European Commission

Pilot project on the design, implementation and execution of the transfer of GNSS data during an E112 call to the PSAP

Contract No 440/PP/GRO/PPA/15/8308

Deliverable D4.1-D4.2 - Tests specification

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LIST OF ABBREVIATIONS

3GPP - 3rd Generation Partnership Project

A-GNSS - Assisted Global Navigation Satellite System

A2C - Authorities to Citizens communication

ACE - Accredited Center of Excellence

AML - Advanced Mobile Location

API - Application Program Interface

BSC - Base Station Controller (2G)

BSSAP-LE - LCS Extension for Lb, Lp and Ls interfaces

BSSMAP-LE - BSSMAP LCS Extension

BSSLAP - BSS LCS Assistance Protocol

C&C - Command & Control

C2A - Citizens to Authorities communication

CAD - Computer-aided dispatch

CAPEX - Capital expenditures

CEN - European Committee for Standardisation

CERN - European Organisation for Nuclear Research

CNES - French Space Agency

CS – Creativity Software

EC - European Commission

E-CID – Enhanced Cell ID

ECAS - Emergency Call Answering Service

ECC - Electronic Communications Committee

EE - British mobile phone operator, formerly Everything Everywhere

EGNOS - European Geostationary Navigation Overlay Service

E-GNSS – European Global Navigation System

EISEC - Enhanced Information System for Emergency Calls

ESA - European Space Agency

ESSN - Emergency Services Staff Network

ETC - Electronic Toll Collection

ETSI - European Telecommunications Standards Institute

EU - European Union

FP7 - Framework Programme 7

GIS - Geographical Information System

GMLC - Gateway Mobile Location Center

GNSS - Global Navigation Satellite System

GPS - Global Positioning System

GSM - Global System for Mobile Communications

HSS - Home Subscriber Server

ICE - In Case of Emergency

IETF - Internet Engineering Task Force

IP - Internet Protocol

IPR - Intellectual Property Right

IRSN - French Nuclear Safety Institute

Iupc - Interface between RNC and SAS (RNC interface)

IVE - in-vehicle equipment

IVS - in-vehicle systems

KPI - Key Performance Indicator

LAC - Location Area Code

LBS - Location based Services

LCS - LoCation Services

LCS-AP - LCS Application Protocol

LPP - LTE Positioning Protocol

LTE - Long-Term Evolution

LPP - LTE Positioning Protocol

MAC - Media Access Control

MEP - Member of the European Parliament

MLC - Mobile Location Centre

MME - Mobility Management Entity (4G)

MNO - Mobile Network Operator

MSD - Minimum Set of Data

MSG - Mobile Standard Group

MSISDN – Mobile Station Integrated Services Digital Network Number

MT-LR - Mobile Terminating Location Request

NG - Next Generation

NG112 - Next Generation 112

OPEX - Operating Expenditures

OS – Operating System

OTDOA - Observed Time Difference Of Arrival

PCAP - Positioning Calculation Application Part

PCO - Project Control Office

PEMEA - Pan-European Mobile Emergency Application

PSAP - Public Service Answering Point

R&D - Research & Development

RNC - Radio Network Controller (3G)

Rx - Received Signal level

RRLP - Radio Resource Location services Protocol

RTT – Round Trip Time

SAS - Standalone SMLC

SET - SUPL enabled terminal

SIM - Subscriber Identity Module

SIP - Session Initiation Protocol

SL - SUPL Location

SLA - Service Level Agreement

SLC - SUPL Location Center

SLP - SUPL location platform

SMLC - Serving Mobile Location Center

SMS - Short Message Service

SSID - Service Set IDentifier

SUPL - Secure User Plane

TDOA - Time Difference of Arrival

TA - Timing Advance (between an MS and its serving BTS)

TL - Task Leaders

TLRR - Trigger Location Reporting Request

TM - Technical Manager

TOA - Time of Arrival

TTFT - Time To First Fix

WP - Work Package

WPL - Work Package Leader

UE - User Equipment (mobile)

UMTS - Universal Mobile Telecommunication System

URI - Uniform Resource Identifier

URN – Uniform Resource Name

WGS84 - World Geodetic System Datum 84

VoLTE - Voice over LTE

1. INTRODUCTION

1.1 PLACE OF THIS DOCUMENT AND OBJECTIVES

This document is the "Tests technical design and specification", identified as D4.1 and D4.2 in the list of project deliverables.

It is generated as part of the contract 440/PP/GRO/PPA/15/8308.

The objectives of this document are to specify the trials and specific technicalities related to the architectures selected for the pilots in D3.3. As a reminder, here are the four architectures selected for the pilots:

- **Architecture 1:** Handset hybrid positioning method + E-GNSS SUPL server and client + SMS transmission. This architecture aims to evaluate the added value of Galileo GNSS system (Precision/Accuracy; Response Time, …) in the process of estimating the caller location in the case of an emergency call.
- **Architecture 2:** Handset hybrid positioning method + SMS transmission international roaming enabled. This architecture aims to test the transmission of caller location using SMS in the case of international roaming conditions.
- **Architecture 3:** Handset hybrid location method + SMS transmission method + NBL Location Calculator based on Radio Measurement Report (RMR). For this architecture, the pilots will focus on offline tests of the location estimate process using enhanced Network-Based Location methods based on the Radio Measurement Report sent by the handset to the Mobile Network Operator. In this architecture, we should distinguish the so called HELP112 Location Server that receive and decode the location estimated by the handset location API (this location estimate is then available for the PSAP), and the so called Location Calculator that uses the Radio Measurement Report (sent along with the handset based location estimate) to compute another location estimate based on NBL methods (TA, Enhanced Cell-Id, OTDO-A, …). The location computed by the Location Calculator using the RMR is used as a safety net in the case where no location or a simple Cell-Id location is returned by the handset.
- **Architecture 4:** Handset hybrid location method + Data channel transmission method. Pilots will focus here on testing the transmission of location data using the data channel (HTTPS).

The technical description of these four architectures is given in HELP112 deliverable D3.2.

Each test will be described in one section of this document with regards to the technicalities to be implemented in the selected pilots. For each test previously defined and their related pilot(s), the last section of the document will describe the use cases of the test with regards to the User Scenarios as defined in D1.1 and D3.1.

The chart overleaf defines the place of this document and its interaction with other work packages deliverables:

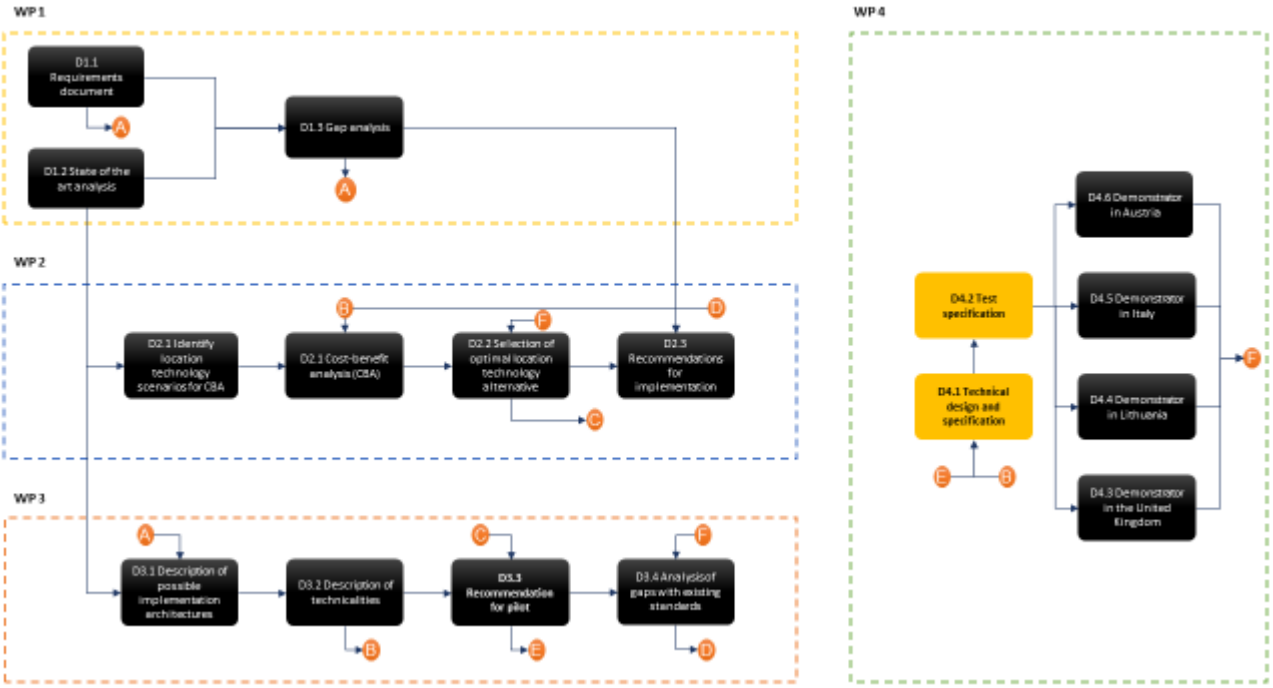

Table 1 - HELP112 flow chart

As a reminder, here are the goals of each work package's deliverable:

- WP1:
  - D1.1: Defines the **user requirements and formulates a set of user scenarios** that will lead the implementation and evaluation of the architecture.
  - D1.2: Analyses and compares the **existing solutions and the underlying technologies** for the provision of caller location.
  - D1.3: Analyses how **existing solutions satisfy the requirements,** reports the **barriers for deployment** and provides **recommendations for the implementation.**
- WP2:
  - D2.1: Defines the **key location and transmission technology scenarios** and assess the **costs and benefits of each scenario.**
  - D2.2: Recommends **the optimal scenario(s) for the help112 caller location** based on the results of the cost-benefit analysis.
  - D2.3: Provides **a more detailed assessment of the costs linked to implementation of the selected technology scenario(s)** as well as **key operational and financial recommendations.**
- WP3:
  - D3.1: **Defines possible implementation architectures for the pilot sites**, covering location/transmission tech. alternatives of WP1.
  - D3.2: Describes **technicalities of these architectures** and recommendations for their implementation.
  - D3.3: **Selects the architecture to be deployed** for the pilots based on outputs of WP2.

- D3.4: **Analyses the gaps between the selected architecture and the existing standards** (eCall, 3GPP, ECC-REP-225).

- WP4:
  - D4.1: **Describes the necessary modifications, adaptations, and new development in the PSAP** based on D3.2 outputs.
  - D4.2: **Specifies the tests to be performed in each pilot** based on the Architectures selected in D3.3 and on the User Scenarios.
  - D4.3: Describes **the implementation process and tests results** of the selected architectures in the **UK pilot.**
  - D4.4: Describes **the implementation process and tests results** of the selected architectures in the **Lithuanian pilot.**
  - D4.5: Describes **the implementation process and tests results** of the selected architectures in the **Italian pilot.**
  - D4.6: Describes **the implementation process and tests results** of the selected architectures in the **Austrian pilot.**

1.2 FOREWORD

Emergency caller location is the most important piece of information for both PSAPs and first responders. Ensuring it is accurate, reliable and timely will save lives and significant emergency services resources. Not having it will mean negative outcomes for our citizens.

In the absence of a detailed and prescriptive regulatory framework, emergency mobile caller location information in Europe has typically relied on Cell-ID. Often, Cell-ID is inadequate because the cell radius is too large, notably in rural areas, and sometimes the serving cell might not be the closest one to the handset.

Developments in location technologies and the proliferation of GNSS enabled smartphones are leading to improved location information being available in the handset. Making such handset derived positioning information available to PSAPs during emergency communications in a secure and reliable manner is highly desirable.

This consortium, known as the HELP112 consortium, aims demonstrate that accurate and reliable caller location information is highly effective and is also highly efficient. It also studies possible deployment strategies across Europe in a cost effective manner, securing better outcomes for our citizens and simultaneously not placing any additional burden on the emergency services, mobile network providers or public authorities.

1.3 APPLICABLE DOCUMENTS

AD	Title of the document & reference
AD 1	Contract 440/PP/GRO/PPA/15/8308
AD 2	Help112 Consortium Agreement

Table 1 – Applicable documents

1.4 REFERENCE DOCUMENTS

RD	Title of the document & reference
RD 1	Help112 Technical, Management & Financial Proposal TPZF/SSA-T2015-PP-0451 is1.0 31/07/2015
RD 2	Help112 Requirements Document D1.1
RD 3	Help112 Requirements Document D3.1
RD 4	Help112 Technical description D3.2

Table 2 – Reference documents

2. GENERIC TEST OF ESTIMATE AND TRANSMISSION OF HANDSET BASED LOCATION DATA TO EMERGENCY SERVICES.

2.1 TEST-BED TECHNICALITIES

The generic test of estimate and transmission of handset based location data to emergency services defines the procedure to test the estimate of the location of an emergency caller triggered by a call to 112 or whatever national emergency number using the caller's handset own capabilities (GNSS, WiFi, …), and the transmission of the location data from the handset to the PSAP. This generic test will be the basis for the following specific tests:

- Test of SMS transmission method (Section 3).
- Test of data channel (HTTPS) transmission method (Section 5).
- Test of SMS transmission method international roaming enabled (Section 4).
- Test of Galileo added value in caller's location estimate process (Section 6).

The pilots which are going to test the estimate and transmission of handset based location data to emergency services are under the process of implementing HELP112 solutions on the basis of Advanced Mobile Location (AML). AML process is fully compliant with HELP112 architectures 1, 2, and 4 described in HELP112 deliverables D3.1 and D3.2, and particularly with the location MSD (Minimum Set of Data) defined for HELP112 solutions. The following sub-section described the test process and are based on the AML "Trial Guide and Test Results" [1].

2.2 TEST DESCRIPTION

The tests consist of a voice call to 112 (a national emergency number may be used if implemented as part of the solution tested) and the location is automatically sent to 112 or the country specific emergency number for location data.

To avoid any confusion on the live service, there is a script to be followed for speaking to the 112 call handling agent at the PSAP answering the call. Test calls need to be planned and agreed with the PSAP call handling team – contact (insert local PSAP email address) using "HELP112 emergency test calls" as the subject.

The test results will be summarised by PSAP team providing different results about the location provided by the handset based location solution, including:

- An analysis of the rate of calls with handset location provided to the PSAP.

1

Please see the second part of the AML Specifications & Requirements document, starting from page 19.

- An analysis of the improvement of precision brought by the handset based location solution when compared to network provided cell coverage.
- An analysis of the response time of the HELP112 handset based location solution.

2.2.1 General Testing

2.2.1.1 Handset settings

- Data settings – If it is not specifically instructed to turn OFF the data connectivity in the related test, mobile data is to be enabled at all times.
- Time settings – automatic (i.e. aligned with network time, not set by user).
- Network Settings – automatic (i.e. uses 4G, 3G or 2G).
- HELP112 handset battery Protection Settings – set as "on".

Battery – battery is expected to have at least 15% battery charge (To be configured on the handset if needed).

2.2.1.2 Wifi mode

Wifi can be enabled/disabled according to the individual tests described later.

