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SIM7100 ECALL Application Note V0.01
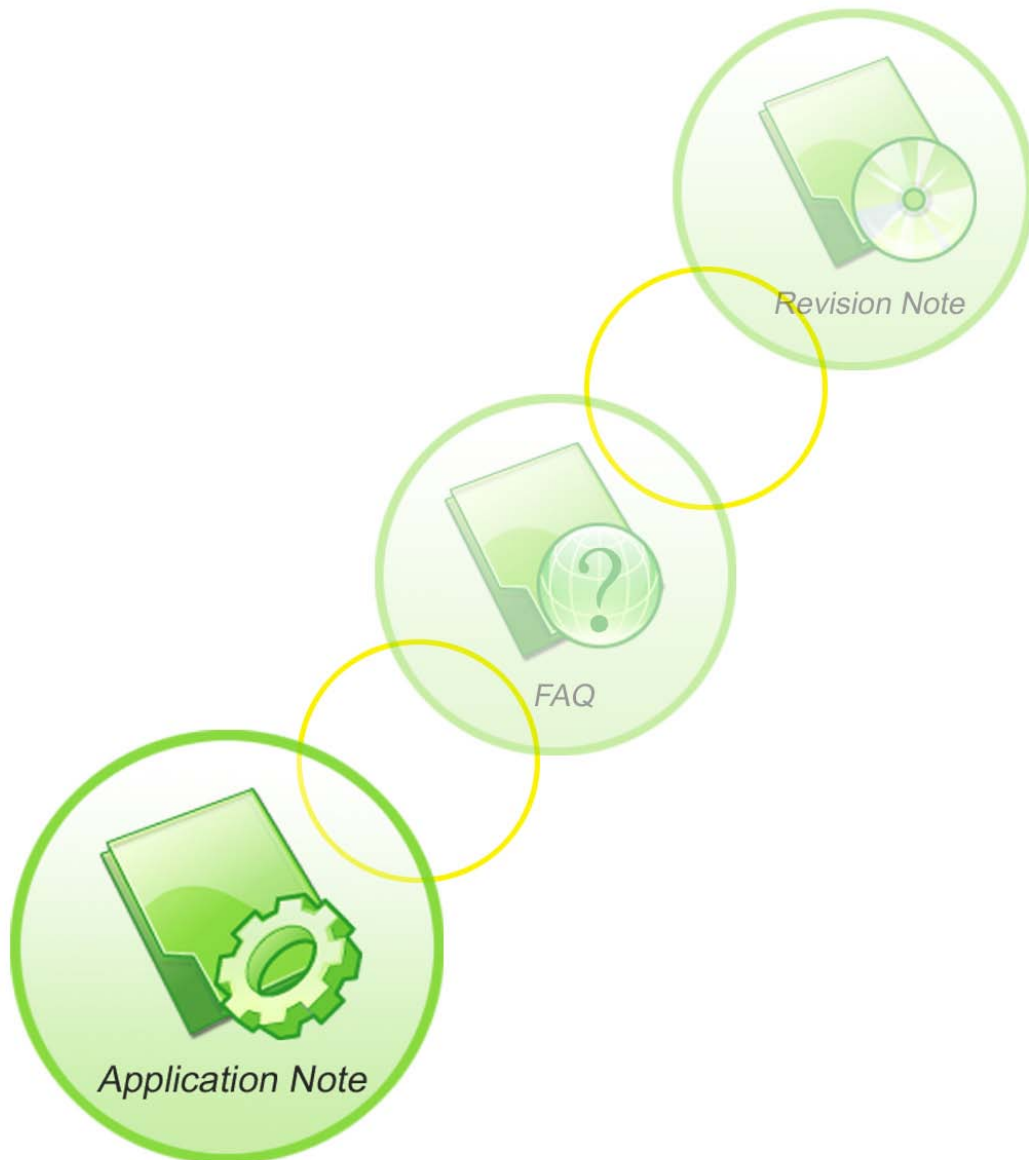
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Version History

Date	Version	Description of change	Author
2014-06-11	V0.01	New version	

Scope

This document presents the AT commands of ECALL operation and application examples. This document can apply to SIMCom 3G modules, including SIM7100 series modules.

1. Introduction

eCall refers to an interoperable in-vehicle emergency call service which is envisioned to be introduced and operated across Europe in 2010. The European Commission has brought together standardization bodies, the automotive industry, mobile telecommunication industry, public emergency authorities and others in the eSafety Forum initiative [1] which has identified high-level requirements, recommendations and guidelines for this eCall service [2].

