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Emergency Communications (EMTEL); Transporting Handset Location to PSAPs for Emergency Communications - Advanced Mobile Location

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Foreword

This Technical Specification (TS) has been produced by ETSI Special Committee Emergency Communications (EMTEL).

Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the ETSI Drafting Rules (Verbal forms for the expression of provisions).

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Introduction

One of the biggest challenges facing the Emergency Services is determining the location of mobile callers. Cell based location has been available to the Emergency Services since 2003. While cell data can help with verbal establishment of a caller's location, a more precise location will allow an even quicker emergency response.

Advanced Mobile Location (AML) allows use of native smart phone technology to pass (Assisted) GNSS or Wi-Fi™ based location data to Emergency Service PSAPs. These technologies can provide a location precision as good as 5 m outdoors (and averaging to within circular areas of ~25 m radius for indoor locations), a significant improvement on existing cell coverage provided by mobile networks, which average (across the UK as an example) circular areas of about 1,75 km radius.

The present document builds a second version on the Advanced Mobile Location. The AML initiative is described in ETSI TR 103 393 [i.1] and is now being used in an increasing number of countries to improve the precision and accuracy of a caller's location information for emergency communications from mobile handsets.

1 Scope

The present document describes the content and the transport methods used for AML messages with handset derived location information and associated data.

It also considers the future evolution of transport methods as PSAPs, networks and terminals become increasingly IP based.

2 References

2.1 Normative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

Referenced documents which are not found to be publicly available in the expected location might be found at https://docbox.etsi.org/Reference/.

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

[1] ETSI TS 123 040: "Digital cellular telecommunications system (Phase 2+) (GSM); Universal Mobile Telecommunications System (UMTS); LTE; 5G; Technical realization of the Short Message Service (SMS) (3GPP TS 23.040)".

[2] Void.

[3] IETF RFC 6442: "Location Conveyance for the Session Initiation Protocol".

[4] Void.

[5] ETSI TS 103 479: "Emergency Communications (EMTEL); Core elements for network independent access to emergency services".

[6] ETSI TS 123 038: "Digital cellular telecommunications system (Phase 2+) (GSM); Universal Mobile Telecommunications System (UMTS); LTE; Alphabets and language-specific information (3GPP TS 23.038)".

[7] GSMA™ NG.119: "Emergency communication".

2.2 Informative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

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

[i.1] ETSI TR 103 393 (V1.1.1): "Emergency Communications (EMTEL); Advanced Mobile Location for emergency calls".

3 Definition of terms, symbols and abbreviations

3.1 Terms

Void.

3.2 Symbols

Void.

3.3 Abbreviations

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

3GPP	3G (mobile) Partnership Project
AGNSS	Assisted Global Navigation Satellite System
AML	Advanced Mobile Location
ASCII	American Standard Code for Information Interchange
DCS	Data Coding Scheme
GMLC	Gateway Mobile Location Centre
GNSS	Global Navigation Satellite System
GSM	Global System for Mobile
GSMA	Global System for Mobile communications Association
HTTP	HyperText Transfer Protocol
HTTPS	HyperText Transfer Protocol Secure
ICCID	Integrated Circuit Card Identifier
ID	Identifier
IEI	Information Element Identifier
IMEI	International Mobile Equipment Identity
IMSI	International Mobile Subscriber Identity
IP	Internet Protocol
ISDN	Integrated Services Digital Network
LOC	Level Of Confidence
LS	Location Server
LTE	Long Term Evolution
MCC	Mobile Country Code
MIME	Multipurpose Internet Mail Extensions
MNC	Mobile Network Code
MNO	Mobile Network Operator
MSC	Mobile Switching Centre
MSISDN	Mobile Station International Subscriber Directory Number
NG	Next Generation
NTP	Network Time Protocol
OS	Operating System
PDU	Packet Data Unit
PSAP	Public Safety Answering Point
RFC	Request For Comments
SIM	Subscriber Identity Module
SIP	Session Initiation Protocol
SMPP	Short Message Peer to Peer
SMS	Short Message Service
SMSC	Short Message Service Centre
ToC	Time of Communication
ToP	Time of Positioning
UCS	Universal Character Set
UTC	Universal Time Coordinated
VoLTE	Voice over LTE
VoNR	Voice over New Radio

WGS World Geodetic System

4 Overview

AML functionality is triggered by an emergency communication (which is progressed normally by the handset and the network), and is designed to supplement the basic network location provided wherever possible, i.e. with some acknowledgement of limitations in GNSS or Wi-Fi™ availability for the handset and the time required to acquire location using GNSS.

Location information established by the handset, using its built-in GNSS and Wi-Fi™ connectivity, together with user plane assistance data from a handset-selected service where available, is transported (e.g. through use of SMS) to the Emergency Service PSAPs. Handsets can use more than one location technology to establish a location, for example the handset may combine location information from Cell and Wi-Fi™ sources to obtain the best possible, "hybridised", result.

