 4c d2 11 6d c5 82 aa bc 6f 4e 45 cd
f9 cb e2 f7 4e b1 aa f6 9c b4 ef 86 cd e4 8f 86
e0 21 47 d6 c4 9e a2 25 87 14 4b bf da a8 ef 92
c0 4a fe b0 c4 e9 3b a9 34 53 56 1e 65 ac d5 06
5b be 12 ab de 11 81 9d 86 43 40 39 cf 4e 61 91
24 d5 f3 08 24 0a b0 ea 11 63 5a ef 2e df c8 bc
39 e7 77 68 d7 84 b6 7f 6f 7c b6 03
eCall in voice mode
```

- The “eCall MSD” window appears. This window shows the decoded MSD:



- At reception of a new MSD, the panels in the window are automatically updated.
- The PSAP and the IVS are now in voice mode, the eCall is still active and, if the headphones are connected to both PSAP and IVS modem, it is possible to have a normal voice call.
- If the “Voice Echo Mode” checkbox is selected, the audio signal coming from IVS will be echoed back.
- PSAP has captured the IVS number, which is displayed in the dedicated text box.
- From the PSAP, press the “Data mode” button to again pull the MSD from the PSAP. If the connection is still active, the PSAP switches again to data mode, the microphone and loudspeaker are muted, and the MSD will again be transferred from IVS to PSAP. When the transfer is completed, the PSAP returns to voice mode.

- Press the “Call End” button to terminate the call. In this case, the following message will be displayed in PSAP Status window:
```
User closing call
Call closed
```

☞ Closing PSAP is not allowed during the call.

On IVS side:

- When the MSD is received, the PSAP acknowledges the IVS. In the **AT Terminal** the following information text response is displayed:
```
+UUECALLDATA: 0,"00"
```

- The ACK-AL flags are displayed in the second parameter of the +UUECALLDATA URC.
- When the call is dropped by the PSAP, this information text response is displayed:
```
+UUECALLDATA: 7

NO CARRIER
```

6.5.2 Callback example

When an eCall is terminated, it is possible for PSAP to call back the IVS. This can be done simply by clicking the “Callback“ button. Immediately after the call set-up, the normal voice communication should be available, as long as the PSAP does not pull an MSD.

On PSAP side:

- Click the “Callback” button. A call starts to the number displayed in the IVS number textbox.

On IVS side:

- When an incoming call is detected, answer with ATA command and wait the +UCALLSTAT URC i.e. that call is active:
```
RING

ata

OK
+UCALLSTAT: 1,0
```
- Then, start eIM in pull mode providing latest MSD:
```
AT+UECALLDATA=1,0,"c5e165df6a789b4aaaa46ee4a651820daaf625803735d9dfd5c7067927d821a43d4b
64b74cd2116dc582aabc6f4e45cdf9cbe2f74eb1aaf69cb4ef86cde48f86e02147d6c49ea22587144bbfdaa
8ef92c04afeb0c4e93ba93453561e65acd5065bbe12abde11819d86434039cf4e619124d5f308240ab0ea11
635aef2edfc8bc39e77768d784b67f6f7cb603"
```

Both

- IVS synchronizes with PSAP, and after some seconds, the MSD is received.
- The eCall continues as in previous examples.

☞ The eIM is started in pull mode, i.e. without transmitting the START signal, after the +UCALLSTAT URC is received. In that way, the internal voice muting at call setup and trigger of T5 timer is skipped (in case that internal voice handling is enabled).

Appendix

A Glossary

Abbreviation	Definition
3GPP	3rd Generation Partnership Project
AT	AT Command Interpreter Software Subsystem, or attention
DUT	Device Under Test
eCall	Emergency Call
eIM	eCall In-band Modem
IVS	In-Vehicle System (eCall related)
MSD	Minimum Set Of Data (eCall related)
PSAP	Public Safety Answering Point

Table 5: Explanation of the abbreviations and terms used

B PAN European eCall IVS test list

The following test list is for information only and may not be up-to-date.