The introduction and use of in-vehicle eCall for deployment of emergency assistance is expected to save many lives and reduce social burden by improving the notification of road accidents and speeding up emergency service response [3].

In the event of a collision, the intended solution can automatically or manually establish an emergency voice call (E112) via the cellular network to the local emergency agencies, i.e., the Public-Safety Answering Point (PSAP), as illustrated in Figure 1. Aside from enabling two-way speech communication between the motorist and the PSAP operator, eCall also allows transfer of a data message from the In-Vehicle System (IVS) over the cellular network to the PSAP which is denoted as eCall Minimum Set of Data (MSD). The MSD includes vehicle location information, time stamp, and number of passengers, Vehicle Identification Number (VIN), and other relevant information.

As part of the eSafety initiative, ETSI MSG and the 3rd Generation Partnership Project (3GPP) were requested to standardize the eCall service.

For eCall data transfer, an in-band modem solution has been identified as the most suitable technology that fulfills all eCall requirements [6]. With this solution the MSD is transmitted "in-band" over the voice channel. This supports quick deployment of an end-to-end eCall solution in both vehicles and PSAPs.

2. References

[1] eSafety Forum: http://www.esafetysupport.org/en/esafety_activities/esafety_forum

[2] eSafety Forum eCall Driving Group, "European Memorandum of Understanding for Realization of Interoperable In-Vehicle eCall", May 2004.

[3] eSafety Forum, "Clarification Paper – EG.2 , High level requirements for a eCall in-vehicle system, Supplier perspective", March 2006, Version 1.0.

[4] eSafety Forum, "Recommendations of the DG eCall for the introduction of the pan-European eCall ", April 2006, Version 2.0.

[5] 3GPP TS 22.101 V9.0.0 "Service aspects; Service principles".

[6] 3GPP TR 26.967 V8.0.1 "eCall Data Transfer; In-band modem solution".

3. Terms

ACK – Acknowledgement.

AL-ACK – Application Layer ACK.

ARQ – Automatic Repeat-reQuest. An error control mechanism for data transmission where the receiver requests retransmission of data that has not been correctly received.

BTS – Base Transceiver Station.

Call manager – A specific level to deal with call information in modem abstract structure.

Ecall Application – The third program to invoke the ecall interface.

Ecall modem task – A specific level to transmit and receive msd information in ecall modem abstract structure.

GPS/GLONASS /API – Global positioning system module interface.

HL-ACK – Higher Layer ACK.

IVS – The in-vehicle system which includes the eCall data modem, collision detectors, position location (e.g. GPS/GLONASS) function.

IVS data modem – The eCall data modem located in the IVS used to transmit the MSD information to the PSAP and receive feedback from the PSAP.

IVS/UE – The in-vehicle system as user equipment.

LL-ACK – Lower layer ACK.

MSD – Minimum Set of Data to be sent from the IVS to the PSAP. This includes the location information of the vehicle, direction of travel, number of passengers with fastened seat belts, vehicle information, and other information deemed relevant for the emergency service agencies.

MSDrv – Minimum Set of Data redundancy version.

MO – Mobile Originated.

MT – Mobile Terminated.

NACK – Negative Acknowledgement.

PLMN – Public Land Mobile Network.

PSAP – Public Safety Answering Point.

PSAP data modem – The eCall data modem located in the PSAP used to receive
MSD information from the IVS data transmitter and transmit feedback to the IVS.
PSTN/GSTN – Public Switched Telephone Network/General Switched Telephone Network.
RV – Redundancy Version.
SF – Synchronization Frame.
TRAU – Transcoder and Rate Adaptation Unit.

