EC25&EC21 eCall

Application Note

LTE Module Series

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About the Document

History

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1 Introduction

This document mainly introduces how to use the eCall function of Quectel EC25&EC21 modules. For details about the mechanism of eCall service, please refer to *3GPP TS 26.267*.

1.1. eCall Overview

eCall is defined as a manually or automatically initiated emergency call from an In-Vehicle System (IVS), supplemented with a Minimum Set of (emergency related) Data (MSD), as defined under the EU Commission's eSafety initiative.

It can be depicted by the figure below.

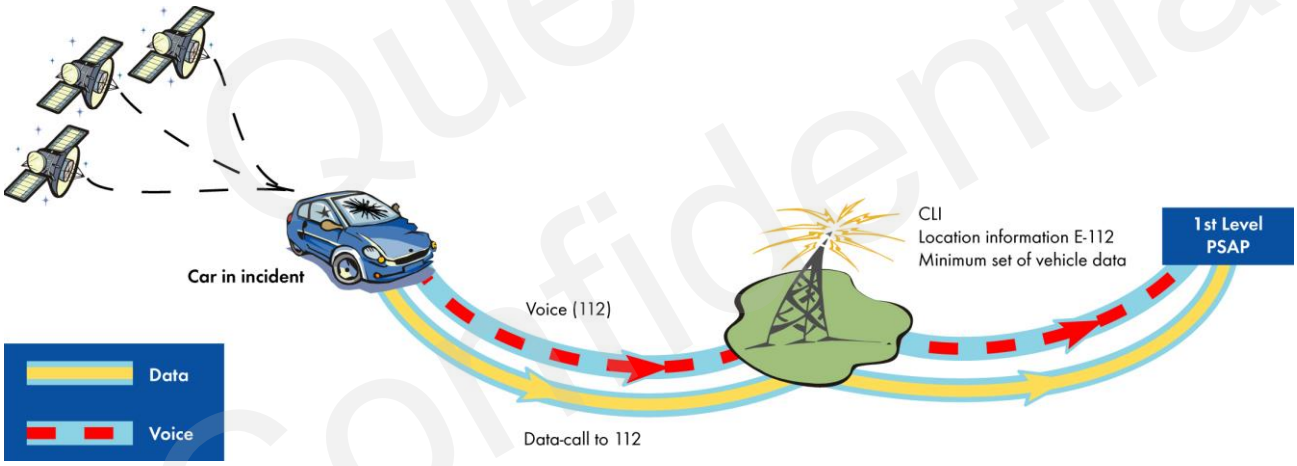

Figure 1: eCall System Overview

The architecture of eCall system is described in the figure below. In Quectel test system, the module has the ability to act as an IVS and also to simulate the Public Safety Answering Point (PSAP). Thus, eCall testing can be easily performed by preparing two Quectel modules in the circumstance without accessing to a real PSAP. The testing examples are available in ***Chapter 3***. Of course, if a real PSAP can be accessed, testing in the real environment is preferred.