2.2.1.3 "Typical User" settings for location functionality

Three sets of tests are defined for the different types of location (use cases) in section 2.3 in order to test a handset's ability to provide a location using Assisted GNSS, Wifi, cell coverage or standalone GNSS. To be sure that the HELP112 solution is activating the GNSS and WiFi sensors when a call to 112 is made, it is helpful to use the three Android Location modes as our three "typical user" types:

A. High Accuracy (the "use everything for best service" user that can use assisted GNSS (A-GNSS), WiFi or Cell ID based locations
B. Battery Saving (for the "careful user", WiFi and cell only),
C. Device Sensors (privacy conscious setting, uses stand-alone GNSS).

For other handset operating systems, the nearest equivalent should be used.

Whatever the location mode set on the phone (A, or B, or C), the HELP112 handset software shall activate the GNSS and WiFi sensors during the emergency call, and then turn them to the state they were prior to the emergency call (disabled or enabled depending on the settings of the phone prior to the emergency call). According with recital (36) and Art.10 of the Directive on privacy and electronic communications (Directive 2002/58/EC) Member States may restrict the users' and subscribers' rights to privacy with regard to calling line identification where this is necessary to trace nuisance calls and with regard to calling line identification and location data where this is

necessary to allow emergency services to carry out their tasks as effectively as possible. In doing so, Member States shall ensure that there are transparent procedures governing the way in which a provider of a public communications network and/or a publicly available electronic communications service may override the elimination of the presentation of calling line identification and the temporary denial or absence of consent of a subscriber or user for the processing of location data, on a per-line basis for organisations dealing with emergency calls and recognised as such by a Member State, including law enforcement agencies, ambulance services and fire brigades, for the purpose of responding to such calls. For these purposes, Member States may adopt specific provisions to entitle providers of electronic communications services to provide access to calling line identification and location data without the prior consent of the users or subscribers concerned.

The activation of GNSS and WiFi sensors allows to compute a location using all the positioning methods available at the handset level with regards to the environment of the caller.

To avoid any potential additional charge for the caller, the data connectivity is not turned ON during the emergency call if turned OFF prior to the call. If the data connectivity is not available during the emergency call, the handset will not have any access to GNSS assistance data or WiFi access point database. In this case, the GNSS location process might be too long with regards to HELP112 response time requirement, or the location computed using WiFi positioning method might be erroneous (e.g: the first location returned by the phone is the last WiFi location estimate, but the caller is not close to the related WiFi access point anymore). This is a direct consequence of the lack of GNSS assistance data. If no assistance data are available, the receiver will have to decode all the navigation message from the GNSS signal in order to know the position of the satellites in view. This process could last several minutes and therefore not be compliant with HELP112 response time requirement which says that the response time of the location solution shall be less than 30 seconds.

2.2.2 Location accuracy tests

For the purpose of HELP112 pilots, all tests assigned to a pilot site should be carried out sequentially (i.e. without switching "typical user" type between tests). That is to say A tests, B tests, and C tests are completed sequentially for a single phone.

For each phone to be tested, a pilot will have to conduct one test for each assigned user scenario (use case).

2.2.3 Transmission methods tests

Transmission method such as SMS, HTTPS, or SMS when roaming would not be tested in the whole range of User Scenarios assigned to a pilot but probably only once or twice in a suitable location.

2.2.4 The Test Process

For each user scenario:

1. Print out the Test Form from Section 2.2.8 of this document.
2. Find a place as described in the test description, but choose a location that is near a landmark you can identify later on Google maps or another on-line mapping source, for instance a road junction.
3. Write down the date and your text description of your location onto the test form. This should be enough to help you find it later on a map, plus note anything that might affect GNSS signals such as heavy rain or thick cloud cover.
4. Conduct each test for the location setting the GNSS and WiFi capabilities as specified in the test form and for the tested user scenario, and noting down the time you initiated the call.
5. Make the emergency call following the steps outlined in Section 2.2.7.
6. Once you are back in office and have a PC, fill in the provided Microsoft Excel spreadsheet (see section 2.2.9 "Test results") with the date you wrote down on the test forms. Enter one row per test. To get the longitude and latitude of your test location see the section 2.2.5 ("Determining your Longitude and Latitude").

Once you have tested all of your User Scenarios, please email back the Excel spreadsheet to the PSAP Test contact point.

2.2.5 Determining the Longitude and Latitude values for your Test Position

In order to test the accuracy of the coordinates in the HELP112 message, it is necessary to determine the actual position of where the test call is made. This can be done by using this web tool: http://www.nanchatte.com/map/circleService-e.html. It can be useful to use reference landmarks for pinpointing your exact location (using satellite view on internet mapping tool).

Once your position is located, copy the Lat / Long (decimal WGS84) values into the test rows in your spreadsheet for this location. Example below:

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	Telephone #	Telephone model	User Scenario Id	Date	Time	Test Name	Latitude (degrees WGS84)	Longitude (degrees WGS84)	Text description of location	Estimated Latitude (degrees WGS84)	Estimated Longitude (degrees WGS84)	Precision (meters)	Accuracy (meters)	Location method
2	073647326348	Samsung S7	1	20/07/2016	10:45	1	52.195455	1.405907	This is an example row to show what is expected in each cell	52.205455	1.410907	1000	200	Cell-Id
3	073488727427	HTC wildfire S	1	22/07/2016	10:54	A	52.387119	1.273282	Standing on the first road junction on the left from Blakes farm in the direction of the shops	52.387112	1.273287	8	2	A-GPS
4	073488727427	HTC wildfire S	2	22/07/2016	13:56	B	52.387119	1.273282	Standing on the first road junction on the left from Blakes farm in the direction of the shops	52.396996	1.279362	1100	210	Cell-Id
5	073488727427	HTC wildfire S	2	22/07/2016	14:03	C	52.387119	1.273282	Standing on the first road junction on the left from Blakes farm in the direction of the shops	52.387139	1.273261	10	2.6	GPS
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2.2.6 Summarising Test Results

The pilot will normally provide a summary of the test results highlighting the following key measures:

- Average time for HELP112 location data to reach PSAP's HELP112 Location Server (a location server retrieves and decode the location message sent by the handset and then stores the location information and makes it available to the PSAPs – see D3.2 for further details). This will be measured at PSAP level (difference between the time of the location estimate arrival at the PSAP call-taker level, and the time of the beginning of the call).
- Accuracy and precision (radius) of HELP112 location
- % of HELP112 locations estimated based on GNSS, WiFi and Cell
- % HELP112 failures
- Comparison with existing network-based accuracy and precision obtained from query to mobile network's GMLC if available.
- Check the compliance of the location information received at PSAP level with the HELP112 location Minimum Set of Data (MSD) defined in D3.1.
- A compliance matrix of the solution tested will be provided for each type of User Requirements (Please refer to list of User Requirements defined in D3.1). All information that might justify the compliance or the non-compliance of the solution with a user requirement will be written in the pilot report. The compliance matrix templates are presented in Appendices A to E of this document.

2.2.7 Emergency call procedure

This is an example for the UK Stage 1 PSAP – each country will want to adjust to its own PSAP call handling processes for test calls.

For each test, please follow the script below and copy the responses to the test sheets. Obtaining the coordinates (Northings & Eastings) is optional as Stage 1 PSAP will be able to retrieve these through their records.

NOTE: Please can you ensure that you clearly mark down the date and time of the tests you have made (this can normally be obtained from the mobile's phone log). For each test please can you note below the precise location of where the call was made from.

Any questions on the script please contact (insert country specific PSAP contact point) using "HELP112 emergency test calls" as the subject.

