

Annex I

Specification of the E112 call location solution for publicly available telephone networks or services

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1. Introduction

This document aims to specify the solution, to be implemented by providers of publicly available mobile telephone networks or services, for the provision to authorities responsible for providing emergency services of information on the location of callers to the single European 112 emergency number.

The information to be provided concerns Geographic Coordinates and Extent and Format of Uncertainty¹ of the location from which the call is originated.

In case of service failure, although the location information may not be available, the call continues normally, as is the case currently via ISUP where the 'Called Number' is equivalent to 1122XY(Z)²/112.

2. Definitions and abbreviations

2.1. Definitions

E112 - an emergency communications service using the single European emergency call number, 112, which is enhanced with location information of the calling user.

Public safety answering point - a physical location where emergency calls are received under the responsibility of a public authority.

2.2. Abbreviations

E112	-	Enhanced 112
DSS1	-	Digital Subscriber Signalling System No. 1
GSM	-	Global System for Mobile Communication
IAM	-	Initial Address Message (ISUP)
IMEI	-	International Mobile Equipment Identity
ISDN	-	Integrated Services Digital Network
ISUP	-	ISDN User Part
ITU	-	International Telecommunication Union

¹ The format of the area of uncertainty and its characteristics must be defined. In a first stage, the format considered is a circle with the radius as parameter. In other stages or formats, an ellipse, an arc-band or a polygon in general may be considered, with appropriate parameters for the purposes of a definition through standard algorithms.

² The fourth digit of the CGR (*Centro de Grupos de Rede* – Network Groups Centre) is used in the Azores.

MSC	–	Mobile Switching Centre
PSAP	–	Public safety answering point
PBX	–	Private Branch eXchange
PSTN	–	Public Switched Telephone Network
SIM	–	Subscriber Identity Module
SS7	–	Signalling System N.º 7
UMTS	–	Universal Mobile Telecommunications System
WGS84	–	World Geodetic System Datum 84 (reference geocentric origin)

3. Solution

The solution to be implemented consists of the submission of the Geographic Coordinates and the Extent and Format of Uncertainty, which provide the references for the caller location, in the field 'Redirecting Number' via SS7(ISUP) signalling to the PSTN, the delivery to the PSAP being carried out according to the DSS1 access protocol.

This is a solution based on the *Push* technique (location information delivered real-time for all calls, with a direct correlation between the call and location information) using the current interface via PSTN while ensuring the privacy of data, as the information is directly interconnected to the emergency call.

In ISDN accesses where 'S' and 'T' interfaces coincide, the PSAP must be prepared to tell apart the two DSS1 'Redirecting Number' information elements, the first corresponding to the 1122XY(Z) value received in the 'Original Called number' ISUP parameter and the second to the location value received in the 'Redirecting Number' ISUP parameter.

In ISDN accesses connected as PBX, the PSAP must be prepared to interpret the DSS1 'Facility' information element through the operation 'DivertingLegInformation2', where the field 'diverting Nr' corresponds to the value received in the 'Redirecting Number' ISUP parameter and the field 'Original Called number' corresponds to the value received in the 'Original Called number' ISUP parameter.

The PSAP must also ensure the maintenance and forwarding of information elements identified above, where the call is transferred between its answering points.

3.1. Description of the procedure

Where a user makes a call to the 112 emergency number from a terminal connected to the public mobile telephone network, an internal network process is launched to obtain its location, and the Geographic Coordinates method must be used.

In a first stage the Geographic Coordinates of the cell are sent (centre and radius of the cell).

Geographic Coordinates must be codified according to the WGS84 standard and follow the format below:

Format: FFDDMMSSddmmsRR

Field	Meaning	Component
FF	Message format. Possible values: 10 to 99 At this stage: 0x → reserved 11 → Optimus 12 → TMN 13 → Vodafone	Format
DD	Degrees	Latitude
MM	Minutes	
SS	Seconds	
dd	Degrees	Longitude
mm	Minutes	
ss	Seconds	
RR	Possible values: 00 to 99	Extent and Format of Uncertainty At this stage for formats 11, 12 and 13 RR – Cell radius

As referred above, RR means the cell radius, and may take values from 00 to 99, according to the following mapping:

TMN		Vodafone		Optimus	
Digit	Radius	Digit	Radius	Digit	Radius
00	< 100 m	00	< 100 m	00	< 100m
01	< 250 m	01	< 250 m	01	< 250 m
02	< 500 m	02	< 500 m	02	< 500 m
03	< 750 m	03	< 1 km	03	< 1 km
04	< 1 km	04	< 2km	04	< 2 km
05	< 2 km	05	< 4km	05	< 4 km
06	< 4 km	06	< 10km	06	< 10 km
07	< 10 km	07	< 20km	07	< 20 km
08	< 20 km	08	< 30km	08	< 30 km
09	> 20 km	09	> 30km	09	> 30 km

The algorithm used to calculate the coverage radius of each cell is associated to a margin of error. The error will be greater the higher the extent of the cell.

The radius values include a strong theoretical component, and consequently the Geographic Coordinates supplied may present errors.

Providers of publicly available mobile telephone networks or services must correct the errors detected and reported by PSAPs.

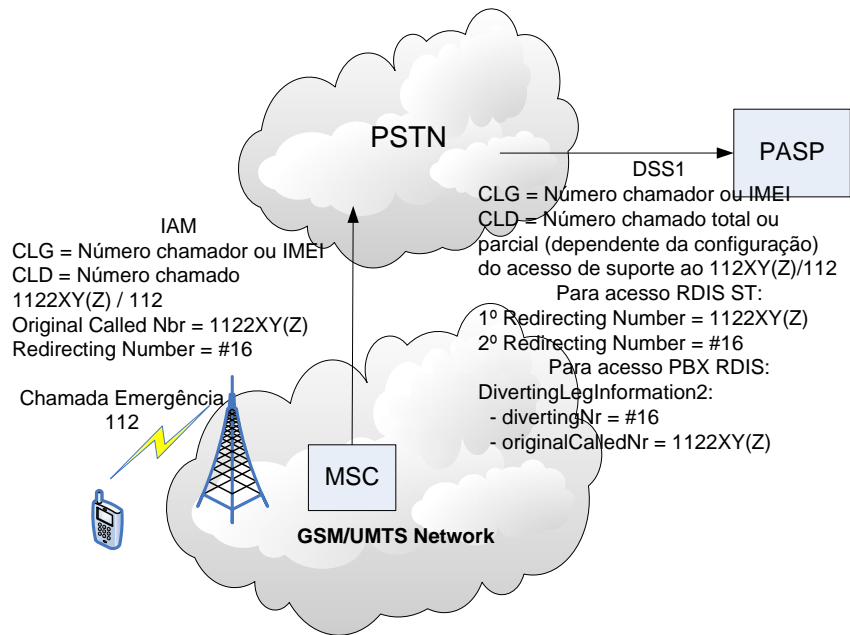
As mentioned earlier, the delivery to the PSAP of the location information is carried out via DSS1 (ITU-T Q.931, Q.932, Q.952, EN 300 403-1 and EN 300 196-1), the mapping between ISUP and DSS1 signalling being based on recommendation Q.699, according to the EN 300 201-1 standard (section 9.2.5 for ISDN accesses where 'S' and 'T' interfaces coincide and section 10.2 for PBX ISDN accesses).

The delivery to the PSAP of location information by providers of publicly available mobile telephone networks or services must be carried out according to the ISUP signalling protocol (ITU-T Q.761, Q.762, Q.763 and Q.764), the PSTN network ensuring the interfaces with the PSAP, which is responsible for converting the information from ISUP to DSS1 (ITU-T Q.699 and EN 300 207-1), and for avoiding the loss of any relevant information.

The 'Calling Party Number', 'Called Number', 'Redirecting Number' and 'Original Called Number' ISUP parameters and the 'Calling Party Number', 'Called Number', 'Redirecting Number' and 'Facility - DivertingLegInformation2' DSS1 information elements shall include, in addition to other fields not relevant to this specification, the following information (the respective format is described in detail in point 3.2):