4. Overview

eCall is defined as a manually or automatically initiated emergency call from a vehicle. It is
supplemented with a minimum set of emergency related data (MSD), and compatible with the EU
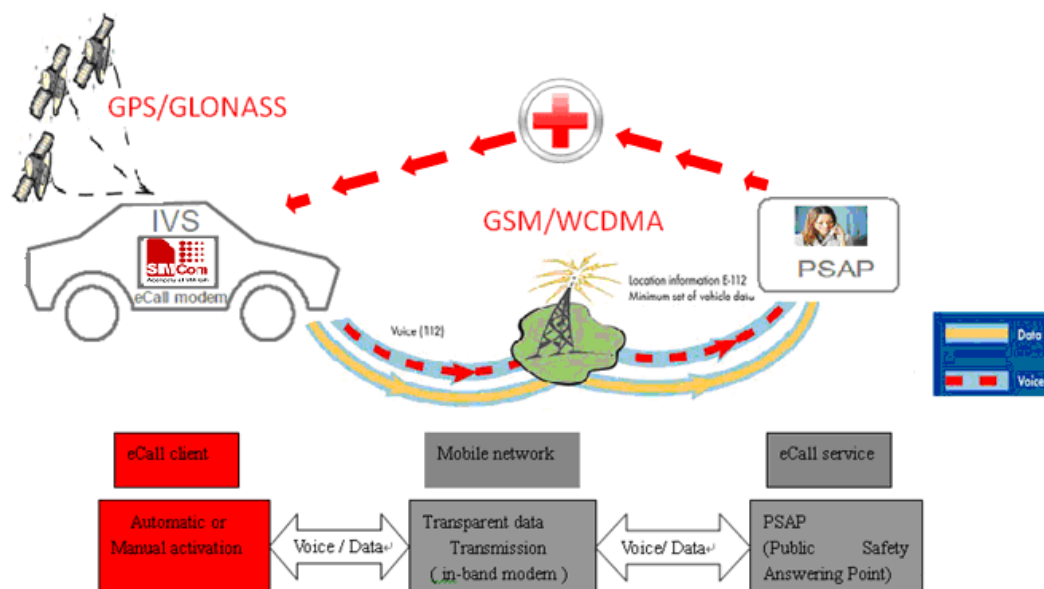Commission's eSafety initiative. eCall can be depicted by the figure below.


Figure 1: Overview of eCall System

The eCall System: Figure illustrates parts of the eCall system. When a collision is detected by the
IVS sensors in the vehicle, the IVS can be prompted by the user, or automatically, initiate an E112
emergency voice call. The emergency voice call is routed to the appropriate PSAP using the
existing emergency routing procedures for voice E112 calls.
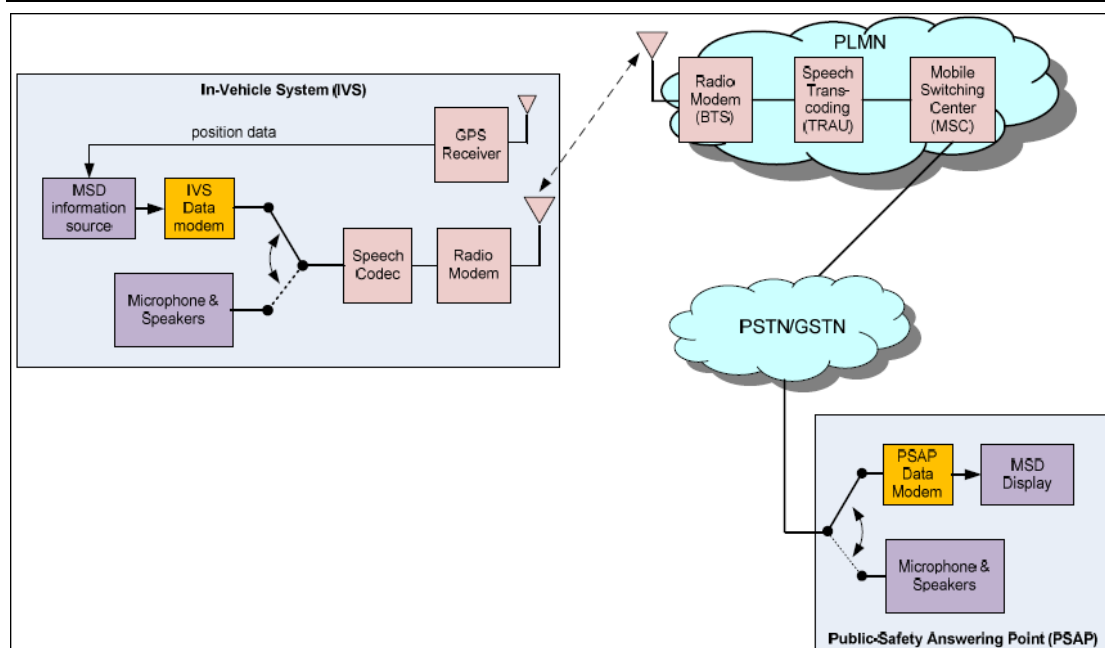
When triggered by a request from the PSAP operator through the PSAP modem, the in-band IVS data modem is used to transmit the relevant information (MSD) through the voice path established to the PSAP. Transmitting the MSD information through this voice path enables the system to use the E112 routing protocols deployed in existing networks.

The PSAP has a corresponding data modem to receive the transmission from the IVS and display the data to the PSAP operator.

