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ICS 33.060

M 36

YD/T 3711-2020

**Technical Requirement of IMS Based Vehicle eCall
System Based on Public Telecommunication Network**
基于公众电信网的车载紧急报警系统 基于 IMS 的数据传输技术要
求

Issued on: April 16, 2020

Implemented on: July 1, 2020

**Issued by: Ministry of Industry and Information Technology of the People's
Republic of China**

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Technical Requirement of IMS Based Vehicle eCall System Based on Public Telecommunication Network

1 Scope

This Standard specifies the technical requirements for IMS-based data transmission in the vehicle emergency call system based on the public telecommunication network, mainly including the call process of eCall, MSD transmission and update process, and the equipment functions and interface parameters involved in the LTE and IMS networks.

This Standard is applicable to VoLTE networks, terminal vehicle equipment, wireless subsystem equipment, MSC, EPC core network and IMS network system equipment that provide IMS-based vehicle emergency call services.

2 Normative References

The following documents are essential to the application of this Document. For the dated documents, only the versions with the dates indicated are applicable to this Document; for the undated documents, only the latest version (including all the amendments) is applicable to this Document.

YD/T 1522.5-2010 Technical requirements for session initiation protocol (SIP) - Part 5: Session initiation protocol based on the unified IMS

Technical requirements for emergency call services based on Voice over LTE (VoLET)

3GPPTS22.101 Technical specification group services and system aspects; service aspects; service principles

3GPP TS23.167IMS (IP Multimedia Subsystem (IMS) emergency sessions)

3GPPTS 24.008 (Mobile radio interface layer 3 specification; Core network protocols; Stage 3)

3GPPTS 24.301 (Non-Access-Stratum (NAS) protocol for Evolved Packet System (EPS); Stage 3)

3GPP TS 26.071 (Mandatory speech CODEC speech processing functions; AMR speech Codec; General description)

3GPP TS 26.093 (Mandatory speech codec speech processing functions Adaptive Multi-Rate (AMR) speech codec; Source controlled rate operation)

3GPP TS 26.171 (Speech codec speech processing functions; Adaptive Multi-Rate – Wideband (AMR-WB) speech codec; General description)

3GPP TS 26.193 (Speech codec speech processing functions; Adaptive Multi-Rate – Wideband (AMR-WB) speech codec; Source controlled rate operation)

3GPP TS 26.267 (eCall data transfer; In-band modem solution; General description)

3GPP TS 31.102 (Characteristics of the Universal Subscriber Identity Module (USIM) application)

IETF RFC 8147 (Next-Generation Pan-European eCall)

CEN EN 15722 (2011 Intelligent transport system – eSafety – eCall minimum set of data (MSD))

3 Terms, Definitions and Abbreviations

3.1 Terms and Definitions

For the purposes of this Document, the following terms and definitions apply.

3.1.1 Public safety answering point

A physical location that can receive public calls, such as a public safety answering station or an emergency command center/interaction platform.

3.1.2 eCall

An emergency call initiated manually or automatically from a vehicle (Circuit & Emergency Call or IMS Emergency Call) and carrying the emergency-related Minimum Set of Data (MSD).

3.1.3 Minimum set of data

The minimum set of data sent by a vehicle for rescue purposes, see CEN EN 15722 eCall minimum set of data.

3.1.4 Restrictive state

The user data is valid and available, and a cell has been selected. It is known that the cell cannot provide ordinary services, and only emergency services can be provided. At this time, the user is in a service state.

3.1.5 eCall only mode

Steps 4~5:

- a) If the IMS emergency call eSRVCC process is deployed: E-CSCF anchors the emergency call signaling to EATF, parses the eCall URN of the Request-URI in the emergency call request and the UE access location information in the P-Access-Network-Info header domain; and searches the E-CSCF built-in or external LRF based on this information to determine the number of the emergency call center PSAP; and routes the emergency call to the MGCF or ISBC; and then to the corresponding emergency call center PSAP.
- b) If the IMS emergency call eSRVCC process is not deployed: EATF network elements do not need to be deployed; and emergency call signaling does not need to pass through EATF network elements. Other processes are the same as the IMS emergency call process with eSRVCC deployed.

Steps 6~9:

After receiving the INVITE request, the PSAP rings, responds to the 180 message, and passes it to the UE through the IMS core.

Step 10:

The PSAP goes off-hook and responds to the 200OK message. PSAP supports INVITE request to carry MSD information. In the returned 200OK, it carries the application/emergencyCallData.control type message body to confirm the receipt of MSD information.

Steps 11 ~ 13:

E-CSCF/P-CSCF/SBC forwards 200OK message to UE. UE confirms the successful transmission of MSD information based on 200OK information.

Steps 14 ~ 17:

UE responds with ACK and passes it to PSAP through IMS core.

eCall emergency call is established successfully, media channel is created successfully, and initial MSD transmission and confirmation are completed.