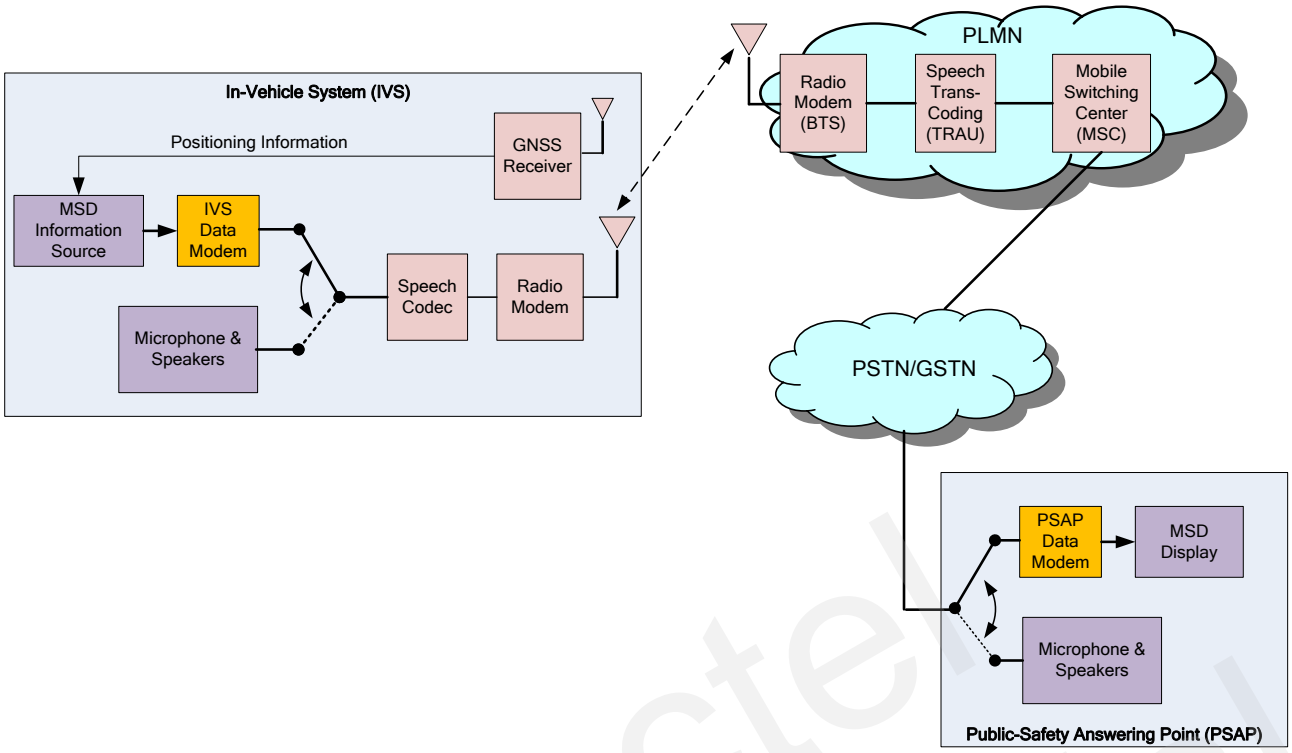

Figure 2: eCall System Architecture

1.2. eCall Operation Modes and Procedures

After an emergency voice call has been (automatically or manually) established, the IVS modem receiver constantly monitors the incoming signal from the speech decoder output. When prompted by a request from the PSAP operator for MSD, the IVS connects the IVS data modem transmitter to the input of the speech coder and mutes any speech from the motorist for the duration of MSD transmission to prevent it from interfering with the eCall data transmission. Alternatively, it can be the IVS that may trigger the MSD transmission. In this case, the IVS asks the PSAP to request an MSD transmission.

The first operation mode shall be referred to as the ***pull*** mode whereas the latter one is the ***push*** mode. Essentially, push mode is realized by a request from the IVS to the PSAP to pull the MSD.

The following figures show the detailed procedure of each mode.