2.2.7.1 Voice script

Person	Dialog	Record Response
Tester	**This is "HELP112 pilot" with a test call**	
Operator	May I have your initial please (this may be requested later in the call)	
Tester	**Please confirm the telephone number is – (*Read the telephone number, or MSISDN, of your mobile phone*).**	
Operator	Will confirm Yes or No.[2]	
Tester	**What is shown in the Service Type? (*This will be the mobile network name*).**	
Operator	Will read back the information presented.	*e.g. T-Mobile, Three.*
Tester	**What is the zone code or Cell Id please?**	
Operator	Operator will read out the zone code (4 digits) or cell Id (10 digits) presented.	*e.g. 1234*
Tester	**Are Police Connect-to Numbers present?** **Which Police abbreviation please?**	
Operator	Will confirm Yes or No and give the abbreviation.	*e.g. NYKS*
Tester	**Please can you type HELP112D in the notes field.**	
Operator	Yes.	
Tester	**Thank you, that completes the test.**	

[2] *PSAP operators may not give this information but can confirm it.*

2.2.8 Test form

User scenario Id	Instructions		
Write User scenario Id here	*Write User scenario description here*		
Date of Test	Text description of your location		
Test	WiFi	Time of Test	Comments
A	**ON**		
B	**ON**		
C	**OFF**		

2.2.9 Test Results

Copy this template and record test results for returning to PSAP

HELP112-Test-Results-template-HBL-ger

3. TEST OF INTERNATIONAL ROAMING-ENABLED SMS TRANSMISSION (ARCHITECTURE 2)

3.1 TEST-BED TECHNICALITIES

The pre-requisites to test the international roaming-enabled (Intra EU as well as Outside-EU) SMS transmission of location data for an E112 call are the following:

- Implementation of HELP112 architecture 2 described in HELP112 deliverable D3.2. Among the two solutions proposed in document D3.2, the pilot site(s) implementing this architecture have all chosen to implement solution 2-A (See D3.2 for further details).

  The chart below shows the components involved in Architecture 2-A and the interfaces between them:

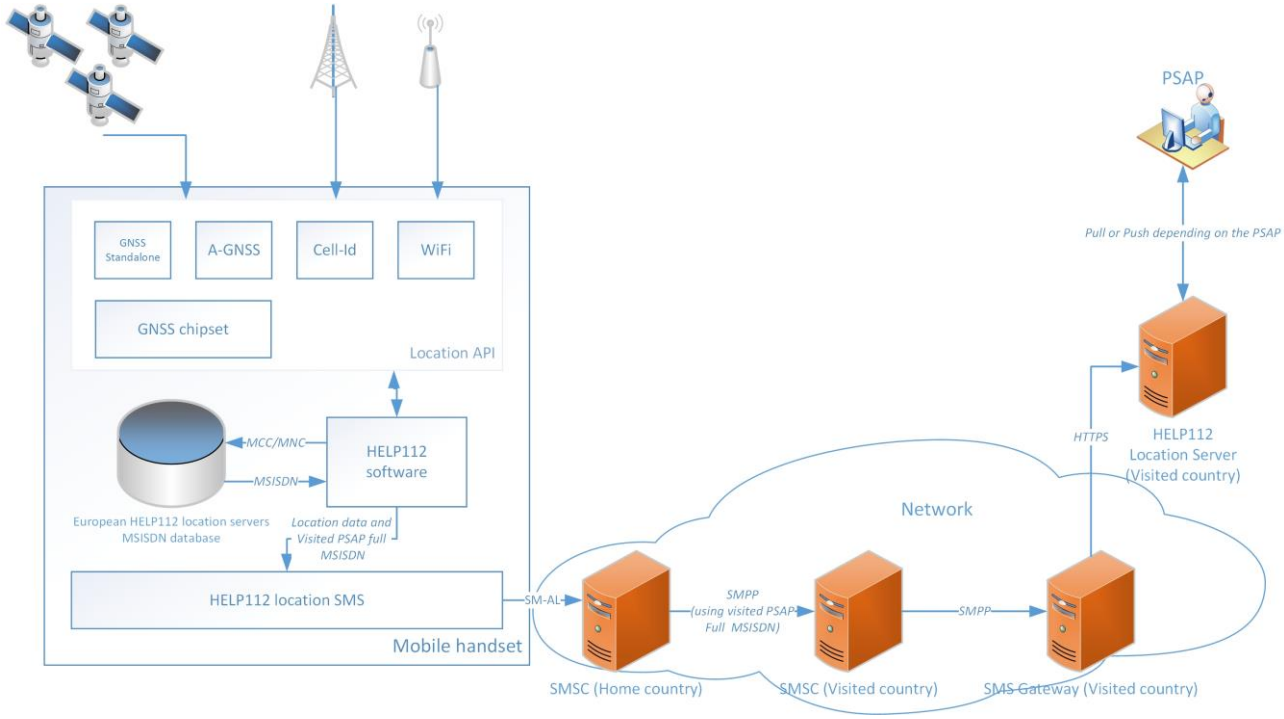


Figure 1 - Architecture 2-A components description

- This test has to be conducted between two pilots, acting as Home and Visitor network/PSAPs.
- One pilot (Pilot A – Visited Network) will implement Architecture 2-A receiving the location data from the network to the PSAP.
- The other pilot (Pilot B – Home Network) will provide a smartphone having the HELP112 handset's software in the way presented in Architecture 2-A, that is to say a HELP112 software that sends the location data SMS to the long number of the appropriate HELP112 location server based on the MCC (Mobile Country Code) of the country the tester is calling from (Pilot A country – Visited Network) instead of 112.

- To do so, pilot B (Home Network) will have to provide pilot A (Visited Network) with the corresponding smartphone embedding the HELP112 software of HELP112 Architecture 2-A, and a SIM card of pilot B country (Home Network).

3.2 TEST DESCRIPTION

For each phone to be tested, this test is basically the generic test described in Section 2 where the call is made in pilot A country (Visited Network) using a pilot B (Home Network) phone embedding a pilot B (Home Network) SIM card.

The expected result is to receive the location data at the pilot A (Visited Network) HELP112 location server and not at pilot B (Home Network) location server.

In order to test the correct transmission of the HELP112 location SMS to the appropriate PSAP, the test will be done for one or two User Scenarios.

The selected User scenario(s) for each pilot site will be defined later in this document.

The international roaming test using SMS transmission will be done along with the accuracy tests for the related User Scenarios.

4. TEST OF DATA CHANNEL (HTTPS) TRANSMISSION (ARCHITECTURE 4)

4.1 TEST-BED TECHNICALITIES

The pre-requisites to test the transmission of HELP112 location data using the data channel (HTTPS) are the following:

- Implement HELP112 architecture 4 as described in HELP112 deliverable D3.2. Among the two solutions proposed in document D3.2, the pilot site(s) which will implement this architecture all chose to implement solution 2-A (National approach - See D3.2 for further details).
- All pilots need to agree on an ICD (Interface Control Document) for the sending of HELP112 location data using HTTPS (e.g.: XML over HTTPS as described in D3.2) before implementing this solution. The ICD used for the test is the one provided by Google for its AEL (Android Emergency Location) implementation of AML (Please see Appendix F for further details).
- OS providers or Handset manufacturers have to provide handsets that implement the solution presented in D3.2. Particularly, the HELP112 handset's software shell send the location data to the URL of the most appropriate HELP112 location server based on the MCC and MNC.

4.2 TEST DESCRIPTION

For this test, the tester will perform the generic test described in Section 2 with different phones (Two or three with SIM cards from different network providers) implementing HELP112 Architecture 2 described in D3.2 in a country where the pilot has also implemented this solution.

The expected result is to receive the location data at the appropriate PSAP using the data channel to convey the data.

In one or two countries, this test could also be done with a phone embedding a SIM card from a foreign network provider in order to test the handling of international roaming using this solution.

For each pilot concerned, this test will be done for one or two User Scenarios focusing on the data connectivity settings and availability.

The chosen User scenario(s) for each pilot site will be defined later in this document.

The international roaming test using SMS transmission will be done along with the accuracy tests for the related User Scenarios.