5.2.2 Transmit MSD to PSAP that does not support NG-eCall during session establishment

When the UE detects that packet services are available, but does not detect that the network supports NG-eCall and no circuit domain services are available, the UE can initiate a normal IMS-based emergency call. The specific process is shown in 3GPP TS 23.167.

When the UE detects that the network supports NG-eCall services, but the PSAP does not support NG-eCall, the UE shall transmit MSD in the manner specified in 7.7.2 of 3GPP TS

F	No		---	---	If CS is available, access CS	None
^a Indicated by the network NG-eCall capability in SIB1, see 6.4						

5.5 eCall only mode

A terminal configured in eCallonly mode shall remain in the EMM-DEREGISTERED state. The terminal UE shall reside in an available network cell; but shall avoid any mobility management and other signaling interactions with the network. The terminal UE may initiate mobility management and connection management procedures to establish, maintain and release an NG-eCall session or a session connected to a non-emergency MSISDN or URI configured by the UICC for testing and terminal reconfiguration purposes.

With the release of any session, the terminal UE starts a timer whose value depends on the type of session (e.g., either an eCall or a session to a non-emergency MSISDN or URI). While the timer is valid, the terminal UE shall perform normal mobility management and allow responses to paging messages to receive and establish an incoming session (e.g., from an emergency handling center, PSAP or HPLMN operator). When the timer expires, if the terminal UE is still in the attached state, the terminal shall initiate a detach procedure and enter the EMM-DEREGISTERED state.

NOTE 1: The HPLMN operator may modify the eCallonly mode configuration status of the terminal UE recorded in the UICC. The HPLMN operator may add, modify or delete a non-emergency MSISDN or URI configured in the UICC for testing and reconfiguration. This behavior may be after the UE calls a non-emergency MSISDN or URI for reconfiguration. When the eCallonly mode configuration is deleted, the UE behaves like a normal UE and can support NG-eCall.

NOTE 2: Test and reconfiguration calls can be treated as normal (non-emergency) calls by the serving PLMN and can use normal charging rules according to the operator's policy.

NOTE 3: The MSISDN configured in the UICC for NG-eCall testing and terminal reconfiguration can be different from the MSISDN configured in the CS domain for testing.

For a terminal UE configured for eCallonly, when attached to EPS using E-UTRAN access, the terminal shall not indicate support for other RAT wireless access technologies to access the PS domain.

NOTE 4: For a terminal UE configured in eCallonly mode to access the PS domain, only E-UTRAN wireless technology is supported in the current version.

5.6 SRVCC requirements

If the operator network supports the IMS emergency call SRVCC process, then the IMS-based eCall process shall support the SRVCC handover process shown in Figure 7.

6 Interface Parameters and Processes

6.1 SIP signaling for MSD transmission

6.1.1 SIP INVITE

UE initiates an IMS-based eCall and sends an INVITE request. Based on the requirements for IMS-based VoLTE emergency calls, the following requirements are added:

Request-URI value of INVITE:

- If the user manually triggers the eCall, it is urn:service:sos.ecall.manual;
- If the sensor automatically triggers the eCall, it is urn:service:sos.ecall.automatic.

The Accept header carries application/emergencyCallData.control+xml, indicating that the UE can accept this type of message body.

The Recv-Info header carries emergencyCallData.eCall.MSD, indicating that the INFO request carrying MSD information can be received.

The value of the message body Content-Type corresponding to the MSD information is application/emergencyCallData.eCall.MSD. The MSD information is carried in the message body of the application/emergencyCallData.eCall.MSD type; the MSD information uses binary ASN.1 PER in accordance with the CEN EN 15722 encoding format, which does not exceed 140 bytes.

The MSD message body needs to carry the Content-ID header field, whose value is an ID that can uniquely identify the MSD information.

For more requirements on INVITE requests, see IETF RFC8147.

6.1.2 SIP 200 response (INVITE)

After receiving the initial INVITE request carrying MSD information, the PSAP verifies the MSD information, confirms that the MSD information is correct, and returns 200OK after the PSAP goes off-hook. The requirements are as follows:

The value of the message body Content-Type corresponding to the MSD control information is application/emergencyCallData.control+xml, and the MSD control information is carried in the message body of the application/emergencyCallData.control type. Thereof, the "received" attribute of the ack element is set to "true", and the "ref" attribute is set to the value of the Content-ID corresponding to the MSD message body sent by the UE.

For more requirements on the 200 response, see IETF RFC8147.