B.1 NAD Protocol

	3GPP TS 51.010 Ch. 26.9.6a Structured Calls /eCall
26.9.6a.1	eCall with USIM
26.9.6a.1.1	Void
26.9.6a.1.2	Test call using eCall capable MS with “eCall-only” subscription on USIM
26.9.6a.1.3	Manually initiated eCall using eCall capable MS with “eCall-only” subscription on USIM
26.9.6a.1.4	Manually initiated eCall using eCall capable MS with eCall capable USIM
26.9.6a.1.5	eCall Inactivity State after T3242 expires
26.9.6a.1.6	Automatically initiated eCall
26.9.6a.1.7	Reconfiguration call using eCall capable MS with “eCall-only” subscription on USIM

	3GPP TS 34.123 Ch. 13.3 eCall Emergency Call Procedures
13.3.1	eCall /with USIM
13.3.1.1	Void
13.3.1.2	Test call using eCall capable UE with eCall-only subscription
13.3.1.3	Manually initiated eCall using eCall capable UE with “eCall-only” subscription on USIM
13.3.1.4	Reconfiguration call using eCall capable UE with an “eCall-only” subscription
13.3.1.5	Manually initiated eCall using eCall capable UE with eCall and non eCall subscription on USIM
13.3.1.6	eCall Inactivity State after T3242 expires
13.3.1.7	Automatically initiated eCall
13.3.1.8	Manually initiated eCall Location Updating using eCall-only capable UE/Reject Cause codes: IMSI Unknown in HLR or Illegal MS or Illegal ME
13.3.1.9	Void
13.3.1.10	eCall Inactivity State after T3243 expires

B.2 In-band modem conformance

	3GPP TS 26.269 eCall Data Transfer; In-band Modem solution; Conformance testing
5.1	Bit exactness
5.2	Minimum performance requirements
5.2.1	MSD Transmission time
5.2.1.1	Full campaign (all AMR-FR codec modes plus GSM-FR)
5.2.1.2	Error-free case for AMR 12.2 and FR
5.2.1.3	GSM-HR codec
5.2.1.4	Noisy Conditions
5.2.1.5	Scaling of PCM signals
5.2.2	CRC check quality
5.2.3	Transmission failures
5.2.4	False detection due to signaling tones
5.2.5	Push messages
5.2.6	HLACK messages

B.3 High-level application protocol

	CEN/TC 278 / EN 16454:2015
CTP	Name
1.1.0.1	Test for conformance to ETS TS 102936-1 and 102936-2
1.1.0.2	Test for conformance to valid SIM/USIM
1.1.0.3	Test conformance that automatic eCall triggering does not occur when ignition is OFF
1.1.1.1	Test for power on and self-test
1.1.1.2	Verify that IVS does not perform PLMN registration after power-up (eCall-only IVS)
1.1.1.3	IVS periodically scans and maintains a list of available PLMNs (eCall-only IVS)
1.1.2.1	Test for automatic activation of eCall
1.1.2.2	Verify that an automatic eCall in progress was not disconnected upon a new eCall trigger
1.1.2.3	Post-side-crash performance of the automatic trigger
1.1.2.4	Post-frontal-crash performance of the automatic trigger
1.1.2.5	Performance of automatic trigger - different crash types
1.1.3.1	Test of manual activation of eCall
1.1.3.2	Verify that a manually eCall in progress was not disconnected upon a new eCall trigger
1.1.4.1	Verify activation of test eCall
1.1.5.1	Test for network registration
1.1.5.2	Verify that manual termination of eCall by vehicle occupants was not allowed (auto eCall)
1.1.5.3	Verify that manual termination of eCall by vehicle occupants was not allowed (manual eCall)
1.1.5.4	Verify that ongoing automatically triggered eCall was not disconnected when ignition is witched OFF
1.1.5.5	Verify that ongoing manually triggered eCall was not disconnected when ignition is witched OFF
1.1.5.6	Priority over conflicting communication
1.1.5.7	Network registration is re-tried when network registration attempt was not successful
1.1.6.1	Test for mute IVS audio including entertainment audio
1.1.7.1	Test for set-up TS12 call with eCall identifier (flag) set to “automatic”
1.1.8.1	Test for set-up TS12 call with eCall identifier (flag) set to “manual”
1.1.9.1	Test for set-up TS11 call to test number
1.1.10.1	Verify that an eCall is attempted when IVS is in mobile network coverage but no networks are available for registration