1.2.1. Push Mode

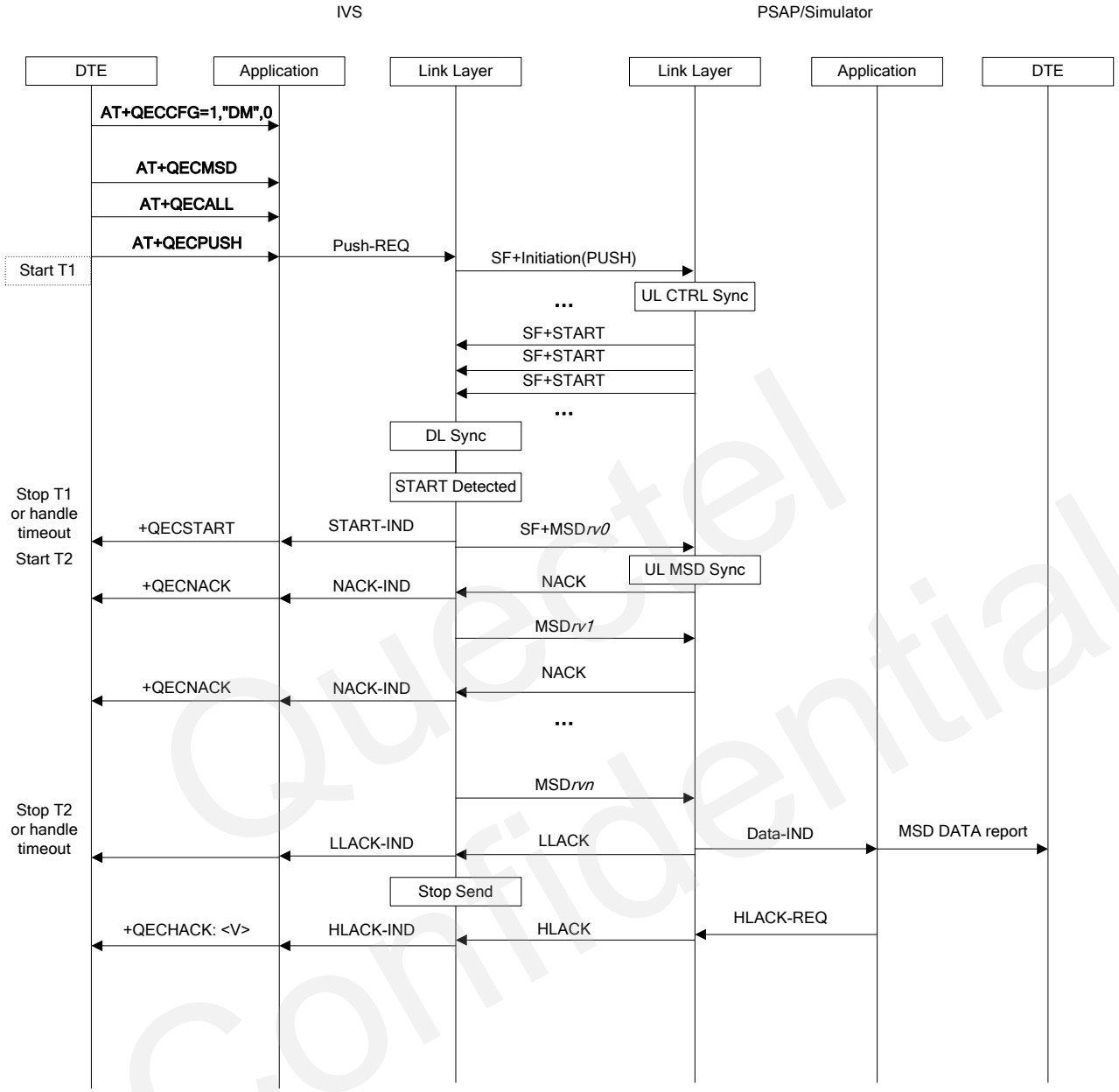

Figure 3: Push Mode Operation Flowchart

1. In push mode the PSAP Rx starts monitoring the incoming signal immediately after the call has been established.
2. IVS Tx continues to send the push message (SF+INITIATION). In the PSAP side, if two correct synchronization preambles (CONTROL_SYNC) have been detected and a subsequent push message has been identified, PSAP thinks it detected the push message.
3. Then PSAP triggers to START state, resets its Rx, and sends the “SF+START” message continuously until it detected synchronization frames (MSD_SYNC). IVS will detect the synchronization and lock the synchronization state after receiving two successful synchronizations,

and “+QECSTART” will be reported to port. After detection of “START” message, fast modulation mode is chosen, and IVS triggers the MSD SEND state.

4. Upon detection of the “START” message, the IVS starts the transmission of the first MSD message with incremental redundancy version *rv0* which is preceded by a synchronization frame.
5. The PSAP Rx will demodulate the MSD and send “NACK” if CRC check failed or send “ACK” if CRC check passed.
6. If the MSD of one revision is not received correctly, IVS will receive “NACK”, and send next redundancy revision of the same MSD until it receives “LLACK” or “HLACK”.
7. If “HLACK” is received, “+QECHACK: <code>” will be reported and <code> represents the HLACK data.

For the error handling flow, please refer to *3GPP TS 26.267*.

The timeout mechanism in the flowchart above is not implemented in modem. It should be implemented by customers.

1.2.2. Pull Mode

The pull mode is mostly the same with push mode, but only the MSD send is triggered by PSAP. The operation procedure is demonstrated in the figure below.