- The Content-type header field takes the value of application/emergencyCallData.control+xml corresponding to the message body; the "ref" parameter of the ack element is set to the Content-ID corresponding to the message body "application/emergencyCallData.control+xml" in the INFO request received by the UE; the "success" attribute of the "actionResult" sub-element takes the value "false"; the "action" attribute takes the value "send-data"; and the "reason" attribute selects a suitable value according to IETF RFC8147.
- The MSD message body needs to carry the Content-Disposition header field, with the value By-Reference.

For more requirements on INFO requests and responses, refer to IETF RFC8147.

6.2 PLMN selection

If the terminal UE is not in eCallonly mode, the PLMN selection method is the same as the normal PLMN selection.

If the terminal UE is in eCallonly mode, the terminal UE shall try to stay in an appropriate cell and then enter the eCall inactive state. If the terminal cannot find an appropriate cell, the terminal UE shall try to stay in an acceptable cell in the restrictive state and then enter the eCall inactive state. In the restrictive state, the available and allowed PLMNs shall be searched like ordinary UEs.

The UE selects the PLMN according to the normal priority. The terminal UE shall not consider PLMNs that do not support NG-eCall unless the PLMN supports UTRAN or GERANCS access. If no PLMN is available, the terminal UE shall be allowed to make a second PLMN selection, but there is no restriction on NG-eCall or CS support.

Cell selection and PLMN selection at the access layer have no effect on NG-eCall.

6.3 NAS message

During the LTE system registration process of the terminal, the network side needs to add two identifiers supporting eCall, "manually initiated eCall" and "automatically initiated eCall", in the IE "Emergency Number List" item in the Attach Accept message. For details, see 3GPPTS 24.301 and 3GPP TS 24.008.

6.4 RRC message

The E-UTRAN cell sends the "eCallOverIMS-Support" field to indicate whether the cell supports NG-eCall. The "eCallOverIMS-Support" field is transmitted in SystemInformationBlock1. If SystemInformationBlock1 does not carry this field, it means that the network does not support NG-eCall.

After receiving the "eCallOverIMS-Support" field, the terminal UE shall process the

- If the user instructs the terminal to deactivate (such as shutting down), the terminal UE shall enter EMM-NULL;
- If the terminal receives a request from the upper layer to establish NG-eCall, the terminal shall enter the EMM-DEREGISTERED.ATTEMPTING-TO-ATTACH state. The terminal UE shall select EMM and ESM processes to establish NG-eCALL at the earliest opportunity.;
- If the terminal receives a request from the upper layer to establish a call to the HPLMN for testing and reconfiguration services other than MSISDN or URI, the terminal shall enter the EMM-DEREGISTERED.ATTEMPTING-TO-ATTACH state. Once the attachment process is completed, the terminal UE shall perform related EMM and ESM processes to establish non-emergency calls.

The eCall inactivity process is only applicable to UEs configured in eCallonly mode. This process is initiated when the following conditions are met:

- If the UE is in any EMM-REGISTERED substate other than EMM-REGISTERED.PLMN-SEARCH or EMM-REGISTERED.NO-CELL-AVAILABLE substate:
- If the UE is in EMM-IDLE mode and any of the following conditions apply:
 - Timer T3444 times out or has timed out, and timer T3445 is not running;
 - Timer T3445 times out or is found to have timed out, and timer T3444 is not running or:
 - Timers T3444 and T3445 time out or are found to have timed out.

The terminal UE shall perform the following processes:

- Stop other running timers (such as T3411 and T3412);
- If the terminal UE is currently registered for EPS services only, perform the detach procedure for EPS services;
- If the terminal is currently registered for both EPS services and non-EPS services, perform a joint detach for EPS services and non-EPS services;
- Delete any GUTI, TAI list, last visited registered TAI, equivalent PLMN list and KSI; and enter EMM-DEREGISTERED.eCALL-INACTIVE state.

6.6 Test and reconfiguration URI

The USIM card provides two numbers or URIs for the eCall feature, one for the test number or URI and the other for the reconfiguration number or URI. When service indication item n°89

or service indication item n°112 is available, the USIM indicates support for eCall in the service list.

The USIM card can be modified by reconfiguration, changing from only supporting eCall to supporting both eCall and normal calls, or from supporting eCall and normal calls to supporting only eCall. This reconfiguration can be done by modifying the contents of the USIM service table, or by modifying the contents of EF_{EST}. The terminal shall use any of the following modes to notify these changes using the REFRESH_{proactive} command:

- USIM initialization and file modification notification;
- USIM initialization and full file modification notification;
- UICC reset;
- USIM application reset;
- 3G session reset.

For support requirements for eCall only, see 3GPPTS31.1025.3.40.1.

For support requirements for eCall and normal calls, see 3GPPTS31.1025.3.40.2.

6.7 Gm interface

The Gm interface is located between the UE and P-CSCF and shall support all signaling interactions between the UE and the IMS network, including emergency call signaling. This interface adopts SIP and shall also meet the requirements of 4.2.1 in YD/T 1522.5-2010; and shall be able to carry vehicle emergency call indications and MSD in call signaling.