1.1.10.2	Re-dial attempt completed within 2 minutes after eCall is dropped
1.1.10.3	Test for duration of eCall initiation signal
1.1.10.4	Verify that PLMN registration procedure is executed upon initiating an eCall (eCall-only IVS)
1.1.11.1	Test for “Send MSD” with indicator set to “Automatically initiated eCall” (AIeC)
1.1.12.1	Test for “Send MSD” with indicator set to “Manually initiated eCall” (MIeC)
1.1.13.1	Test for “Send MSD” with indicator set to “Test”

	CEN/TC 278 / EN 16454:2015
1.1.14.1	Verify MSD transfer
1.1.14.2	Test for un-mute IVS audio when AL-ACK received
1.1.15.1	Test for establish voice link to PSAP operator
1.1.15.2	Verify MSD transfer while eCall conversation in progress
1.1.15.3	Verify that the IVS audio is un-muted if SEND MSD request was not received and timer T5 has expired
1.1.15.4	Verify MSD transfer upon T6 expiration
1.1.15.5	Verify that MSD is transferred continuously until T7 expires and IVS reconnects loudspeaker and microphone on its expiry
1.1.16.1	Test for Clear-down call automatically
1.1.16.2	Verify that IVS clears down the eCall upon T2 expiry
1.1.16.3	Verify that IVS registers recent eCalls, stores the fact of the AL-ACK receipt and its timestamp
1.1.17.1	Verify that the call-back is allowed by IVS
1.1.17.2	Verify that the call-back is answered automatically by IVS
1.1.17.3	Verify that MSD transfer occurs upon PSAP request during call-back
1.1.17.4	Test for IVS remains registered for a minimum of 1 hour
1.1.17.5	Test for IVS remains registered for a minimum of 1 hour and a maximum of 12 hours (eCall-only IVS)

C ERA-GLONASS IVS test list

Test methods for IVS are specified in the GOST standards [17],[23],[24],[25],[26],[27] and amendments.

C.1 IVS functional and data transfer protocols test methods

C.1.1 IVS tests in regard to functional requirements

Test methods	GOST R 55530-2013
6.1	Checking MSD transfer in automatic mode
6.1.1	Checking MSD transfer using in-band modem
6.1.2	Checking MSD transfer by SMS
6.2	Checking MSD transfer in manual mode
6.2.1	Checking MSD transfer using in-band modem
6.2.2	Checking MSD transfer by SMS
6.3	Checking that transferred MSD contains last known vehicle location as for detection time of RTA event
6.4	Checking that transferred MSD contains expected last known vehicle location as for detection time of RTA event
6.5	Checking that transferred MSD contains valid vehicle location data
6.6	Checking that transferred MSD contains valid vehicle movement direction data
6.7	Checking that loud voice communication is possible during emergency calls
6.8	Checking IVS status indicators (for IVS in auxiliary equipment configuration)
6.9	Checking IVS operation in Test mode
6.10	Checking IVS operation in “Service Station” mode (for IVS in auxiliary equipment configuration)
6.11	Checking IVS operation in “Software Downloading” mode (for IVS in auxiliary equipment configuration)
6.12	Checking UIM (for IVS in auxiliary equipment configuration)
6.13	Checking internal memory of IVS
6.14	Checking operation of IVS backup battery and power supply
6.15	Checking IVS registration in network
6.16	Checking electric power supply and power consumption requirements (for IVS in auxiliary equipment configuration)

C.1.2 IVS tests in regard to requirements of data exchange protocols

Test methods	GOST R 55530-2013
6.17	Checking transfer of SMS command for setting SMS transmission number when SMS is used as a redundant data channel
6.18	Checking transfer of SMS command for setting emergency call number used in tests
6.19	Checking transfer of MSD in manual activation mode using in-band modem
6.20	Checking transfer of MSD in manual activation mode using SMS
6.21	Checking transfer of SMS command for initiation of test emergency call
6.22	Checking transfer of MSD with test call attributes using in-band modem