The eCall system uses an in-band data modem to transmit the MSD information over the voice path to the PSAP. This approach enables the eCall solution to be quickly deployed end-to-end in vehicle IVS's and PSAPs without modifications to the existing cellular and wireline infrastructure.

5. Ecall flow

Sim7100 module supports both push mode and pull mode. Push mode is realized by a request from the IVS to the PSAP to push the MSD; pull mode is realized by PSAP actively requiring MSD from IVS.

The flow charts of these two modes are described as follows.

You can establish eCall by AT+CECALLS command. When eCall is established successfully, it will transmit MSD in push mode automatically. If MSD transmission is finished, you can do voice talk ; or PSAP can request MSD and then IVS transfers MSD in pull mode.

If PSAP terminates the eCall, the MT eCall on the IVS side will be valid in 12 hours. When MT eCall is coming, and the incoming call number is same as the MO call number you dialed last time IVS will answer the eCall automatically, and then IVS will transfer MSD in pull mode automatically.

5.1 eCall Flow Chart in Push Mode

For MO eCall on the IVS, when eCall is established successfully, it will automatically transmit MSD in push mode. If MSD transmission is finished, and the param of num_times_to_loop is n (*n !=0, num_times_to_loop is in PSAP side,it could be configured in ecall_psap_efs.txt file in psap side*), IVS will transmit n times MSD in push mode. The following figure shows the detailed procedure in push mode.