6.8 Mw interface

The Mw interface is located between P-CSCF and E-CSCF/S-CSCF; and mainly exchanges emergency call signaling information. This interface uses the SIP protocol and shall meet the requirements of 4.2.2 in YD/T 1522.5-2010; and can carry vehicle emergency call indications and MSD in call signaling.

6.9 Mm/Mx interface

The Mm/Mx interface is located between the E-CSCF and the PSAP in the IMS domain/IP domain. The E-CSCF shall route the emergency call to the nearest PSAP in the IMS domain/IP domain through this interface according to the routing information provided by the external LRF or the built-in LRF. This interface uses the SIP protocol and shall meet the requirements of 4.2.1 in YD/T 1522.5-2010; and can carry vehicle emergency call indications and MSD in call signaling.

6.10 Mi/Mj interface

The Mi/Mj interface is located between the E-CSCF and the BGCF/MGCF; and mainly implements the IMS domain emergency call request and the connection with the PSAP in the fixed soft switch network/PSTN/PLMN. The interface uses the SIP protocol and shall meet the requirements of 4.2.3 in YD/T 1522.5-2010; and can carry the vehicle emergency call indication and MSD in the call signaling.

7 Equipment Requirements

7.1 Terminal

To support NG-eCall emergency call service, the terminal shall support the following functions:

The terminal shall support the terminal functions specified in 8.1 of *Technical Requirements for Emergency Call Service of Voice Call Solution Based on LTE (VoLTE)*: It shall support judging whether the cell it is located in supports NG-eCall according to the "eCallOverIMS-Support" field of SystemInformationBlock1:

The terminal shall support setting the Request-URI to "urn:service:sos.ecall.automatic" or "urn:service:sos.ecall.manual" in the SIPINVITE request;

The terminal shall support carrying the "application/emergencyCallData.eCall.MSD+xml" MIME message body in the SIPINVITE, including an MSD of no more than 140 bytes; and performing binary ASN.1 encoding according to the method specified in CEN EN15722: 2015:

The terminal shall support carrying the "application/emergencyCallData.eCall.MSD+xml" MIME message body in the SIPINFO, including an MSD of no more than 140 bytes, and performing binary ASN.1 encoding according to the method specified in CEN EN15722:2015.

The terminal shall support the SIP signaling extension specified in IETF RFC 8147:

The terminal shall have an available UICC card. If the terminal does not have an IMSI, a valid GUTI or a valid P-TMSI, the terminal shall not carry the IMEI in the attach message:

NOTE: This requirement is used when the terminal does not have a UICC card. YD/T XXXX *Technical Requirements for Emergency Call Services Based on LTE Voice Call Solutions (VoLTE)* 8.1 stipulates that "If the terminal does not have an IMSI, a valid GUTI or a valid P-TMSI, the terminal carries the IMEI in the attach request message." It is not applicable to NG-eCall services.

The terminal shall support eCallonly mode.

The terminal is recommended to support establishing calls to non-emergency MSISDN and URI for eCall testing and reconfiguration.

The terminal shall support the following audio codec standards and meet the listed coding rate

functions on the basis of the original EPS emergency call service function:

In the NAS message ATTACH ACCEPT message, the Emergency Number List needs to add two eCall types. For details, refer to 6.3 on the requirements of NAS messages.

7.4 HSS

In accordance with the requirements of the *Technical Requirements for Emergency Call Services Based on LTE Voice Solutions (VoLTE)*, there is no need to expand the existing functions of HSS.

7.5 S-GW/P-GW

According to the requirements of *Technical Requirements for Emergency Call Services of Voice Solutions Based on LTE (VoLTE)*, no extension is required.

7.6 MSC

According to the requirements of *Technical Requirements for Emergency Call Services of Voice Solutions Based on LTE (VoLTE)*, no extension of MSC is required.

For MSC and SRVCC-IWF network elements, there are no special requirements, which are consistent with the requirements for IMS-based VoLTE emergency calls. For MGCF network elements, it is necessary to have the ability to serve as a gateway device between E-CSCF and PSAP, support simultaneous connection with FG-PSAP and NG-PSAP, and be able to flexibly route according to PSAP number/URI.

7.7 IMS network equipment

7.7.1 Proxy Call Session Control Function (P-CSCF)

Based on the requirements of IMS-based VoLTE emergency calls, add:

- Support eCall URN identification;
- Support MSD information transmission and update process;
- Anonymize MSD information in device signaling tracking, that is, the original MSD information cannot be presented and saved in signaling tracking.

7.7.2 Emergency Call Session Control Function (E-CSCF)

Based on the requirements of IMS-based VoLTE emergency calls, add:

- Support eCall URN identification;
- Support MSD information transmission and update process;

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