6.23	Checking transfer of MSD with test call attributes using SMS
6.24	Checking transfer of SMS command for repeated MSD transfer in regard to RTA event recorded earlier
6.25	Checking packet transmission of firmware data specific to a given IVS type (for IVS in auxiliary equipment configuration)
6.26	Checking that emergency call button is protected from accidental pressing
6.27	Checking that backlighting of emergency call button is available

C.2 IVS tests for compliance with established requirements

The IVS tests are for compliance with established requirements for electromagnetic compatibility and resistance to climatic and mechanical loads.

C.2.1 IVS tests for compliance with established electromagnetic compatibility requirements

Test methods	GOST R 55518-2013
5.2.1	OD completeness check
5.2.2	IVS completeness check
5.2.3	IVS workability check under rated power-supply voltage
5.2.4	IVS workability check under changes of power-supply voltage
5.2.5	IVS workability check under power-supply voltage of reverse polarity
5.2.6	Check of protection of the IVS external electric circuits from their short circuit to the poles of the source of power-supply
5.2.7	Check of the IVS workability under conductive noise in power circuits
5.2.8	Check of the degree of the IVS noise emission into the onboard network
5.2.9	Check of the IVS workability under the noise generated in control (alarm) circuits
5.2.10	Check of the IVS workability under the noise generated by electrostatic discharges
5.2.11	Check of compliance with requirements for radio-noise voltage generated on the connectors of the IVS power-supply sockets
5.2.12	Check of compliance with requirements for intensity of the electromagnetic field generated by the IVS
5.2.13	Check of the IVS workability under electromagnetic radiation in the frequency range from 20 to 2000 MHz

C.2.2 IVS tests for compliance with established resistance to climatic loads requirements

Test methods	GOST R 55518-2013
6.2.1	IVS marking check
6.2.2	Test for resistance to low ambient temperature
6.2.3	Test for resistance to high ambient temperature
6.2.4	Test for resistance to ambient temperature change
6.2.5	Test under high humidity and high temperature using a constant test mode
6.2.6	Test for resistance to dust providing evaluation of the IVS protection degree in compliance with GOST 14254
6.2.7	Water-resistance test providing evaluation of the IVS protection degree in compliance with GOST 14254

C.2.3 IVS tests for compliance with established mechanical load resistance requirements

Test methods	GOST R 55518-2013
7.2.1	IVS marking check
7.2.2	Check of IVS workability under sinusoidal vibration
7.2.3	Check of IVS resistance to sinusoidal vibration
7.2.4	Check of IVS workability under multiple mechanical shocks
7.2.5	Check of IVS resistance to multiple mechanical shocks
7.2.6	Check of IVS workability under single mechanical shocks (acceleration is 75g) (for auxiliary equipment configuration only)
7.2.7	Check of IVS resistance to mechanical shocks during transportation
7.2.8	Check of IVS resistance to overloads in front collision of vehicle

C.3 IVS tests for conformity to quality requirements for in-vehicle loudspeaker communication

Test methods	GOST R 55531-2013
7.1	Signal processing delay in IVS
7.2	Loudness rating
7.3	Frequency sensitivity response
7.4	IVS self-noise level
7.5	Suppression of out-of-band signals
7.6	Signal distortion in IVS
7.7	IVS performance in single-talk mode
7.8	Performance of voice direction switching
7.9	IVS performance in double-talk mode
7.10	Speech quality in receive and transmit channels
7.11	IVS performance in acoustic noise conditions
7.12	Background noise quality in transmit channel
7.13	Properties of electro-acoustic components
7.14	Subjective quality assessment of IVS loudspeaker communication