Figure 5-1 illustrates the call flow a mobile-originated eCall
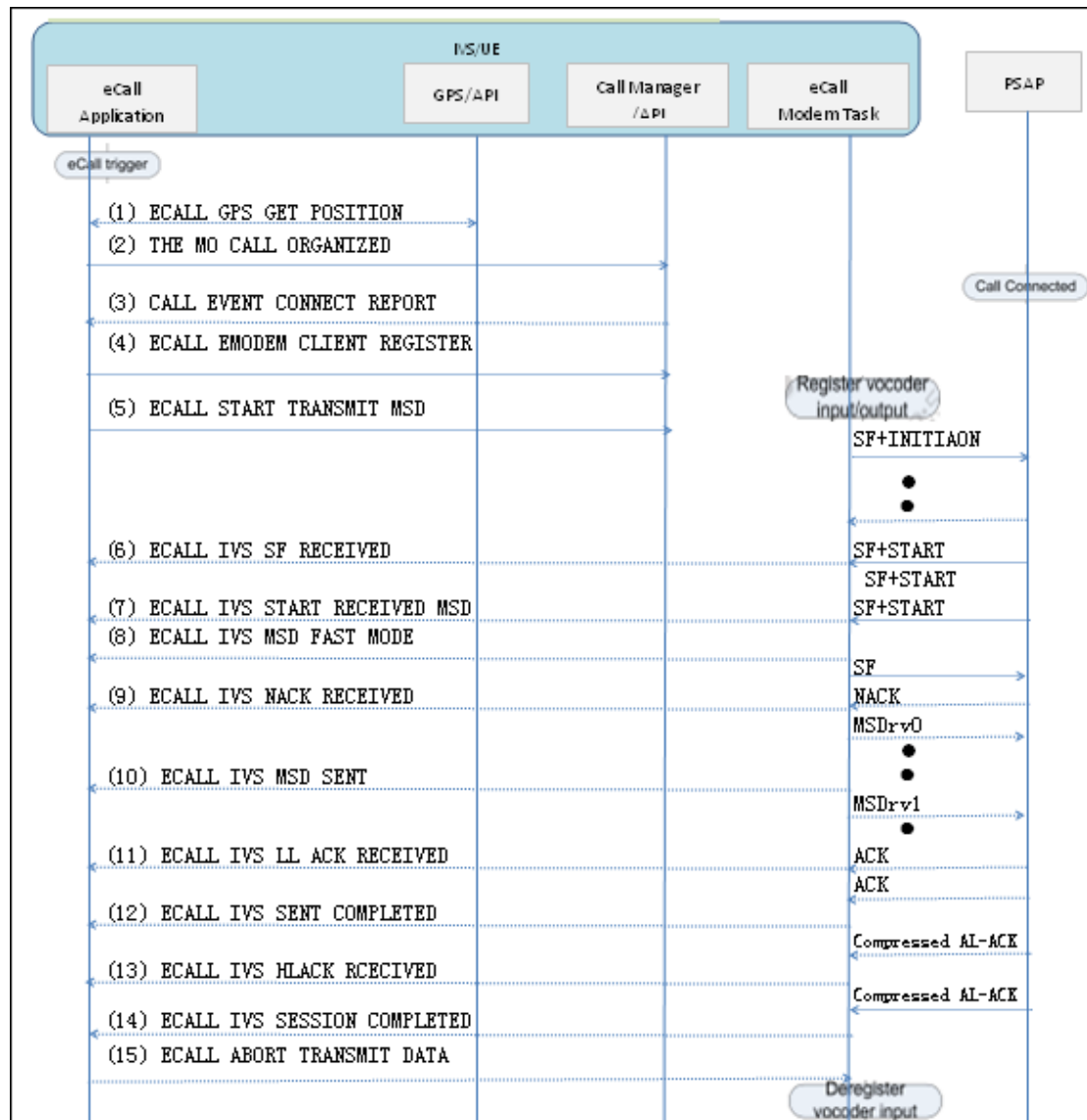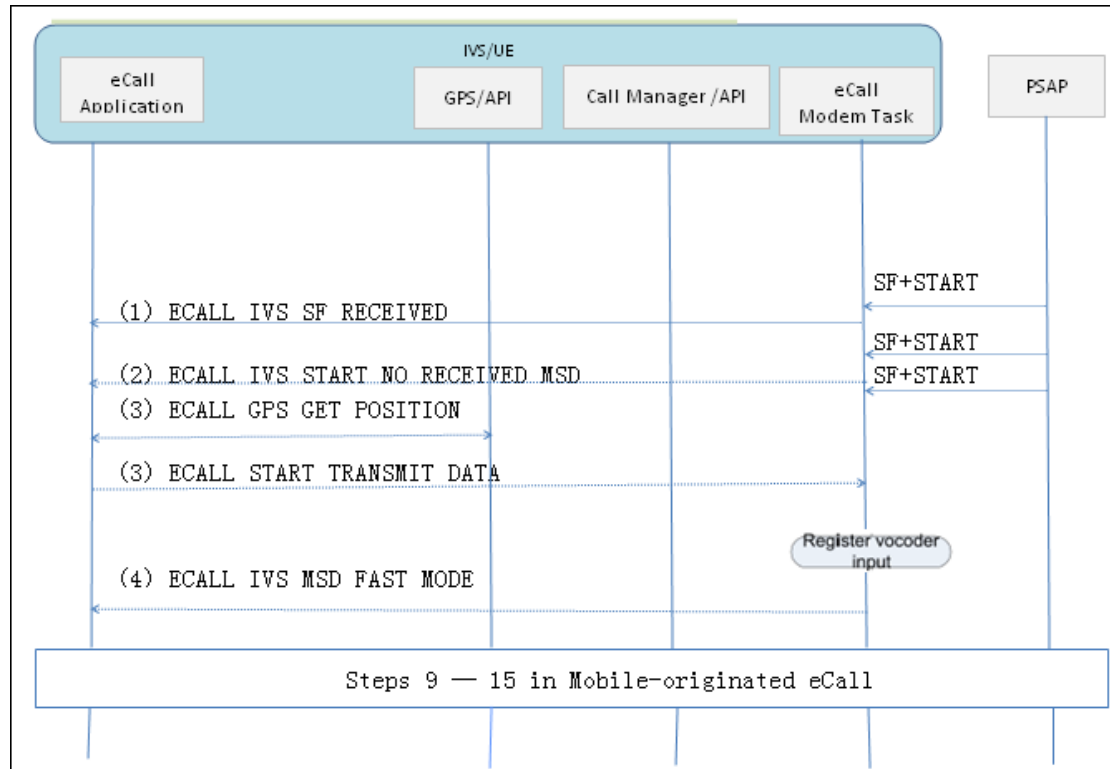

5.2 Additional Data Request

This call flow illustrates how the IVS receives an additional data request from the PSAP and transmits the MSD successfully.The flow need some preconditions.

Preconditions

. The call is still connected.