- 'Calling party number' parameter/Information Element address signals – caller number or IMEI (the latter is delivered in calls made without a card, in case the network presents this facility).
- 'Called Party Number' ISUP parameter address signals – 1122XY(Z) or the access number to the 112 service (after translation)
- 'Called Party Number' DSS1 parameter number digits – access numbers supporting the 112 answering points
- ISUP and 2nd DSS1 'Redirecting number' parameter/Information Element field address signals and DSS1 'Facility: DivertingLegInformation2' field 'divertingNr'- #2 Information format + #12 digits Lat./Long. (degrees, minutes, seconds) + #2 digits mapping of Extent and Format of Uncertainty
- 'Original Called Number' ISUP field address signals, DSS1 '1st Redirecting number' field number digits and DSS1 'Facility: DivertingLegInformation2' field 'Original Called Nr' – 1122XY(Z)

The extent of the 'Redirecting number' field supported on the PSTN does not exceed 16 digits, which may all be used for the purpose of the delivery of location information according to agreed formats.



General solution procedure

IAM

CLG = Calling party number or IMEI
 CLD = Called Party Number
 1122XY(Z)/112
 Original Called Nbr = 1122XY(Z)
 Redirecting Number = #16
 Emergency call 112

CLG = Calling party number or IMEI

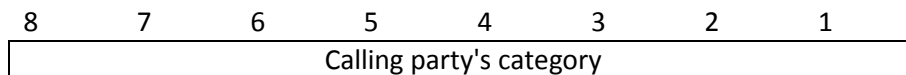
CLD = Total or partial Called Party Number (depending on the configuration) of the access supporting the 1122XY(Z)/112
 For ISDN ST:
 1st Redirecting number = 1122XY(Z)/
 2nd Redirecting number = #16
 For PBX ISDN:
 DivertingLegInformation2:
 - diverting Nr = #16
 - Original Called No. – 1122XY(Z)

3.2. Format of fields used

3.2.1. ISUP

3.2.1.1 'Calling party's category' field

Format of the 'Calling party's category' field (ITU Q.763):



For the E112 service, this field shall use the following codes:

0 0 0 0 0 0 0	calling party's category unknown at this time (national use) ³
0 0 0 0 1 0 1 0	ordinary calling subscriber
0 0 0 0 1 0 1 1	calling subscriber with priority

³ Valid for terminals without a SIM card.

3.2.1.2 'ISUP Calling Party Number' field

Format of the 'Calling party number' field (ITU Q.763):

	8	7	6	5	4	3	2	1
1	O/E	Nature of address indicator						
2	NI	Numbering plan indicator			Address presentation restricted indicator		Screening indicator	
3	2nd address signal				1st address signal			
:								
:								
m	Filler (if necessary)				nth address signal			

For the E112 service, fields shall use the following codes (only relevant fields are indicated):

a) *Nature of address indicator*

0 0 0 0 1 1 national (significant) number (national use)⁴
 0 0 0 0 1 0 0 international number⁵

b) *Numbering plan indicator*

0 0 1 ISDN (Telephony) numbering plan (ITU-T Recommendation E.164)

c) *Address presentation restricted indicator*

0 0 presentation allowed
 0 1 presentation restricted

d) *Address signal*

Caller number or IMEI (the latter sent in calls made without a card or with an operator card different than that of the access mobile network, where the network provides this facility).

3.2.1.3. 'Called Party Number' field

Format of the 'Called party number' field (ITU Q.763):

	8	7	6	5	4	3	2	1
1	O/E	Nature of address indicator						
2	INN	Numbering plan indicator			spare			
3	2nd address signal				1st address signal			
:								
:								
m	Filler (if necessary)				nth address signal			

For the E112 service, fields shall use the following codes (only relevant fields are indicated):

⁴ Valid for calls originated nationally and for terminals without a SIM card.

⁵ Valid for calls originated internationally while in roaming on national territory.

Nature of address indicator

0 0 0 0 1 1 national (significant) number

Numbering plan indicator

0 0 1 ISDN (Telephony) numbering plan (ITU-T Recommendation E.164)

Address signal

1122XY(Z), 112 or number supporting 112 (after translation).

3.2.1.4. 'ISUP Redirection Information' field

Format of the 'Redirection Information' field (ITU Q.763 and Q.732):

	8	7	6	5	4	3	2	1
1	H	G	F	E	D	C	B	A
2	P	O	N	M	L	K	J	I

NOTE – The parameter may be received without the second octet from an ISUP'88 (*Blue Book*).