C.4 IVS tests for conformity to accident detection requirements

Test methods	GOST R 55532-2013
6.1	Checking delivery set completeness if in-vehicle emergency call system
6.2	Examining technical documentation for in-vehicle emergency call system
6.3	Verifying detection of true emergency events
6.4	Checking resistance of in-vehicle emergency call system to false actuations
6.5	Checking conformity of RTA severity calculation algorithm to established requirements
6.6	Checking automatic RTA event detection capabilities of in-vehicle emergency call system in field tests

C.5 IVS tests for wireless communication modules

C.5.1 IVS tests in regard to implementation of GSM modem functions

Test methods	GOST R 55533-2013
IVS-GSM electric parameters	
6.6.2	Level of spurious emissions
6.6.2.1	Level of spurious emissions at IVS-GSM antenna connector, in active mode
6.6.2.2	Level of spurious emissions at IVS-GSM antenna connector, in standby mode
6.6.2.3	Level of spurious emissions from IVS-GSM body without antenna connector, in activemode
6.6.2.4	Level of spurious emissions from IVS-GSM body without antenna connector, in standby mode
6.6.3	Parameters pertaining to frequency and phase in static RF channel, maximum output power, power control levels of transmitting device, synchronization of transmitted packets, and sensitivity of receiving device
6.6.4	Levels of IVS-GSM out-of-band emissions due to modulation
6.6.5	Levels of IVS-GSM out-of-band emissions due to transients during transmitter power switches
IVS-GSM functional parameters	
6.7.1	Availability of IMEI number

Test methods	GOST R 55533-2013
6.7.2	Performance of procedures for call receiving; establishing, maintaining and closing GSM-900 connections; ensuring stability of established GSM-900 connection in cases of channel switchover and transition to GSM-1800 sub-band
6.7.3	Performance of procedures for calling and call receiving; establishing, maintaining and closing GSM-1800 connections; ensuring stability of established GSM-1800 connection in cases of channel switchover and of transition to GSM-900 sub-band

C.5.2 IVS tests in regard to implementation of UMTS modem functions

Test methods	GOST R 55533-2013
IVS-UMTS electric parameters	
7.5.6	Maximum permitted power for different IVS-UMTS classes
7.5.7	Maximum permitted carrier frequency deviation of subscriber device transmitter from value set by base station or from rated carrier frequency value of frequency channel
7.5.8	Maximum permitted deviation of actual transmitter power from values determined by level of pilot-signal received from base station and by data received from it
7.5.9	Maximum permitted value power control parameters in case of inner loop power control
7.5.10	Minimum permitted value of output power set in IVS-UMTS using and inner loop control
7.5.11	Maximum permitted transmitter on/off delay upon reception of power control signals of quality below/above established threshold
7.5.12	Maximum permitted IVS-UMTS power radiated with transmitter turned off
7.5.13	Permitted temporal variations of radiated power during IVS-UMTS transmitter on/off switches
7.5.14	Permitted limits of radiated power attenuation in adjacent frequency channels
7.5.15	Permitted limits of spurious emission of IVS-UMTS
7.5.16	Maximum permitted value of error vector magnitude
7.5.17	Maximum permitted value of peak error in code region
7.5.18	Maximum permitted bit error rate (BER) at signal level of -117 dBm at receiver antenna input (reference level of receiver sensitivity)
7.5.19	Maximum transmitter power of auxiliary device built-in into IVS-UMTS
IVS-UMTS functional parameters	
7.6.2	Availability of road accident emergency services using IVS-UMTS with subscriber identity module/card (USIM/UICC)
7.6.3	Ensuring IVS-UMTS access to transport services of UMTS network