5. TEST OF GALILEO ADDED VALUE (ARCHITECTURE 1)

This section aims at defining the technicalities related to the implementation of the test-bed for architecture 1, and the related test to evaluate the benefits of using Galileo GNSS system to compute the location of the caller in the case of a call to emergency services. Due to the impossibility to implement an end-to-end solution that uses Galileo assistance data during the timeframe of HELP112 project, and the necessity to master the full location process, the tests of location estimate using both Galileo signals and Galileo assistance data will be performed offline and then compared to the locations calculated without using Galileo in the exact same conditions (environment and time). To, perform these tests, we will make use of chipset manufacturers test device to compute location estimates for several User Scenarios (defined later in the document) using GNSS signal in space (including Galileo). Since these tests are going to be performed by Telespazio France completely offline from any emergency call, and therefore from any emergency services infrastructure, they will be performed in France in Toulouse surroundings, apart from any HELP112 pilot site. This will allow to fully master the test process (locations, conditions, equipment,…), handle any issue that could happen during the test phase, and be able to postpone any test if the required conditions are not met.

In addition, items of the first Galileo enabled smartphone (i.e. the BQ Aquaris X5 plus with firmware release upper than 1.5.0 – Qualcomm Galileo enabled GNSS engine inside) will be sent in two pilot sites in order to be tested along with the other phones in an E112 end-to-end solution performing the generic test depicted in section 2. For these pilots, the locations provided by the BQ Aquaris X5 plus will be compared to the location provided by the other phones and the location provided by the network (Cell-Id if available at the PSAP level) in order to assess the impact of Galileo signal in the location estimate accuracy/precision and process time (TTFF). Nevertheless, using these commercial phones brings some limitations to the tests of Galileo added value in the location estimate process, such as:

- The Android location API only provides the location estimate, its type (GNSS, WiFi, Cell-Id), and its precision.
- The Android location API of Android Marshmallow (Release of Android installed in the BQ Aquaris X5 plus) cannot provide the information about the GNSS constellation(s) used to compute the location estimate.
- Using this phone, it is not possible to master the use or not of GNSS assistance data.
- Using this phone, it is not possible to select which GNSS constellation(s) to be used in the location estimate process (in order to effectively see the added value of Galileo in the location estimate process).

That is the reason why offline tests will remain interesting to go deeper in the evaluation of Galileo added value in the location estimate process (Precision/Accuracy, Time To First Fix, Sensitivity). In the following subsections, we will focus on the description of these offline tests using chipset manufacturers test devices.

5.1 TEST-BED TECHNICALITIES

The technical pre-requisites to test the added value of using Galileo in the location estimate of a person in distress during an emergency call to 112 are the following:

- Get test platforms including GNSS chipsets from two different manufacturers with the following features (4 platforms – 2 from one chipset manufacturer and 2 from another would be needed to cover all the aspects of this test):
    1. A multi-constellation GNSS chipset including Galileo. The choice of the GNSS chipset shall be relevant with regards to the smartphone market.
    2. This chipset shall be able to receive and use assistance data for GPS and Galileo (at least predictive orbits).
    3. Allow to configure which constellation (GPS a/o GLONASS a/o Beidou a/o Galileo) to be used in the location estimate process.
    4. Allow to configure for which constellation(s) the assistance data are sent to the chipset.
    5. Allow to reset all previous data that could accelerate the location estimate process. That is to say be able to configure the platform in order to compute a location from a cold start.
    6. Log the start time of the location estimate process.
    7. For each location estimate:
        - Log the timestamp of the location (in GPS time),
        - Log the location estimate in WGS84 coordinates system (in decimal degrees,with at least five decimal digits to get a ~1m precision),
        - Log the precision of the location estimate (radius of confidence in meters),
        - Log the confidence in the location estimated (in percentage),
        - Log the location method used to calculate the location estimate,
            - Cell-Id,
            - WiFi,
            - GNSS,
            - And any hybrid solution.
        - Log which constellation(s) and which satellite(s) were in visibility of the GNSS antenna at the location estimate time,
        - If GNSS has been used in the location estimate process:
            - Log which constellation(s) and satellite(s) are used to compute the location,
            - Log the Dilution Of Precision value (DOP), at least the Horizontal-DOP value (H-DOP),

- And for each constellation used to compute the location estimate, log whether or not assistance data are used and their type (Almanac, Doppler, …).

8. And log the end time of the location estimate process.
9. All logs mentioned above shall be written in a readable format.

5.2 TEST DESCRIPTION

The added value of Galileo in the location estimate process will be tested by performing the test depicted in Section 6.2.1 for several selected User Scenarios using the test platforms described in section 6.1.

The User Scenarios will be chosen based on the difficulties to get GNSS location in the related environment. The idea being to prove that Galileo (Assisted or not) improves the availability of GNSS location estimate and its TTFF (Time To First Fix) in environment with high local constraints such as forest, urban canyon, indoor not far from a window, and so forth.

The selected User Scenarios are depicted in section 6.2.3.

5.2.1 The test process

In the test described hereafter, two platforms with the same E-GNSS chipset and the same functionalities are used in parallel. One of these two platforms will perform location estimate using all the available constellations including Galileo and the other platform will perform the same location estimate, at the exact same time, but without using Galileo. For one chipset manufacturer, if only one platform is available, the tests with and without Galileo for a User Scenario will be performed sequentially by following the test process hereafter.

Here is the test process to follow and fill in for each selected User Scenario:

User scenario Id	Instructions
Write User scenario Id here	*Write User scenario description here*

Pre-requisites

- Get the required test platform from chipset manufacturers. In the case of 4 platforms (from 2 manufacturers – 2 platform per manufacturer), each platform will be noted as follows:
  - Manufacturer 1/Platform 1 : Id – P11
  - Manufacturer 1/Platform 2 : Id – P12
  - Manufacturer 2/Platform 1 : Id – P21
  - Manufacturer 2/Platform 2 : Id – P22

- Perform the test in a timeslot where at least 3 Galileo satellites are above the horizon at the location the test is performed.

- In order to test the accuracy of the coordinates in the HELP112 message, it is necessary to determine the actual position of where the test call is made. This can be done by using the following mapping tool that allows you to work out your location in appropriate coordinates (WGS84): http://www.nanchatte.com/map/circleService-e.html. It can be useful to use reference landmarks for pinpointing your exact location (using satellite view on internet mapping tool). Once your position is located, copy the Lat / Long (decimal WGS84) values into the test rows in your results spreadsheet for this location.

Date of Test	Text description of your location

Action Id	Description	Comments
Cold start without assistance data		
1	Configure P11 to: • Perform location estimate using all the constellations available **<u>including</u>** Galileo. • **<u>Do not use assistance data</u>** for any constellation during the location estimate process. • **<u>Erase all previous assistance data</u>** (such as predictive orbits) that could improve the location process (Cold start).	

2	In the results spreadsheet, note that P11 is configured in cold start mode, without assistance data, and with all GNSS constellations **including** Galileo (enumerate each constellation configured).	
3 **Optional (if P12 is available)**	Configure P12 to: • Perform location estimate using all the constellations available **except** Galileo. • **Do not use assistance data** for any constellation during the location estimate process. • **Erase all previous assistance data** (such as predictive orbits) that could improve the location process (Cold start).	
4 **Optional (if P12 is available)**	In the results spreadsheet, note that P12 is configured in cold start mode, without assistance data, and with all GNSS constellations **except** Galileo (enumerate each constellation configured).	
5	Note the exact date of the test in the results spreadsheet.	
6	Simultaneously start the location process on P11 and P12 (if available) and verify the process is ongoing on each platform.	
7	After 2 minutes, stop simultaneously the location process on P11 and P12 (if available).	
8 **Optional (if P12 is unavailable)**	Repeat actions 3, 4, 5, 6, and 7 with P11.	
9 **Optional (if P21 and P22 are available)**	Repeat action 1 to 8 by replacing P11 by P21 and P12 by P22.	
10	For each platform, repeat the location process 5 times	
Warm start without assistance data		
11	Configure P11 to: • Perform location estimate using all the constellations available **including** Galileo.	