For the E112 service, fields shall use the following codes (only relevant fields are indicated):

Redirecting Indicator (Bits CBA)

1 0 0 call diverted, all redirection information presentation restricted⁶
0 1 1 call diverted

Original redirection reason (Bits HGFE)

0 0 0 0 unknown/not available

Redirection Counter (Bits KJI)

2

Redirecting Reason (Bits PONM)

0 0 0 0 unknown/not available

3.2.1.5. 'ISUP Redirecting Number' field

Format of the 'Redirecting Number' field (ITU Q.763 and Q.732):

For the E112 service, fields shall use the following codes (only relevant fields are indicated):

Nature of address indicator

0 0 0 0 1 1 national (significant) number

Numbering plan indicator

0 0 1 ISDN (Telephony) numbering plan (ITU-T Recommendation E.164)

⁶ The use of code 100 (call diverted, all redirection information restricted) is recommended.

Address presentation restricted indicator
 0 0 presentation allowed

Address signal
 #2 Information format + #12 digits Lat./Long. (degrees, minutes, seconds) + #2 digits mapping of Extent and Format of Uncertainty

3.2.1.6. Original Called Number

Format of the 'Original Called Number' field (ITU Q.763 and Q.732):

	8	7	6	5	4	3	2	1
1	O/E		Nature of address indicator					
2	spare		Numbering plan indicator		Address presentation restricted indicator		spare	
3	2nd address signal				1st address signal			
:								
:								
m	Filler (if necessary)				nth address signal			

Nature of address indicator
 0 0 0 0 1 1 national (significant) number

Numbering plan indicator
 0 0 1 ISDN (Telephony) numbering plan (ITU-T Recommendation E.164)

Address presentation restricted indicator
 0 0 presentation allowed

Address signal
 1122XY(Z).

3.2.2. DSS1

3.2.2.1. 'Calling Party Number' Information Element

Format of the 'Calling Party Number' IE (ITU Q.931):

8	7	6	5	4	3	2	1	Octet
Calling party number information element identifier								
0	1	1	0	1	1	0	0	1
Length of calling party number contents								2
ext. 0/1	Type of number			Numbering plan identification				3
ext. 1	Presentation indicator		Spare 0 0 0			Screening indicator		3a*
0	Number digits (IA5 characters)							4*

For the E112 service, fields shall use the following codes (only relevant fields are indicated):

Type of number

0 0 0 Unknown

Numbering plan identification

0 0 0 0 Unknown

Presentation indicator

0 0 presentation allowed
0 1 presentation restricted

Number digits

Caller number or IMEI.

3.2.2.2. 'Called Party Number' Information Element

Format of the 'Called Party Number' IE (ITU Q.931):

8	7	6	5	4	3	2	1	Octet
0	Called party number information element identifier							1
	1	1	1	0	0	0	0	2
Length of called party number contents								
ext. 1	Type of number			Numbering plan identification				3
0	Number digits (IA5 characters) (Note)							4 etc.

NOTE – The number digits appear in multiple octet 4s in the same order in which they would be entered, that is, the number digit which would be entered first is located in the first octet 4.

For the E112 service, fields shall use the following codes (only relevant fields are indicated):

Type of number

0 0 0 Unknown

Numbering plan identification

0 0 0 0 Unknown

Number digits

Numbers of accesses to the 112 answering points

3.2.2.3. 1st 'Redirecting number' Information Element

The format of the 'Redirecting number' IE shall be as follows (ITU Q.952):

8	7	6	5	4	3	2	1	Octet
0	Redirecting number information element identifier							1
	1	1	1	0	1	0	0	
Length of redirecting number contents								
2								
ext. 0/1	Type of number			Numbering plan identification				3
ext. 0/1	Presentation indicator	Spare 0		0	0	Screening indicator		3a* 1
ext. 1	Spare 0 0 0			Reason for redirection				3b* 1
Spare 0	Number digits (IA5 characters)							4 etc.