C.5.3 IVS tests in regard to implementation of in-band modem functions

Test methods	GOST R 55533-2013
8.6.2	Measuring MSD transmission time for AMR-FR and GSM-FR codecs
8.6.3	Measuring MSD transmission time for AMR-12.2 and FR codecs
8.6.4	Measuring MSD transmission time for GSM-HR codec
8.6.5	Measuring MSD transmission time for voice codecs in presence of white noise channel
8.6.6	Measuring MSD transmission time for various values of PCM signal gain
8.6.7	Checking absence of false emergency call detection due to signaling tones at receiver input of IVS-modem
8.6.8	Testing transmission/reception of PUSH messages from/to IVS-modem
8.6.9	Testing reception of HLACK messages

C.6 IVS tests for navigation modules

Test methods (clause number)	GOST R 55534-2013
5.1	Checking that navigation signals of standard precision in L1 band of GLONASS GNSS may be received and processed in order to determine vehicle coordinates and its velocity components
5.2	Checking that navigation signals of standard precision in L1 band of GPS GNSS may be received and processed in order to determine vehicle coordinates and its velocity components
5.3	Checking that navigation signals of standard precision in L1 band of GLONASS and GPS GNSS may be received and processed in order to determine vehicle coordinates and its velocity components
5.4	Checking that navigation parameters data may be output to external devices in NMEA-0813 format
5.5	Checking receiver autonomous integrity monitoring (RAIM) algorithm
5.6	Checking that navigation parameters
5.7	Estimating error in evaluation of plane view coordinates and altitude in autonomous mode
5.8	Estimating error in evaluation of plane view coordinates, altitude and velocity in dynamic mode
5.9	Checking minimum time interval of observation data updates
5.10	Checking time to restore tracking signals of working NSC constellation after tracking fault caused by blockage
5.11	Evaluating time of navigation fix in cold start
5.12	Evaluating sensitivity of GNSS navigation module in GNSS signal search (locking) mode and in GNSS signal hold (tracking) mode
5.13	Checking that data output rate may be changed in required range using GNSS_DATA_RATE setup parameter
5.14	Checking minimum elevation (cut-off angle) for navigation spacecrafts
5.15	Checking power-off time of navigation module (GNSS navigation receiver) after ignition is turned off
5.16	(no longer mandatory) Checking conformity to requirements of intended use under exposure to harmonic interference
5.17	(no longer mandatory) Checking that GNSS signals may be tracked under exposure to pulse interference

D eCall flag

The eCall Flag, or eCall discriminator, is defined by Table 10.5.135d/3GPP TS 24.008: Service Category information element, Emergency Service Category Value (octet 3).

The meaning of the Emergency Category Value is derived from the following settings (see 3GPP TS 22.101 [28] clause 10):

- Bit 1 Police
- Bit 2 Ambulance
- Bit 3 Fire Brigade
- Bit 4 Marine Guard
- Bit 5 Mountain Rescue
- Bit 6 manually initiated eCall
- Bit 7 automatically initiated eCall
- Bit 8 is spare and set to "0"

The mobile station may set one or more bits to "1".

If more than one bit is set to "1", routing to a combined Emergency center (e.g. ambulance and fire brigade in Japan) is required. If the MSC cannot match the received service category to any of the emergency centers, it shall route the call to an operator-defined default emergency center. If no bit is set to "1", the MSC shall route the emergency call to an operator-defined default emergency center. A mobile station initiating an eCall shall set either bit 6 or bit 7 to “1”. The network may use the information indicated in bit 6 and bit 7 to route the manually or automatically initiated eCall to an operator-defined emergency call center.