	• **Do not use assistance data** for any constellation during the location estimate process. • **Do not erase all previous assistance data** (such as predictive orbits) that could improve the location process (Warm start).	
12	In the results spreadsheet, note that P11 is configured in warm start mode, without assistance data, and with all GNSS constellations **including** Galileo (enumerate each constellation configured).	
13 **Optional (if P12 is available)**	Configure P12 to: • Perform location estimate using all the constellations available **except** Galileo. • **Do not use assistance data** for any constellation during the location estimate process. • **Do not erase all previous assistance data** (such as predictive orbits) that could improve the location process (Warm start).	
14 **Optional (if P12 is available)**	In the results spreadsheet, note that P12 is configured in warm start mode, without assistance data, and with all GNSS constellations **except** Galileo (enumerate each constellation configured).	
15	Note the exact date of the test in the results spreadsheet.	
16	Simultaneously start the location process on P11 and P12 (if available) and verify the process is ongoing on each platform.	
17	After 2 minutes, stop simultaneously the location process on P11 and P12 (if available).	
18 **Optional (if P12 is unavailable)**	Repeat actions 13, 14, 15, 16, and 17 with P11.	
19 **Optional (if P21 and P22 are available)**	Repeat action 11 to 18 by replacing P11 by P21 and P12 by P22.	
20	For each platform, repeat the location process 5 times	

Cold start with assistance data		
21	Configure P11 to: • Perform location estimate using all the constellations available **<u>including</u>** Galileo. • **<u>Use assistance data</u>** for any constellation during the location estimate process. • **<u>Erase all previous assistance data</u>** (such as predictive orbits) that could improve the location process (Cold start).	
22	In the results spreadsheet, note that P11 is configured in cold start mode, with assistance data, and with all GNSS constellations **<u>including</u>** Galileo (enumerate each constellation configured).	
23 **Optional (if P12 is available)**	Configure P12 to: • Perform location estimate using all the constellations available **<u>except</u>** Galileo. • **<u>Use assistance data</u>** for any constellation during the location estimate process. • **<u>Erase all previous assistance data</u>** (such as predictive orbits) that could improve the location process (Cold start).	
24 **Optional (if P12 is available)**	In the results spreadsheet, note that P12 is configured in cold start mode, with assistance data, and with all GNSS constellations **<u>except</u>** Galileo (enumerate each constellation configured).	
25	Note the exact date of the test in the results spreadsheet.	
26	Simultaneously start the location process on P11 and P12 (if available) and verify the process is ongoing on each platform.	
27	After 2 minutes, stop simultaneously the location process on P11 and P12 (if available).	
28 **Optional (if P12 is unavailable)**	Repeat actions 23, 24, 25, 26, and 27 with P11.	

29 **Optional (if P21 and P22 are available)**	Repeat action 21 to 28 by replacing P11 by P21 and P12 by P22.	
30	For each platform, repeat the location process 5 times	
Warm start with assistance data		
31	Configure P11 to: • Perform location estimate using all the constellations available **<u>including</u>** Galileo. • **<u>Use assistance data</u>** for any constellation during the location estimate process. • **<u>Do not erase all previous assistance data</u>** (such as predictive orbits) that could improve the location process (Warm start).	
32	In the results spreadsheet, note that P11 is configured in warm start mode, with assistance data, and with all GNSS constellations **<u>including</u>** Galileo (enumerate each constellation configured).	
33 **Optional (if P12 is available)**	Configure P12 to: • Perform location estimate using all the constellations available **<u>except</u>** Galileo. • **<u>Use assistance data</u>** for any constellation during the location estimate process. • **<u>Do not erase all previous assistance data</u>** (such as predictive orbits) that could improve the location process (Warm start).	
34 **Optional (if P12 is available)**	In the results spreadsheet, note that P12 is configured in warm start mode, with assistance data, and with all GNSS constellations **<u>except</u>** Galileo (enumerate each constellation configured).	
35	Note the exact date of the test in the results spreadsheet.	
36	Simultaneously start the location process on P11 and P12 (if available) and verify the process is ongoing on each platform.	

37	After 2 minutes, stop simultaneously the location process on P11 and P12 (if available).	
38 **Optional (if P12 is unavailable)**	Repeat actions 33, 34, 35, 36, and 37 with P11.	
39 **Optional (if P21 and P22 are available)**	Repeat action 31 to 38 by replacing P11 by P21 and P12 by P22.	
40	For each platform, repeat the location process 5 times	
41	Extract all the data logged by each platform and process them to get the required results defined in the next section and fill the results test form in.	

5.2.2 Test Results

Hereafter is the Galileo test results form to fill in during the tests.

HELP112-Test-Resul
ts-template-Galileo.:

In addition to the information gathered in the Test results form, we will provide a report comparing for each selected User Scenario the location estimated using each test platform and each configuration, including:

- The TTFF and the positioning method used at this moment. This TTFF will be compared to HELP112 RESP_002 requirement (The response time shall be less than 30 seconds for any location solution that provides more accurate and precise caller location and satisfies the accuracy/precision requirements (E-GNSS, A-GNSS, WiFi, Enhanced Cell-ID, …)).
- The location estimate rate with a TTFF < 30 seconds (compliance with RESP_002) with for each of these location:
    - If available, the constellation(s) used to compute the location (GPS and/or Galileo and/or Glonass and/or Beidou).
    - If available, the constellation(s) for which assistance data have been used.
    - If available, the number of satellites used to compute the location and the amount of them related to each constellation (nb_sat_GPS, nb_sat_Galileo, …).

- The location estimate rate with a TTFF > 30 seconds (non-compliance with RESP_002) with for each of these location:
    - If available, the constellation(s) used to compute the location (GPS and/or Galileo and/or Glonass and/or Beidou).
    - If available, the constellation(s) for which assistance data have been used.
    - If available, the number of satellites used to compute the location and the amount of them related to each constellation (nb_sat_GPS, nb_sat_Galileo, …).
- For the location estimated 30 seconds after starting the location estimate process (Location estimate at the HELP112 handset software timeout):
    - If available, the constellation(s) used to compute the location (GPS and/or Galileo and/or Glonass and/or Beidou).
    - If available, the constellation(s) for which assistance data have been used.
    - If available, the number of satellites used to compute the location and the amount of them related to each constellation (nb_sat_GPS, nb_sat_Galileo, …).
- The TTFF mean value.
- The TTFF mean value for the location estimated in less than 30 seconds (HELP112 timeout).
- Rate of location estimate (at the TTFF) with a Precision/Accuracy compliant with HELP112 requirements. A location is taken into account if and only if it complies with HELP112 response time requirement (RESP_002).
- Precision and Accuracy's mean value of the location estimated at the TTFF (if TTFF < 30 seconds) or 30 seconds after starting the location process.
- Precision and Accuracy's standard deviation value of the location estimated at the TTFF (if TTFF < 30 seconds) or 30 seconds after starting the location process.

And for the overall tests (All selected User Scenarios included), a global analyse based on the previous results obtained for each test platform according to each User Scenario and each configuration.