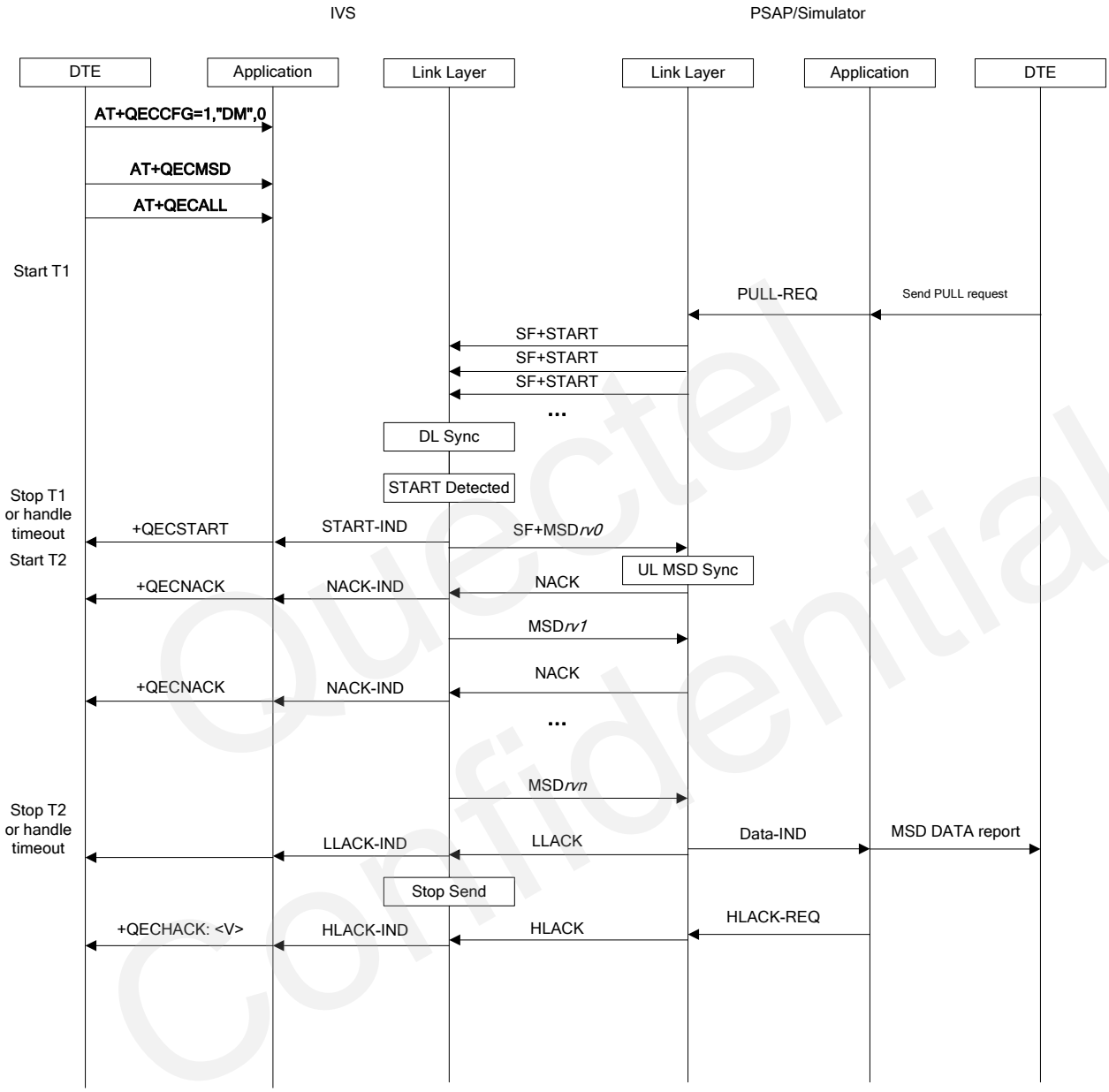

Figure 4: Pull Mode Operation Flowchart

2 Description of eCall AT Commands

2.1. Description of AT Commands

2.1.1. AT+QECCFG Configure Parameters of eCall

The command is used to configure eCall parameters. These parameters will be automatically saved into NV memory, except <T5>, <T6> and <T7>.

If <voiceconfig> is set to 1, EC25/EC21 module will mute IVS speaker automatically in MSD transmission, so voice and noise will not be heard. When MSD transmission is finished, the module will unmute IVS speaker.

There are three eCall modes: eCall only mode, eCall normal mode and eCall default mode. In general, there is no need to change the eCall mode, for it is configured via (U)SIM card by default.