. IVS receive channel is still open.
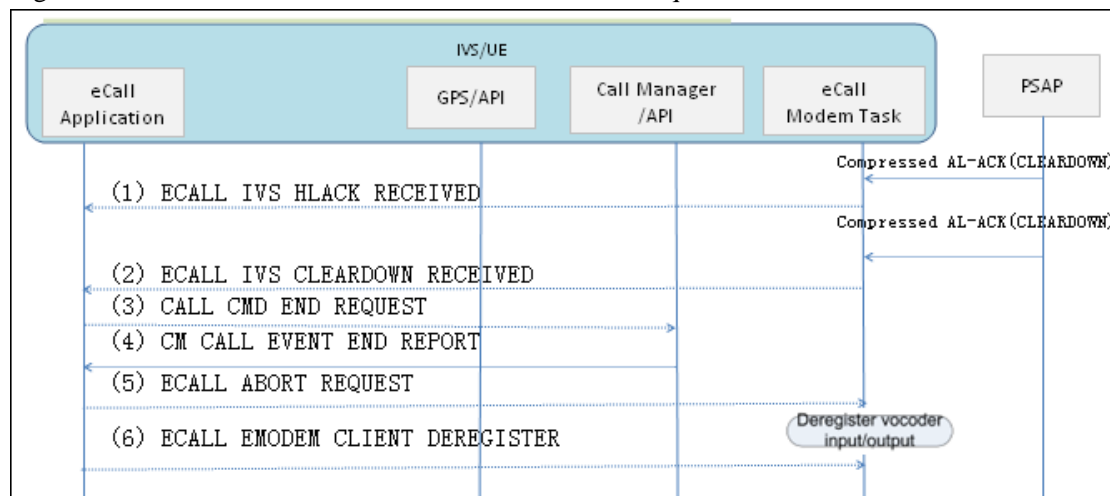
Figure 5-2 illustrates the call flow for an additional data request.

5.3 Call Release

This call flow illustrates how the IVS/UE receives notification from the Call Manager that a call has ended.It can be optionally triggered by an event that the eCall modem has received an AL-ACK message with cleardown status.
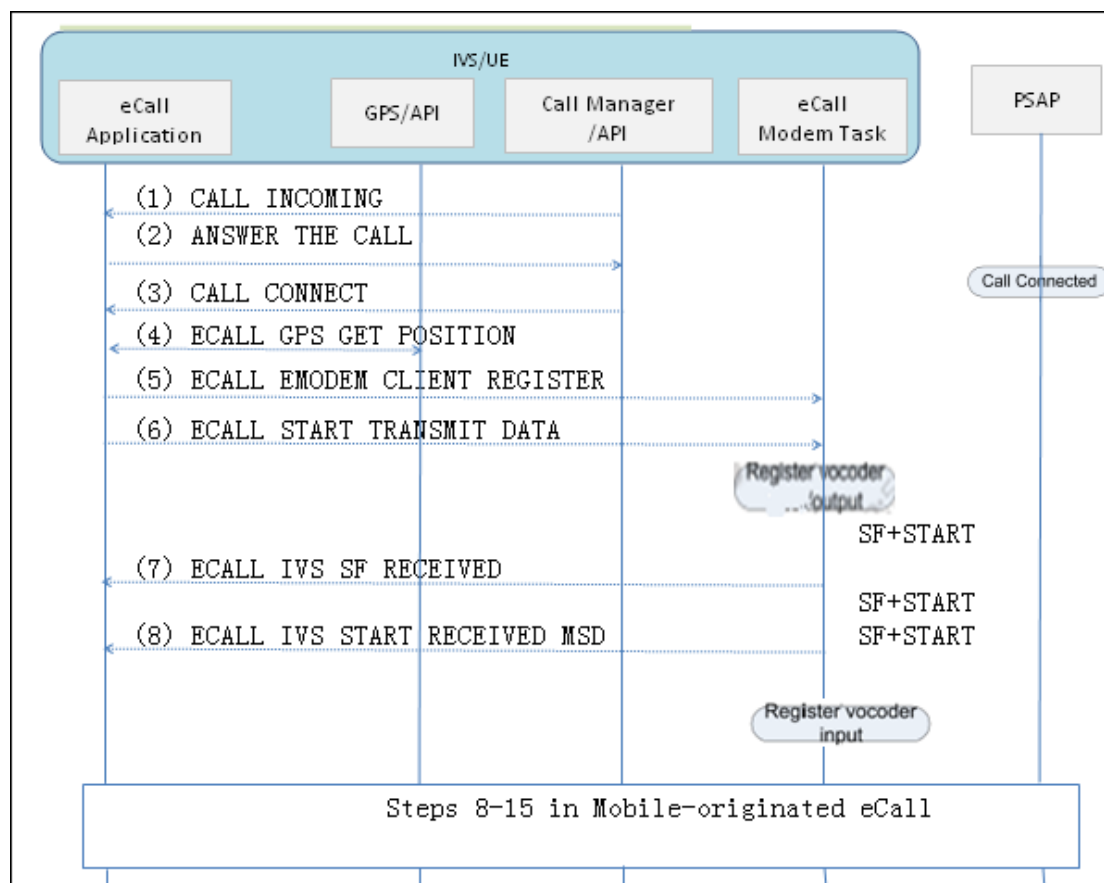
Figure 5-3 illustrates the call flow for an additional data request.