It is important that AML does not interfere with the voice call so both the handset and mobile network shall be configured to be able to simultaneously support a standard 3GPP mobile emergency voice call, location determination using GNSS/Wi-Fi™ capabilities and SMS and/or HTTPS transmission of the location information over the 3GPP mobile network.

5 Handset Functionality

5.1 Positioning methods and time needed to precisely locate

GNSS, or Assisted GNSS, normally offers the best location information but is slower than other methods. At the other end of the spectrum cell based location is quick but typically returns a larger location area. The general rule is that PSAPs need the best data as long as it does not take too long to determine, so a '*send us what you have now*' timeout [T1] is used.

T1 is the maximum time between the emergency communication being initiated and the location message being sent. T1 should be configurable with a T1 value selected in consultation with the provider of the AML functionality on the handset to give best balance between quicker availability to PSAPs and the even higher precision that may become available with a longer T1.

As soon as the emergency communication is initiated the handset shall immediately attempt to determine the best possible current location within the period set by the T1 timeout.

This should allow all location capabilities that the handset provides to be used, respecting the end user's preferences by enabling any capability not normally available only to assist for AML functions on an emergency communication, and subject to a battery check.

If it has not been possible to get a location from any method then a message shall be sent indicating that all positioning methods have failed.

5.2 Triggered by emergency communication without impacting voice

The AML software shall be integrated into all existing emergency communications mechanisms available on the handset including manual dial of 112 (or any other national emergency number specified for the mobile network and country being used), and use of the Emergency Call button (as appropriate).

In an emergency callers are often stressed or panicking so it is important that the AML functionality and transmission of the AML message shall be automatically triggered without any manual intervention by the user. The handset software shall be invisible to the users so as not to cause confusion when they are trying to get help, and so as not to attract attention from those who intend to abuse the facility. No record of the AML message shall be available to the user either during or after the emergency communication.

If an emergency SMS service, typically for deaf or hard of hearing users is provided in a country, then AML shall also be triggered by an emergency SMS message being sent.

5.3 Availability of MSISDN

PSAPs need to be able to match the voice call with the AML data, and to do so they use the MSISDN (Mobile Station International Subscriber Directory Number). The MSISDN is included within an SMS message so this is straightforward if SMS is used for AML transport. In some instances, the MSISDN can be accessed by the handset's AML functionality and, if AML is using HTTPS to transport the location data, it should be included in the HTTPS data string (see clause B.1).

5.4 Data connectivity

The mobile handset requires data connectivity to allow communication with servers operated by the providers of the phone's operating system that:

a) provide assistance information to allow quick establishment of a GNSS position (AGNSS); and

b) provide access to primarily crowd sourced databases for location information related to Wi-Fi™ access points.

In addition such a data connection may support one of the transport mechanisms for AML using an HTTPS message (see clause 6.4).

This data connectivity can be through the mobile network or Wi-Fi™ access points.

Without such a data connection AML messages are still possible using a GNSS location (without assistance) and SMS transport (see clause 6.3).

5.5 Battery life

Before invoking the AML functionality, the handset should check there is sufficient battery life so that the caller can still make a short 5 minute voice call. The priority in the emergency situation is to allow voice connection to the PSAP.

6 Location data and data transport

6.1 General

In order for a PSAP to be able to process messages of a later version than the PSAP currently supports, the PSAP shall ignore all attributes that it cannot process.

6.2 Location data provision by the handset

6.2.1 Data provided

The following attributes are those that are normative for implementation using transport methods described in clauses 6.3 and 6.4:

- AML is required to communicate a location in the form of a circle. The location and size of the circle determined by the handset shall be communicated using the attributes of a WGS 84 latitude and longitude measured in decimal degrees for the centre of the circle, and a radius measurement for the location circle in metres. A precision of 5 decimal degrees should be provided which will equate to 1,1 m precision on the ground.

- The Time of Positioning (ToP): The accuracy of this date and time is important as it will be used to filter out any messages that appear to be too old or have a time in the future. In the first instance the handset should attempt to use the time established by an NTP server, this should be possible if a network connection is available. If NTP is not available then GNSS can be used to give time. Only if these two methods fail then, as a last resort, the handset time and date can be used.

- The confidence level (1 % to 99 %) at which handset location is reported. The default is 1-sigma, or 68 % confidence, but it is common that more reliable results are required and the handset may be configured to report at confidence levels of 90 % or 95 %. The selection of a common confidence level for location reporting makes it easier for the end point operator to make comparisons between locations being provided by multiple sources. The predominant positioning method used to determine the location area is indicated as one of the following:

  - GNSS or AGNSS;
  - Wi-Fi™ signals;
  - Cell;
  - Hybridised results shall be used and should be classified according to predominant location method. It shall also be indicated if it has not been possible to determine the location - see annexes A and B.