AT+QECCFG Configure Parameters of eCall	
Test Command **AT+QECCFG=?**	Response **+QECCFG: "voiceconfig",(0,1)** **+QECCFG: "ecallmode",(0-2)** **+QECCFG: "processinfo",(0,1)** **+QECCFG: "T5",(2-255)** **+QECCFG: "T6",(5-255)** **+QECCFG: "T7",(20-255)** **+QECCFG: "mofailredial",(0-10)** **+QECCFG: "dropredial",(0-2)** **OK**
Read Command **AT+QECCFG?**	Response **+QECCFG: "voiceconfig",<voiceconfig>** **+QECCFG: "ecallmode",<ecallmode>** **+QECCFG: "processinfo",<processinfo>** **+QECCFG: "T5",<timeoutvalue>** **+QECCFG: "T6",<timeoutvalue>** **+QECCFG: "T7",<timeoutvalue>** **+QECCFG: "mofailredial",<mofailredial>** **+QECCFG: "dropredial",<dropredial>**

	OK
Write Command Mute IVS speaker in MSD transmission: **AT+QECCFG="voiceconfig"[,<voiceconfig>]**	Response If <voiceconfig> is null: **+QECCFG: "voiceconfig",<voiceconfig>** **OK** If <voiceconfig> is set: **OK** If there is an error related to ME functionality: **+CME ERROR: <err>**
Write Command Set the eCall mode: **AT+QECCFG="ecallmode"[,<ecallmode>]**	Response If <ecallmode> is null: **+QECCFG: "ecallmode",<ecallmode>** **OK** If <ecallmode> is set: **OK** If there is an error related to ME functionality: **+CME ERROR: <err>**
Write Command Enable to report URC of eCall process information: **AT+QECCFG="processinfo"[,<processInfo>]**	Response If <processinfo> is null: **+QECCFG: "processinfo",<processinfo>** **OK** If <processinfo> is set: **OK** If there is an error related to ME functionality: **+CME ERROR: <err>**
Write Command Set T5 timeout value: **AT+QECCFG="T5"[,<timeoutvalue>]**	Response If <timeoutvalue> is null: **+QECCFG: "T5",<timeoutvalue>** **OK** If <timeoutvalue> is set: **OK**

	If there is an error related to ME functionality: **+CME ERROR: <err>**
Write Command Set T6 timeout value: **AT+QECCFG="T6"[,<timeoutvalue>]**	Response If <timeoutvalue> is null: **+QECCFG: "T6",<timeoutvalue>** **OK** If <timeoutvalue> is set: **OK** If there is an error related to ME functionality: **+CME ERROR: <err>**
Write Command Set T7 timeout value: **AT+QECCFG="T7"[,<timeoutvalue>]**	Response If <timeoutvalue> is null: **+QECCFG: "T7",<timeoutvalue>** **OK** If <timeoutvalue> is set: **OK** If there is an error related to ME functionality: **+CME ERROR: <err>**
Write Command Set MO fail redial: **AT+QECCFG="mofailredial",<mofailredial>**	Response If <mofailredial> is null: **+QECCFG: "mofailredial",<mofailredial>** **OK** If <mofailredial> is set: **OK** If there is an error related to ME functionality: **+CME ERROR: <err>**
Write Command Set drop redial: **AT+QECCFG="dropredial",<dropredial>**	Response If <dropredial> is null: **+QECCFG: "dropredial",<dropredial>** **OK** If <dropredial> is set: **OK**

	If there is an error related to ME functionality: **+CME ERROR: <err>**

Parameter

<voiceconfig>	A numeric parameter. Enable or disable to mute IVS speaker in MSD transmission. The configured value will be saved to NV automatically. 0 Disable to mute IVS speaker automatically in MSD transmission 1 Enable to mute IVS speaker automatically in MSD transmission
<ecallmode>	A numeric parameter. The eCall mode. The configured value will be saved to NV automatically. 0 eCall normal mode. In this mode, the module will register on network. 1 eCall only mode. GPRS attach procedure. An eCall only mobile station shall not perform a normal or combined GPRS attach procedure (*3GPP 24008 4.7.3*). 2 eCall default mode. In this mode, whether or not to register on the network is determined by (U)SIM card.
<processinfo>	A numeric parameter. Enable or disable to report the URC of eCall process information. The configured value will be saved to NV automatically. 0 Disable to report URC of eCall process information 1 Enable to report URC of eCall process information
<T5>	The timer of IVS waiting for “START”. The default timeout value is 2 seconds. The timeout value will not be saved to NV. Customers should set the timeout value before organizing the eCall. For further information about this timer, please refer to *EN 16062*.
<T6>	The timer of IVS waiting for “HACK”. The default timeout value is 5 seconds. The timeout value will not be saved to NV. Customers should set the timeout value before organizing the eCall. For further information about this timer, please refer to *EN 16062*.
<T7>	The timer for MSD transmission. The default timeout value is 20 seconds. The timeout value will not be saved to NV. Customers should set the timeout value before organizing the eCall. For further information about this timer, please refer to *EN 16062*.
<timeoutvalue>	A numeric parameter. The timeout value. Unit: second.
<mofailredial>	Set the dial fail redial times.
<dropredial>	Set the eCall abnormal disconnect redial times.