5.4 eCall Flow Chart in Pull Mode

When MT eCall on the IVS has been established, MSD can be transmitted in pull mode. The following figure shows the detailed procedure in pull mode.

Figure 5-4 illustrates the call flow for a mobile-terminated eCall.

6. SIM module eCall operate

6.1 eCall AT commands

AT+CECALLFMT: set MSD packing format (this command must set to 1 for Europe ecall test)

AT+CECALLCFG: Configure vehicle information

AT+CECALLPOS: Set longitude and latitude

AT+CECALLTIME: Set time stamp

AT+ CMSDMESSAGEID: Set the message identifier of msd data

AT+CMSDOIDDATA: Set the optional additional data

AT+CMSDCONTROL: Set the control data in Minimum set of data (MSD)

AT+CMSD: input hex Minimum set of data(MSD)

(The above settings will be saved in config file, do not need to set again.)

AT+CECALLTOUT: Set T5, T6, T7 timeout value
AT+CECALLS: Make an ecall and send the MSD information once automatically
AT+CECALLE: Hang up ecall

6.2 Description of URC

URCs of SIM7100 eCall AT commands will be reported to the host by the type of "**+ECALL:**". It contains failed eCall , Establish ECALL_MO_CALL successfully, Succeed to transmit MSD as well as Establish ECALL_MT_CALL successfully

Table 6.2-1 lists the timeout URC.

Table 6.2-1 Timeout URC

Name	URC	Description	Default
URC of Failed eCall:All URC are reported for timeout.(If you meet the URCS,you donot do anything,UE will automatically invoke some part)			
ECALL_GPS_FIX_TIMEOUT	"+ECALL:cannot get real GPS/GLONASS data in 80 seconds"	UE donot receive the GPS/GLONASS position in 80 seconds.It starts when the command of "AT+CECALLS" is executed.	80 sec
ECALL_GPS_FIX_IN_CALLTIMEOUT	"+ECALL:cannot get real GPS/GLONASS data during a call in 10 seconds"	UE donot receive the GPS/GLONASS position during the call in 10 seconds.It starts when the call dialed from PSAP is connected,or It starts when UE receive a restart message from PSAP.	10 sec
ECALL_SESSION_TIMEOUT	"+ECALL:ECELL_APP_SESSION_TIMER EXPIRE"	Aborts the MSD transmission.It starts when the eCall modem begins to transmit and stops when the MSD is successfully transmitted (at least two LL-ACKs received)	20 sec
ECALL_START_TIMEOUT	"+ECALL:ECALL_APP_START_TIMER EXPIRE"	Awaits start signal.It starts when the eCall application passes the MSD to the eCallmodem and stops when three valid,consecutive SF and Start messages are received.	2 sec
ECALL_CALLBACK_TIMEOUT	"+ECALL:ECALL_APP_CALLBACK_TIMER EXPIRE"	UE will auto-answer any MT calls before this timer expires.	12 hr
ECALL_AL_ACK_TIMEOUT	"+ECALL:ECALL_APP_AL_ACK_TIMER EXPIRE"	UE donot receive two AL-ACKs in 10 seconds after two LL-ACK are received	10 sec
ECALL_CALL_CLEARDOWN_TIMEOUT	"+ECALL:ECALL_APP_CALL_CLEARDOWN_TIMER EXPIRE "	If the call still connects,UE will end the call autonomously after 1 hour.	1 hr
TCALL_RETRY_TIMER	"+ECALL:ECALL_APP_RETRY_TIMER EXPIRE"	Determines time before the redial,due to call drop.	5 sec-3min

Table 6.2-2 lists other failed URC

Table 6.2-2 other URC

URC	Description	option
URC of Failed eCall:Other URC		
"+ECALL:Read canned msd from config file failed!"	UE will report the message if there is not the file called "ecall_app_efs_input_msd.txt" in IVS when IVS transmit a canned msd.	you need to execute AT+CECALLCFG, AT+CECALLPOS, AT+CECALLTIME to construct the config file If you want to send a canned msd info.

Table 6.2-3 lists successful URC

Table 6.2-3 successful URC

URC of eCall successful information	
URC	Description
"+ECALL: Establish ECALL_MO_CALL successfully"	After executing AT+CECALLS command, and PSAP answer the call, UE will report the message.
"+ECALL: Succeed to transmit MSD"	MSD is transmitted successfully to PSAP in push or pull mode .
"+ECALL: Establish ECALL_MT_CALL successfully"	PSAP execute ATD command during valid time, IVS will answer the call automatically. UE will report the message.