- The SIM card identifier of the handset that has made the emergency communication (IMSI) and the identifier of the handset that made the emergency communication (IMEI):

  - For privacy reasons IMSI information is handled differently, depending upon the transport mechanism SMS/HTTPS as detailed in annexes A and B.
  - For privacy reasons IMEI information may also be handled differently, specifically when only SMS is used a partial IMEI may be sent as detailed in annex A.

- Mobile Country Code of the network (MCC), used to confirm/determine the country in which the emergency communication was made.

- Mobile Network Code (MNC), to confirm/determine the mobile network used to make the emergency communication.

NOTE 1: The MCC and MNC of the network will normally be the same as the MCC and MNC within the IMSI. Differences between them indicate if the handset is roaming.

- A header attribute shall be used to differentiate AML messages from other emergency SMS messages and to also indicate a version number for the interface. For SMS transport, a Message Length attribute shall also be used - see annex A.

The following attributes are those that are optional for implementation using transport methods described in clauses 6.3 and 6.4:

- The Altitude shall be provided in metres (above the WGS 84 ellipsoid) together with the Altitude Variance that indicates the vertical variance, plus or minus, from given altitude.

NOTE 2: The WGS 84 ellipsoid is a reasonable approximation for the shape of the earth. Altitude above the WGS 84 ellipsoid can differ from the actual altitude above mean sea level.

- The Time of Communication (ToC) is the time when the user started the call. It will be used, together with the parameter ToP, to place the received messages in the right order. This attribute is specially important in case of multiple locations reception. The "time of emergency call" helps to match voice call, SMS and HTTP data.

6.3 SMS transport

6.3.1 SMS transport overview

When SMS transport is selected (see clause 8), the standard mobile network SMS service shall be used to send the AML message from the phone to the SMSC (SMS Centre) within each mobile network (using normal 3GPP network standards).

The Short Message Peer-to-Peer (SMPP) open industry standard protocol for transfer of short message data outside mobile networks should then be used to transport the data from the SMSC to the SMS Aggregator (organization that aggregates SMS messages from various mobile networks).

The Aggregator should then forward the message to the PSAP using an Aggregator-defined format, typically an HTTPS post message that includes all the AML data, including the MSISDN which forms part of the SMS message. The PSAP then makes the AML location available to be used to supplement the location available from the mobile network. Either the Aggregator or the PSAP operating the AML Reception server may decode the binary data within the SMS payload - see clause 6.3.2.

Figure 1 shows how the AML location may reach a PSAP organization. The exact details for how AML information is made available to the PSAP that has received the associated voice call will vary from country to country, depending on how PSAPs are organized in that country. This is considered further in clause 8.

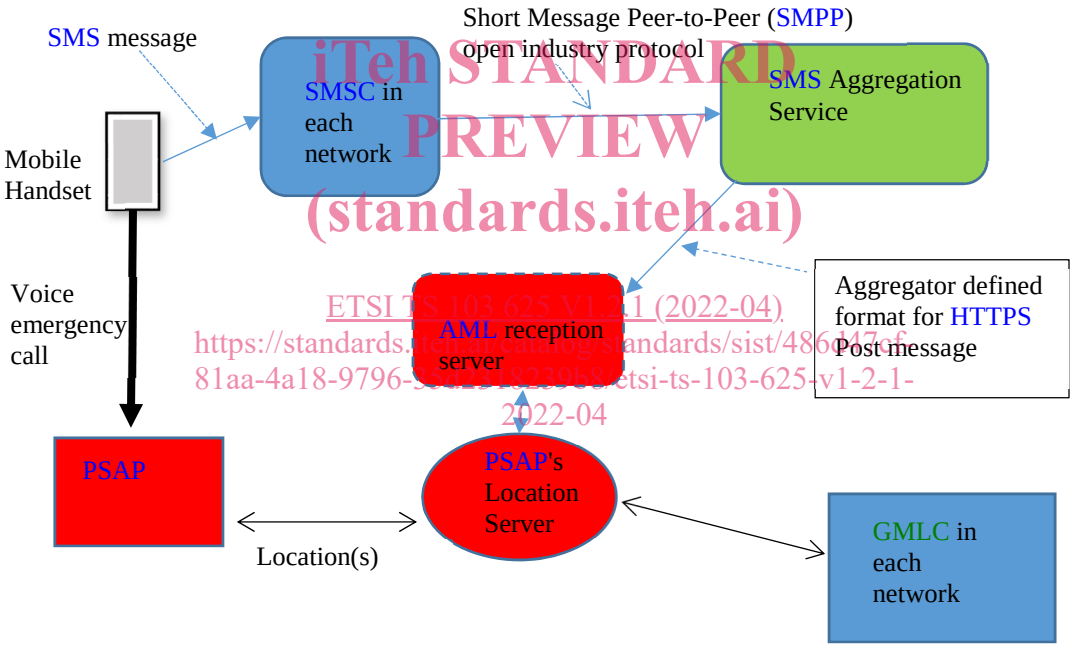

Figure 1: Example of AML location path to reach a PSAP

Figure 2 gives an example of the SMS message used in the AML solution.