Example

```
AT+QECCFG="ecallmode",1          //Set eCall only mode
OK
AT+QECCFG="ecallmode"            //Query the settings of current eCall mode
+QECCFG: "ecallmode",1

OK
AT+QECCFG=“processinfo”,1        //Enable to report URC of eCall process information
OK
AT+QECCFG="processinfo"          //Query whether the URC of eCall process information can be
```

reported

+QECCFG: "processinfo",1

OK

2.1.2. AT+QECMSD Set the Whole MSD Data

The command is used to set the MSD in hex bytes. The max length of <msd_data> is 280 hex characters, which represents 140 bytes of MSD. Spaces in <msd_data> will be skipped; and characters out of the range of '0'~'f' will be regarded as '0'. For more information about MSD structure, please refer to *CEN EN 15722*. Meanwhile, before establishing eCall, this command must be executed to set the MSD.

AT+QECMSD Set the Whole MSD Data	
Test Command **AT+QECMSD=?**	Response **OK**
Write Command **AT+QECMSD=<MSD_data>**	Response **OK**

Parameter

<MSD_data>	MSD data. Should be hex bytes written in string format. Please refer to the example below for details.

Example

```
//Set the 140 bytes of MSD
AT+QECMSD="c5e165df6a789b4aaaa46ee4a651820daaf625803735d9dfd5c7067927d821a43d4b64b74cd2116dc582aabc6f4e45cdf9cbe2f74eb1aaf69cb4ef86cde48f86e02147d6c49ea22587144bbfdaa8ef92c04afeb0c4e93ba93453561e65acd5065bbe12abde11819d86434039cf4e619124d5f308240ab0ea11635aef2edfc8bc39e77768d784b67f6f7cb603"
OK
```

2.1.3. AT+QECALL Establish/Release eCall

The command is used to establish or release eCall. When the module has established eCall, it will automatically transmit MSD in push mode. So before establishing eCall, this command must be executed to set the MSD. The eCall may be initiated automatically, for example, due to a vehicle sensor, or manually set by the vehicle occupants.

For emergency call (<ecalltype> is 1), the dial number is 112. If <dialnumber> is set as other numbers such as 119, it will return "ERROR".

For test call (<ecalltype> is 0), if <dialnumber> has been set, it is preferred to be used; if <dialnumber>

has not been set or has been cancelled, the number can be obtained from the FDN or SDN. If it is failed to get dial number or the eCall mode is incorrect, it will return “ERROR”.

If **AT+QECALL=1** command returns “OK”, it means the module is starting to establish eCall. If establishing eCall fails, “+QECURC: 0,0” will be returned. If network disconnects the eCall, “NO CARRIER” will be returned.

AT+QECALL Establish/Release eCall	
Test Command **AT+QECALL=?**	Response **+QECALL: (0,1),(0,1),(0,1),<dialnumber>** **OK**
Read Command **AT+QECALL?**	Response **+QECALL:** **<session>[,<ecalltype>,<activationtype>[,<dialnumber>]]** **OK**
Write Command **AT+QECALL=<session>[,<ecalltype>,<activationtype>[,<dialnumber>]]**	Response **OK** If there is an error related to ME functionality: **+CME ERROR: <err>**

Parameter

<session>	A numeric parameter. Establish/release eCall. 0 Release eCall 1 Establish eCall
<ecalltype>	A numeric parameter. eCall type. 0 Test Call 1 Emergency Call
<activationtype>	A numeric parameter. Activation type of eCall. 0 Manually initialized eCall 1 Automatically initialized eCall
<dialnumber>	A string parameter. The dial number of the test call. An optional proceeding “+” and numbers 0-9 are allowed only.

Example

```
//Establish a test eCall
AT+QECALL=1,1,0          //Establish a test eCall
OK
AT+QECALL=0              //On IVS side, release the eCall session, like ATH
OK
```

2.1.4. AT+QECPUSH Push MSD Data to PSAP

The command is used to push MSD to PSAP by push mode. It cannot be used until eCall has been established. When MSD is transmitting, this command cannot be executed. Otherwise, it will return "ERROR".