6.3 MSD configure

At present, the MSD include the follow information: Vehicle type, Propulsion storage, Number of passenger, Vehicle id number, Longitude and Latitude of current position.

Vehicle type:
1 — Passenger vehicle class M1
2 — Buses and coaches class M2
3 — Buses and coaches class M3
4 — Light commercial vehicles class N1
5 — Heavy duty vehicles class N2
6 — Heavy duty vehicles class N3
7 — Motorcycles class L1e
8 — Motorcycles class L2e
9 — Motorcycles class L3e
10 — Motorcycles class L4e
11 — Motorcycles class L5e
12 — Motorcycles class L6e
13 — Motorcycles class L7e

Propulsion storage:
1 — Hydrogen storage
2 — Electric energy storage
4 — Liquid propane gas
8 — Compressed natural gas
16 — Diesel tank present
32 — Gas online tank present

Number of passenger:
Refer to actual environment

Vehicle id number:
Refer to actual environment

Longitude and Latitude of current position:
Use canned GPS/GLONASS information or use real GPS/GLONASS information.

6.4 Do the eCall test with the msd data generated by module in push mode

For MO eCall, when eCall is established, MSD will be transferred automatically in push mode.

If test the eCall function, it should test in a test call or an emergency call.

Step1: Set MSD packing format

　　AT+CECALLFMT=1

　　Follow the Europe standard prEN_15722, this command must set for Europe ecall test before ecall connecting

Step2: Configure vehicle information

　　AT+CECALLCFG=5,18,8,"WMJVDSVDSYA123456",14,10,-10,20,-2

Step3: Set longitude and latitude

　　AT+CECALLPOS="121.354138","31.221938"

　Use the real GPS/GLONASS information, the position information can be set any value.

Step4: Set time stamp

　　AT+CECALLTIME=1,2011,10,20,15,30,30

Step5: Set the control data in Minimum set of data (MSD)

　　AT+CMSDCONTROL=1,1,1

Step6: Set the initiatory message identifier of msd

　　AT+CMSDMESSAGEID =1

Step7: Set T5, T6, T7 timeout value

　　AT+CECALLTOUT="T5",4000

Step8: Set the optional additional data

　　AT+CMSDOIDDATA="1.2.125","30304646"

Setp9: Make an eCall.

　　Real GPS/GLONASS: AT+CECALLS=112,0

　　Canned GPS/GLONASS: AT+CECALLS=112,1

　　Use the real GPS/GLONASS information, the module will fix position first, then make a call to target number. The GPS/GLONASS information can be monitored by NMEA port.

　　Use the canned GPS/GLONASS information, the module will make a call to target at once.

Setp10: Hang up eCall.

　　AT+CECALLE

(Step6-Step8 are not necessary.)

Demo for a test call in push mode:

AT+CECALLFMT=1

OK

AT+CECALLCFG=5,18,8,"WMJVDSVDSYA012345",14,10,-10,20,-20

OK

AT+CECALLPOS="121.354138","31.221938"

OK

AT+CECALLTIME=1,2011,10,20,15,30,30

OK

AT+CMSDCONTROL=1,1,1

OK

AT+CMSDMESSAGEID=1

OK

AT+CECALLTOUT="T5",4000

OK

AT+CMSDOIDDATA="1.2.125","30304646"

OK

AT+CECALLS=1860169XXXX,0
OK

+ECALL:Establish ECALL_MO_CALL successfully

VOICE CALL: BEGIN

+ECALL:Succeed to transmit MSD
at+cecalle

OK

VOICE CALL: END: 000032

6.5 Do the eCall test in pull mode

When eCall has established and PSAP terminates the eCall, MT eCall will be valid in 12 hours. For MT eCall, when eCall is established, MSD can be transferred in pull mode. If +ECALL:Succeed to transmit MSD is reported, it indicates MSD has been transmitted in pull mode. The following example shows the transmission in pull mode:
RING

+ECALL:Establish ECALL_MT_CALL successfully

VOICE CALL: BEGIN

+ECALL:Succeed to transmit MSD

VOICE CALL: END: 000024

6.6 Do the eCall test with the hex msd data generated by user

In this example, module sends the msd data generated by user. Module will not care about the original msd data.

AT+CMSD="015C068150820442001426400 0420D101404E80DA4C89A3B2F09905B6440E829F6829EC02030 1027D04303046460"

AT+CECALLS=1860169XXXX,0

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