Related documents

[1] u-blox AT commands manual, UBX-13002752

[2] [InBM 3GPP a] 3GPP TS 26.267 V13.0.0 (2015-12) eCall Data Transfer; In-band modem solution; General description (Release 13)

[3] [InBM 3GPP b] 3GPP TS 26.268 V13.0.0 (2015-12) eCall Data Transfer; In-band modem solution; ANSI C reference code (Release 13)

[4] [InBM 3GPP c] 3GPP TS 26.269 V13.0.0 (2015-12) eCall Data Transfer; In-band modem solution; Conformance testing (Release 13)

[5] [eCall MSDa] EN 15722:2011 Intelligent transport system – eCall minimum set of data (MSD)

[6] [eCall MSDa] EN 15722:2013 Intelligent transport system – eCall minimum set of data (MSD)

[7] [eCall MSDb] EN 15722:2015 Intelligent transport system – eSafety - eCall minimum set of data (MSD)

[8] [eCall HLAPa] EN 16062:2011 Intelligent transport system – eSafety – eCall high-level application requirements (HLAP)

[9] [eCall HLAPb] EN 16062:2015 Intelligent transport system – ESafety – eCall high-level application requirements (HLAP) using GSM/UMTS circuit switched networks

[10] [eCall CONF] EN 16454:2015 Intelligent transport systems – ESafety – Ecall end to end conformance testing

[11] [eCall OPR] EN 16072:2015 Intelligent transport system – eSafety – Pan-European eCall operating requirements

[12] [eCall TSP] peEN 16102 Intelligent transport system – eSafety – Third party supporting eCall: Operating requirements

[13] 3GPP TS 51.010-1 Mobile Station (MS) conformance specification; Part 1: Conformance specification V9.6.0 (2011-06)

[14] 3GPP TS 24.008 V10.2.0 (2011-03) Mobile radio interface Layer 3 specification; Core network protocols; Stage 3

[15] 3GPP TS 31.102 V10.6.0 (2012-06) Characteristics of the Universal Subscriber Identity Module (USIM) application

[16] ETSI TS 127 007 V10.3.0 (2011-04) AT command set for User Equipment (UE) (3GPP TS 27.007 version 10.3.0 Release 10)

[17] GOST R 54618-2011 Global Navigation Satellite System. Road accident emergency response system. Compliance test methods of in-vehicle emergency call system/device for electromagnetic compatibility, environmental and mechanical resistance requirements

[18] Amendment No. 1 GOST R 54618-2011 Global Navigation Satellite System. Road accident emergency response system. Compliance test methods of in-vehicle emergency call system for electromagnetic compatibility, environmental and mechanical resistance requirements [2013]

[19] GOST R 54619-2011 Global Navigation Satellite System. ACCIDENT EMERGENCY RESPONSE SYSTEM. Protocols of data transmission from in-vehicle emergency call system/device to emergency response system infrastructure

[20] Amendment No. 1 GOST R 54619-2011 Global Navigation Satellite System. ROAD ACCIDENT EMERGENCY RESPONSE SYSTEM. Data exchange protocols of the in-vehicle emergency call system with the road accident emergency response system infrastructure [2013]

[21] GOST R 54620–2011 Global Navigation Satellite System. Road Accident Emergency Response System. In-Vehicle Emergency Call system/device. General technical requirements

[22] Amendment No. 1 GOST R 54620-2011 Global Navigation Satellite System. Road Accident Emergency Response System. In-Vehicle Emergency Call System. General Technical Requirements [2013]

[23] GOST R 55530-2013 Global Navigation Satellite System. Road Accident Emergency Response System. Functional test methods of in-vehicle emergency call systems and data transfer protocols

[24] GOST R 55531-2013 Global Navigation Satellite System. Road Accident Emergency Response System. Test methods for verification of in-vehicle emergency call system conformity to quality requirements for loudspeaker communication in vehicle cabin
[25] GOST R 55532-2013 Global Navigation Satellite System. Road Accident Emergency Response System. Test methods for evaluation of in-vehicle emergency call system conformity to accident detection requirements
[26] GOST R 55533-2013 Global Navigation Satellite System. Road Accident Emergency Response System. Test methods for wireless communication modules of in-vehicle emergency call system
[27] GOST R 55534-2013 Global Navigation Satellite System. Road Accident Emergency Response System. Test methods for navigation modules of in-vehicle emergency call systems
[28] 3GPP TS 22.101 version 8.7.0 (Release 8)

☞ For regular updates to u-blox documentation and to receive product change notifications, register on our homepage (www.u-blox.com).