AT+QECPUSH Push MSD Data to PSAP	
Test Command **AT+QECPUSH =?**	Response **OK**
Execution Command **AT+QECPUSH**	Response **OK** If there is an error related to ME functionality: **+CME ERROR: <err>**

Example

```
//Transfer MSD in push mode
AT+QECPUSH
OK
```

2.2. Description of URCs

URCs of EC25/EC21 eCall AT commands will be reported to the host in the format of "+QECURC:". The following will describe the URCs of failed eCall, successful MSD transmission and requesting updating MSD, and information report during eCall.

2.2.1. URC of Failed eCall

When module establishing eCall fails or MSD transmission timeout happens, URC of failed eCall will be reported. And except for establishing eCall fails, others errors cannot hang up eCall. If URC of failed eCall is reported but eCall still holds on, customers can do voice talk, or execute **AT+QECPUSH** command to transmit MSD again. When IVS cannot detect SF, IVS will be reset.

URC of Failed eCall	
+QECURC: 0,<errorcode>	<errorcode> indicates error causes.

Parameter

<errorcode>	Error code. 0 Establishing eCall fails 1 Wait for “START” timeout 2 Wait for “HACK” timeout 3 MSD transmission timeout 4 IVS reset

2.2.2. URC of Successful eCall MSD Transmission and the Request for Updating MSD

When MSD is transmitted successfully, “+QECURC: 1,1,<hackcode>” will be reported. Then customers can do voice talk or execute **AT+QECPUSH** command to transmit MSD again.

When eCall has been established and MSD is not transmitting, MSD can be transmitted in pull mode. In pull mode, URC of updating eCall MSD indicates that MSD is allowed to be updated within 5 seconds. **AT+QECMSD** command can be used to update MSD. If MSD has not been updated in 5 seconds, the old MSD will be transmitted.

URC of Successful eCall MSD Transmission and the Request for Updating MSD	
+QECURC: 1,0	eCall established successfully.
+QECURC: 1,1,<hackcode>	When IVS Link Layer receives 2 “HACK” messages, this URC will be reported to IVS APP. <hackcode> indicates HACK code which is transferred by PSAP.
+QECURC: 1,2,<pullstatus>	<pullstatus> indicates the status of the request for MSD updating.

Parameter

<hackcode>	HACK code which is transferred by PSAP. For details, please refer to *EN 16062*.
<pullstatus>	Status of the request for updating eCall MSD 0 Indicate timeout of updating MSD and the module starts to transfer the old MSD 1 Indicate to update MSD in 5 seconds

2.2.3. URC of eCall Process Information

After **AT+QECCFG=”processinfo”,1** command is executed, this URC will be reported during MSD transmission. Otherwise, this URC will not be reported.

URC of eCall Process Information	
+QECURC: 2,<processinfo>	<processinfo> indicates eCall process information

Parameter

<processinfo>	eCall process information 1 When IVS Link Layer receives “START” message and starts to send MSD, this URC will be reported 2 When IVS Link Layer receives “NACK” message, this URC will be reported 3 When IVS Link Layer receives the first “LACK” message, this URC will be reported 4 When IVS Link Layer receives the second “LACK” message, this URC will be reported 5 When IVS Link Layer receives the first “HACK” message, this URC will be reported 6 Indicates MSD has been updated and the module starts to transfer the new MSD

3 Examples

3.1. MO eCall and Transfer MSD Automatically in Push Mode

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

```
AT+QECMSD=00e165df6a789b4aaaa46ee4a651820daaf625803735d9dfd5c7067927d821a43d4b64b
74cd2116dc582aabc6f4e45cdf9cbe2f74eb1aaf69cb4ef86cde48f86e02147d6c49ea22587144bbfdaa8
ef92c04afeb0c4e93ba93453561e65acd5065bbe12abde11819d86434039cf4e619124d5f308240ab0ea
11635aef2edfc8bc39e77768d784b67f6f7cb603          //Set MSD
OK

AT+QECALL=1,1,0                    //Establish eCall, <ecalltype> is 1 (emergency call).
                                   //<activationtype> is 0 (manually initialized eCall).
                                   //If a test eCall wants to be established,
                                    AT+QECALL=1,0,0,"12345678" command should be
                                    executed (12345678 is the dial number).

OK

//When PSAP answers the call, on IVS side, the MSD will be automatically transmitted in push mode, and
the following URC will be reported.

+QECURC: 1,0          //eCall established successfully.

+QECURC: 1,1,0        //MSD transmission is successful, and HACK code is 0.
                      //(positive ACK).

//Customers can do voice talk, or execute AT+QECMSD command to update MSD and then execute
AT+QECPUSH command to transfer MSD again, shown as follows.

AT+QECMSD=00123456789012345678 9          //Set MSD
OK

AT+QECPUSH            //Transfer MSD in push mode.
OK
```

+QECURC: 1,1,0 //MSD transmission is successful and HACK code is 0.
//(positive ACK)

//At this time, if PSAP requires the MSD, "+QECURC: 1,2,1" will be outputted. For details, please refer to ***Chapter 3.2***.