For the E112 service, fields shall use the following codes (only relevant fields are indicated):

Type of number

0 0 0 Unknown

Numbering plan identification

0 0 0 0 Unknown

Presentation indicator

0 0 presentation allowed

Reason for redirection

0 0 0 0 Unknown

Number digits

1122XY(Z)

3.2.2.4. 2nd 'Redirecting number' Information Element

The format of the 'Redirecting number' IE shall be as follows (ITU Q.952):

8	7	6	5	4	3	2	1	Octet
0	Redirecting number information element identifier							1
	1	1	1	0	1	0	0	
Length of redirecting number contents								
2								
ext. 0/1	Type of number			Numbering plan identification				3
ext. 0/1	Presentation indicator	Spare 0		0	0	Screening indicator		3a* 1
ext. 1	Spare 0 0 0			Reason for redirection				3b* 1
Spare 0	Number digits (IA5 characters)							4 etc.

For the E112 service, fields shall use the following codes (only relevant fields are indicated):

Type of number

0 0 0 Unknown

Numbering plan identification

0 0 0 0 Unknown

Presentation indicator

0 0 presentation allowed

Reason for redirection

0 0 0 0 Unknown

Number digits

#2 Information format + #12 digits Lat./Long. (degrees, minutes, seconds) + #2 digits mapping of Extent and Format of Uncertainty

3.2.2.5. 'Facility' Information Element

The format of the 'Facility' IE shall be as follows (EN 300 196-1):

8	7	6	5	4	3	2	1	Octet	
Facility information element identifier									
0	0	0	1	1	1	0	0	1	
Length of facility contents									
ext. 1	Spare 0 0		Protocol Profile						3
Components									4 etc.

For the E112 service, the 'Components' field shall use the following codes, according to the definition ASN.1 (EN 300 196-1 and EN 300 207-1):

Facility-Information-Element-Components {itu-t identified-organization etsi(0) 196 facility-information-element-component(3)}

Components ::= CHOICE {
 invokeComp [1] IMPLICIT InvokeComponent}

InvokeComponent ::= SEQUENCE {
 invokeID InvokeIDType,
 operation-value DivertingLegInformation2}

InvokeIDType ::= INTEGER (-32768..32767)

Diversion-Operations {ccitt identified-organization etsi(0) 207 operations-and-errors(1)}

DivertingLegInformation2 DivertingLegInformation2 ::= localValue 15

DivertingLegInformation2 ::= OPERATION
 ARGUMENT SEQUENCE {
 diversionCounter DiversionCounter,
 diversionReason DiversionReason,
 divertingNr [1] PresentedNumberUnscreened OPTIONAL,
 originalCalledNr [2] PresentedNumberUnscreened OPTIONAL}

DiversionCounter ::= 2

DiversionReason ::= ENUMERATED {unknown (0)}

Addressing-Data-Elements {itu-t identified-organization etsi(0) 196 addressing-data-elements(6)}

PresentedNumberUnscreened ::= CHOICE {
 presentationAllowedNumber [0] PartyNumber}

PartyNumber ::= CHOICE {
 unknownPartyNumber [0] IMPLICIT NumberDigits}

For the field divertingNr:

NumberDigits ::= #2 information format + #12 digits Lat./Long. (degrees, minutes, seconds) + #2 digits mapping of Extent and Format of Uncertainty.

For the field originalCalledNr:

NumberDigits ::= 1122XY(Z)

4. References

- E.164 - The international public telecommunication numbering plan
- EN 300 196-1 – DSS1; Generic functional protocol; Part 1: Protocol specification
- EN 300 207-1 – DSS1; Diversion supplementary services; Part 1: Protocol specification
- EN 300 403-1 – DSS1; Signalling network layer for circuit-mode basic call control; Part 1: Protocol specification
- Q.699 - Interworking between ISDN access and non-ISDN access over ISDN User Part of Signalling System No. 7
- Q.732 - Call diversion Recommendation groups four services the stage 3 descriptions (CFU, CFNR, CFB, CD)
- Q.761 - Signalling System No. 7 - ISDN User Part functional description
- Q.762 - Signalling System No. 7 - ISDN User Part general functions of messages and signals
- Q.763 - Signalling System No. 7 - ISDN User Part formats and codes
- Q.764 - Signalling System No. 7 - ISDN User Part signalling procedures
- Q.931 - ISDN user-network interface layer 3 specification for basic call control
- Q.932 – DSS1; Generic procedures for the control of ISDN supplementary services
- Q.952 - Stage 3 description for call offering supplementary services using DSS 1 - Diversion supplementary services