Revision history

Revision	Date	Name	Comments
-	09-Dec-2010	lpah	Initial release
P1	15-Jul-2011	hgru	Added PSAP description integrated in m-center
1	30-Jan-2012	lpah	Extended to include LISA-U120-01 product
2	16-Jul-2012	vpah	Improve product applicability description
A	02-Jan-2013	hgru/vpah	Update to new eCall / m-center solution Extended the document applicability to SARA-G350 ECALL Last revision with docu number WLS-CS-11004
B	13-Sep-2013	vpah	Extended to include LEON-G100-ECALL product Update of examples of usage Replaced the document applicability from SARA-G350 ECALL to SARA-G350 Extended the document applicability to LISA-U2x0-02S versions
R07	20-Jan-2014	vpah/ldeo	Extended to “eCall Release 3”: AT+CECALL, UDCONF=90
R08	29-Jul-2014	lpah	Extended to include SARA-G340 / SARA-U270 series
R09	19-Jan-2017	vpah	Extended to include eCall release 4
R10	19-Jun-2020	mrod	Extended with references to eCall Release 5 and m-center eCall new features.

Contact

For complete contact information, visit us at www.u-blox.com.

u-blox Offices

North, Central and South America

u-blox America, Inc.

Phone: +1 703 483 3180
E-mail: info_us@u-blox.com

Regional Office West Coast:

Phone: +1 408 573 3640
E-mail: info_us@u-blox.com

Technical Support:

Phone: +1 703 483 3185
E-mail: support@u-blox.com

Headquarters
Europe, Middle East, Africa

u-blox AG

Phone: +41 44 722 74 44
E-mail: info@u-blox.com
Support: support@u-blox.com

Asia, Australia, Pacific

u-blox Singapore Pte. Ltd.

Phone: +65 6734 3811
E-mail: info_ap@u-blox.com
Support: support_ap@u-blox.com

Regional Office Australia:

Phone: +61 2 8448 2016
E-mail: info_anz@u-blox.com
Support: support_ap@u-blox.com

Regional Office China (Beijing):

Phone: +86 10 68 133 545
E-mail: info_cn@u-blox.com
Support: support_cn@u-blox.com

Regional Office China (Chongqing):

Phone: +86 23 6815 1588
E-mail: info_cn@u-blox.com
Support: support_cn@u-blox.com

Regional Office China (Shanghai):

Phone: +86 21 6090 4832
E-mail: info_cn@u-blox.com
Support: support_cn@u-blox.com

Regional Office China (Shenzhen):

Phone: +86 755 8627 1083
E-mail: info_cn@u-blox.com
Support: support_cn@u-blox.com

Regional Office India:

Phone: +91 80 405 092 00
E-mail: info_in@u-blox.com
Support: support_in@u-blox.com

Regional Office Japan (Osaka):

Phone: +81 6 6941 3660
E-mail: info_jp@u-blox.com
Support: support_jp@u-blox.com

Regional Office Japan (Tokyo):

Phone: +81 3 5775 3850
E-mail: info_jp@u-blox.com
Support: support_jp@u-blox.com

Regional Office Korea:

Phone: +82 2 542 0861
E-mail: info_kr@u-blox.com
Support: support_kr@u-blox.com

Regional Office Taiwan:

Phone: +886 2 2657 1090
E-mail: info_tw@u-blox.com
Support: support_tw@u-blox.com