//Customers can use **AT+QECALL=0** command to hang up eCall. If eCall is hung up by PSAP, "NO CARRIER" will be returned.

AT+ QECALL=0 //Release eCall.
OK

3.2. MT eCall and Transfer MSD in Pull Mode

When eCall has been 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 push mode or pull mode. If customers want to transfer MSD in push mode, **AT+QECPUSH** command should be used. If "+QECURC: 1.2.1" is reported, it indicates PSAP requires MSD, and then MSD will be transmitted in pull mode. The following example shows the transmission in pull mode.

RING //Call is coming and answers the call.

ATA
OK

+QECURC: 1,0 //eCall established successfully.

//Customers can do voice talk, or set the MSD by **AT+QECMSD** command and transmit MSD by **AT+QECPUSH** command.

+QECURC: 1,2,1 //URC is reported, indicates to update MSD.

AT+QECMSD=00e165df6a789b4aaaa46ee4a651820daaf625803735d9dfd5c7067927d821a43d4b64b74cd2116dc582aabc6f4e45cdf9cbe2f74eb1aaf69cb4ef86cde48f86e02147d6c49ea22587144bbfdaa8ef92c04afeb0c4e93ba93453561e65acd5065bbe12abde11819d86434039cf4e619124d5f308240ab0ea11635aef2edfc8bc39e77768d784b67f6f7cb603 //Update and transmit MSD in pull mode.
OK

//Then the MSD will be automatically transmitted and the following URC indicates MSD transmission is successful.

+QECURC: 1,1,0 //MSD is transmitted successfully.

//Customers can do voice talk, or execute **AT+QECMSD** command to update MSD and then use **AT+QECPUSH** command to transfer MSD, please refer to ***Chapter 3.1***.

//Customers can use **AT+QECALL=0** command to hang up eCall. If eCall is hung up by PSAP, "NO CARRIER" will be returned.

NO CARRIER //URC indicating that PSAP hangs up eCall is reported.

4 Summary of eCall Error Codes

The error code <err> indicates an error related to mobile equipment or network. The details about <err> are described in the following table.

The <err> codes listed below are only related to the eCall function of EC25/EC21 module.

Table 1: Summary of Error Codes

<err>	Meaning
850	Unknown error
851	Input parameter error
852	Operation not allowed
853	MSD in transferring
854	Not in IVS mode
855	Set MSD error
856-900	Reserved

5 Appendix A References

Table 2: Related Documents

SN	Document Name	Remark
[1]	3GPP TS 26.267	eCall Data Transfer; In-band Modem Solution; General Description
[2]	3GPP TS 22.101	Service Aspects; Service Principles
[3]	3GPP TS 26.268	eCall Data Transfer; In-band Modem Solution; ANSI-C Reference Code
[4]	CEN EN 15722	Road Transport and Traffic Telematics - eSafety - eCall Minimum Set of Data
[5]	EN 16062	Intelligent Transport Systems - eCall - High Level Application Protocols Requirements (HLAP)

Table 3: Terms and Abbreviations

Abbreviation	Description
ACK	Acknowledgement
BTS	Base Transceiver Station
DTE	Data Terminal Equipment
FDN	Fixed Dialing Numbers
GNSS	Global Navigation Satellite System
GSTN	General Switched Telephone Network
HLACK	High Layer ACK
IVS	In-Vehicle System
LLACK	Link Layer ACK
ME	Mobile Equipment

MO	Mobile Originated
MS	Mobile Station
MSC	Mobile Switching Center
MSD	Minimum Set of Data
MT	Mobile Terminated
NV	Non-volatile
PLMN	Public Land Mobile Network
PSAP	Public Safety Answering Point
PSTN	Public Switched Telephone Network
SDN	Service Dialing Numbers
TA	Terminal Adapter
TRAU	Transcoder and Rate Adaptation Unit
URC	Unsolicited Response Code
(U)SIM	(Universal) Subscriber Identity Module