5.2.3 Selected User Scenarios

Among all the User Scenarios defined for HELP112 project in deliverable D1.1 and D3.1, the selected ones for testing the benefits brought by Galileo in the location estimate process are the following:

Id	User scenario description
SCEN_002	Rural building with all location methods available. An outside location out of town and over 3 meters away from buildings that could block GNSS, but where WiFi signals are present. For example, in a village within WiFi range of house with a WiFi router.
SCEN_003	Rural car with GNSS/A-GNSS available but no WiFi available. A location in the open countryside and inside a parked car far away from buildings or constructions that could block GNSS.
SCEN_004	Urban with GNSS/A-GNSS available but disrupted and WiFi available. An outside location in a town or city street where WiFi signals are present and GNSS signals are disrupted by buildings.
SCEN_005	Motorway or Dual carriageway with GNSS/A-GNSS available but no WiFi available. While driving different sides of a carriageway where GNSS signals are available.
SCEN_006	House location with all location methods available. A location inside a house that has WiFi and in a location that offers a partial satellite coverage.
SCEN_007	Office location with WiFi available but no GNSS available. A location inside an office, which itself is deep inside a building where GNSS signals cannot reach, but WiFi is present.
SCEN_008	Urban with mobile data disabled. An outside location in a town or city street where the caller has deliberately disabled his handset data connection.

In addition to the existing User Scenarios, 112ERC (Lithuanian pilot) and NNO (Austrian pilot) shows a great interest in testing HELP112 solution in challenging environment and particularly the added value of Galileo in the location estimate process when the caller is under a dense forest coverage or onto a mountain. This new User Scenarios are the following:

Id	User scenario description
SCEN_014	Rural countryside in a dense forest with GNSS/A-GNSS available but no WiFi available. An outside location far away from buildings or constructions, but under a dense forest coverage that might block GNSS signals.
SCEN_015	Rural countryside onto a mountain with GNSS/A-GNSS available but no WiFi available and bad network coverage. An outside location onto a mountain far away from buildings or constructions that might block GNSS signals, in a location with bad network coverage.

6. TEST OF USER PLANE NETWORK-BASED LOCATION METHOD ADDED VALUE (ARCHITECTURE 3)

As mentioned in HELP112 deliverable D3.2, it will not be possible to test an end-to-end test-bed of Architecture 3, since no handset's software sending the Radio Measurement Report (RMR) along with the location data to the PSAP will be developed in the timeframe of HELP112 project. Nevertheless, it is still possible to test offline the added value of a user plane network based location method as described in Architecture 3. The results of these tests will then be used in order to encourage OS providers/Handset manufacturers to develop the needed handset's software to send the RMR to the Location Calculator (at PSAP level).

We will therefore describe hereafter the technicalities required for the offline tests of the Location Calculator based on the RMR, and then define the related tests to perform in order to see if this location solution meets the related accuracy and reliability HELP112 user requirements.

6.1 TEST-BED TECHNICALITIES

For the purpose of HELP112 project, the tests of this type of location solution will be conducted by Creativity Software using their LocationWise (CS ®) mobile location platform. This platform meets all the technical aspects described in HELP112 deliverable D3.2 concerning the Location Calculator of Architecture 3. Besides, CS can provide a test platform that could be used independently of any MNO infrastructure. For the locations estimated using the LocationWise platform, the required Radio Measurement Reports will be extracted from the Android phone and sent to Creativity Software in UK in order to compute the related locations.

The test description hereafter is an adaptation of CS' document "Proposed Project Plan for a CS – Location Platform Pilot"[3], and will be the basis for the tests of a Location Calculator using the RMR to compute the location of an emergency caller as described in HELP112 Architecture 3 (see deliverable D3.2).

6.2 TEST DESCRIPTION

6.2.1 Prerequisites

1. Two Android phones of different vendors and types. The preferred choice is HTC Wildfire S (Android phone with GPS).

   Using TEMS (ASCOM's) or Nemo (Anite's) mobile phone could also be used.
2. Two local SIM cards – preferably with data enabled.
3. Cell tower data file for the requested areas.

[3] *Creativity Software, Proposed Project Plan for a CS – Location Platform Pilot, Version 1.0, 2016*

6.2.2 Test environment and setup

The test environment will be composed of the test phones for data collection in use cases selected for the related pilot site while CS LocationWise algorithms and databases will be based at CS offices in London. The logical process is described below:

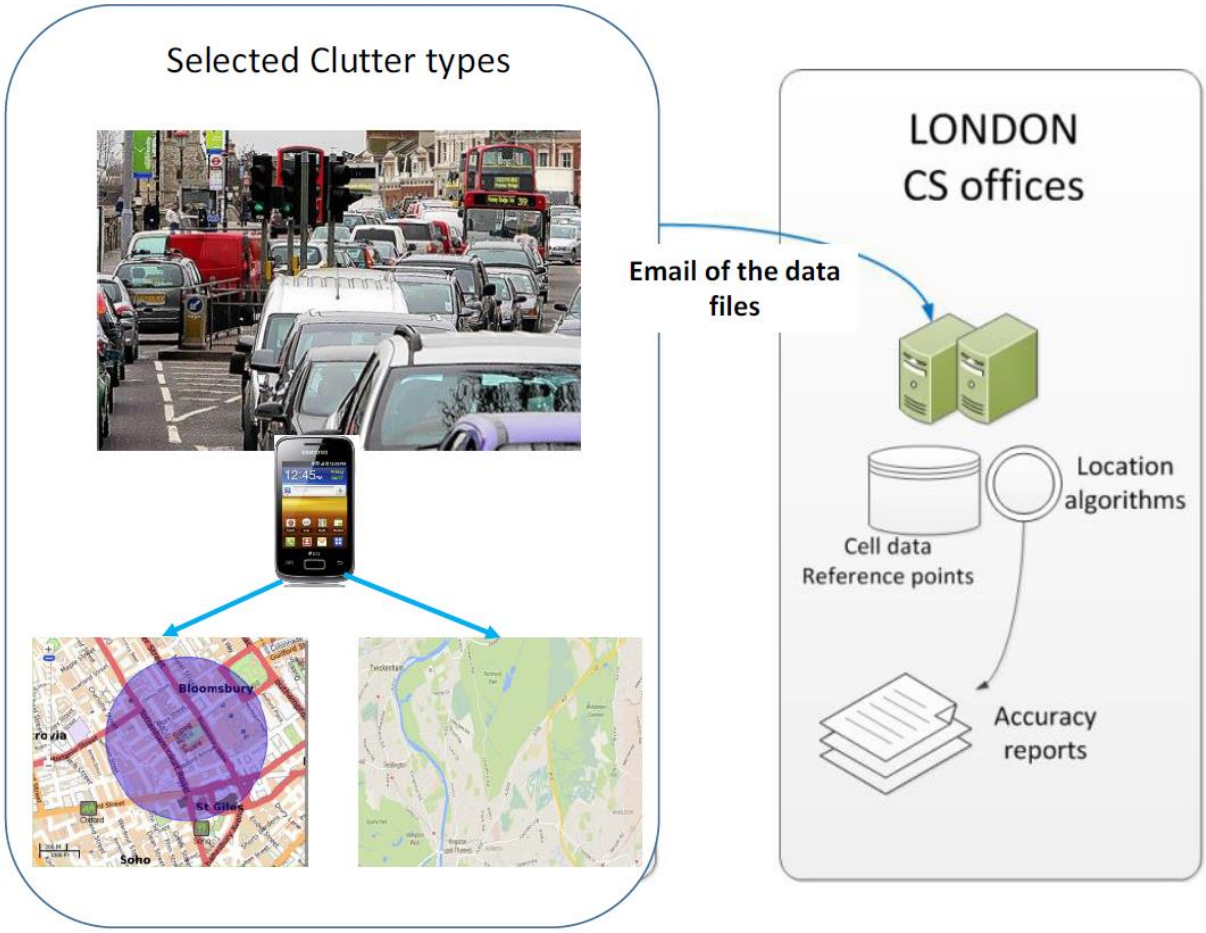


Figure 2 - Location Calculator test - Logical process

6.2.3 Proof of Concept process

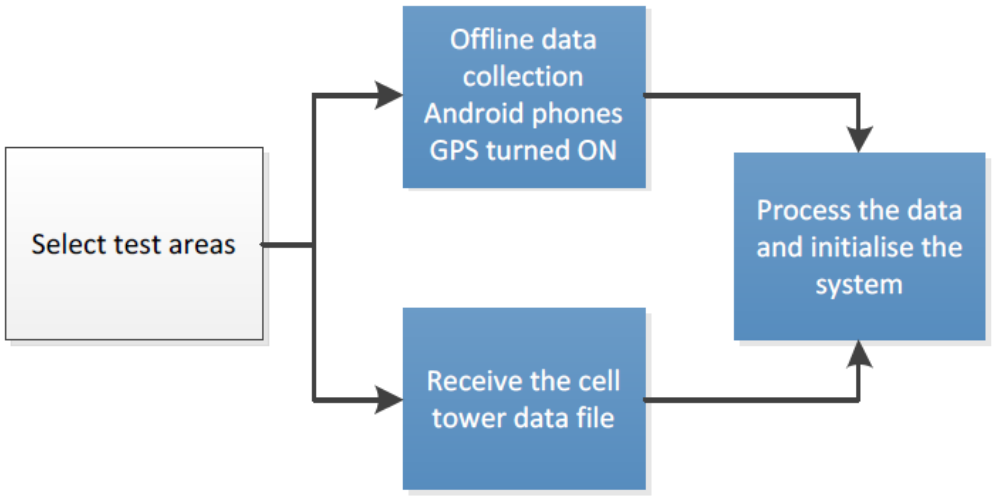
6.2.3.1 Definition of test areas

- For the selected User Scenarios in a pilot site, CS will perform local data collection in a subset of the candidate areas for these User Scenarios, then conduct a number of tests and finally issue a report for these tests.

6.2.3.2 Preparation phase

- CS makes available test phones in pilot countries, while LocationWise server and databases will remain in UK.

- Initial drive test will be conducted.



- It is worth mentioning that the support of MNOs in this phase would be of utmost value by providing:
  - Cell tower database for the 2G network as described in HELP112 deliverable D3.2 on the basis of CS document "Radio Network Data File"[4].
  - Recent 2G drive test for the city (if available), conducted within the target Test areas.

6.2.3.3 Handset's settings

- Data settings – mobile data is to be enabled at all times.
- Time settings – automatic (i.e. aligned with network time, not set by user).
- Network Settings – 2G mode (to correspond to the furnished cell tower database).
- Verify that the handset's battery charge is good enough to perform the test.

6.2.3.4 Wifi mode

Wifi can be enabled/disabled according to the individual tests described later.

6.2.3.5 "Typical User" settings for location functionality

[4] *Creativity Software, Radio Network Data File, Version 1.3, 23th September 2011*

For the Android phone with GNSS capabilities, the "typical user" settings shall be set on "High Accuracy" (the "use everything for best service" user that can use assisted GNSS (A-GNSS), WiFi or Cell ID based locations.

The second phone will have its GNSS capabilities turned OFF.

6.2.3.6 Determining the Longitude and Latitude values for your Test Position

In order to test the accuracy of the coordinates in the HELP112 message, it is necessary to determine the actual position of where the test call is made. This can be done by using an agreed internet mapping tool that allows you to work out your location in appropriate coordinates. It can be useful to use reference landmarks for pinpointing your exact location (using satellite view on internet mapping tool).

Once your position is located, copy the Lat / Long (decimal WGS84) values into the test rows in your test results spreadsheet for this location. Example below:

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	Telephone #	Telephone model	User Scenario Id	Date	Time	Test Name	Latitude (degrees WGS84)	Longitude (degrees WGS84)	Text description of location	Estimated Latitude (degrees WGS84)	Estimated Longitude (degrees WGS84)	Precision (meters)	Accuracy (meters)
2	073647326348	Samsung S7	1	20/07/2016	10:45	User plane NBL - GNSS OFF	52.195455	1.405907	This is an example row to show what is expected in each cell	52.205455	1.410907	1000	200
3	073647326348	Samsung S7	1	20/07/2016	10:54	User plane NBL - GNSS ON	52.195455	1.405907	Near Hill Croft farm standing on the concrete area used to store farm equipment.	52.195435	1.405928	10	2.6
4	073488727427	HTC wildfire S	2	22/07/2016	13:56	User plane NBL - GNSS OFF	52.387119	1.273282	Standing on the first road junction on the left from Blakes farm in the direction of the shops	52.396996	1.279362	1100	210
5	073488727427	HTC wildfire S	2	22/07/2016	14:03	User plane NBL - GNSS ON	52.387119	1.273282	Standing on the first road junction on the left from Blakes farm in the direction of the shops	52.387112	1.273287	8	2
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6.2.3.7 The test process

The goal is to test the location process which uses the collected Radio Measurement Report to make the handset location estimate. The test process for a defined User Scenario is the following:

1. Print out the Test Form from Section 7.2.3.8 of this document.
2. Find a place as described in the User Scenario, but choose a location that is near a landmark you can identify later on Google maps or other on-line mapping source, for instance a road junction.
3. Write down the date and your text description of your location onto the test form (Section 7.2.3.8). This should be enough to help you find it later on a map, plus note anything that might affect GNSS or cellular network signals such as heavy rain or thick cloud cover for GNSS.
4. Get the location with the Android phone or any other agreed test phones with the GNSS turned OFF.
5. Get the location at the same time with a different phone with GNSS turned ON.

6. Check the file (GNSS turned OFF) and send the data to CS in the UK.
7. CS process the data and generates a report showing the estimated positions (for the points and paths) while GNSS was turned OFF using the test results form section.
8. Check the file (GNSS turned ON) and sends the data to CS in the UK.
9. CS process the data and generates a report showing the estimated positions (for all the points and paths) while GNSS was turned ON.
10. CS generates a final report showing the precision of the location estimate using GNSS and the precision of the location estimate using LocationWise on the basis of the Radio Measurement Report.

6.2.3.8 Test form

User scenario Id	Instructions	
Write User scenario Id here	*Write User scenario description here*	
Date of Test	Text description of your location	
Test	Time of Test	Comments
Phone with GNSS OFF		
Phone with GNSS ON		

6.2.3.9 Test results form

Copy this template and record tests results

HELP112-Test-Resul
ts-template-NBL-UP.

7. TESTS TO PERFORM AND USER SCENARIOS FOR EACH PILOT

In this section, we will depict for each pilot, the tests that the pilot will have to perform and their related User Scenarios (Use Cases). As a reminder, you will find in the table hereafter all the User Scenarios defined for HELP112 project in D3.1 deliverable:

Id	User scenario description
SCEN_001	Rural countryside with GNSS/A-GNSS available but no WiFi available. An outside location far away from buildings or constructions that could block GNSS.
SCEN_002	Rural building with all location methods available. An outside location out of town and over 3 meters away from buildings that could block GNSS, but where WiFi signals are present. For example, in a village within WiFi range of house with a WiFi router.
SCEN_003	Rural car with GNSS/A-GNSS available but no WiFi available. A location in the open countryside and inside a parked car far away from buildings or constructions that could block GNSS.
SCEN_004	Urban with GNSS/A-GNSS available but disrupted and WiFi available. An outside location in a town or city street where WiFi signals are present and GNSS signals are disrupted by buildings.
SCEN_005	Motorway or Dual carriageway with GNSS/A-GNSS available but no WiFi available. While driving different sides of a carriageway where GNSS signals are available.
SCEN_006	House location with all location methods available. A location inside a house that has WiFi and in a location that offers a partial satellite coverage.
SCEN_007	Office location with WiFi available but no GNSS available. A location inside an office, which itself is deep inside a building where GNSS signals cannot reach, but WiFi is present.
SCEN_008	Urban with mobile data disabled. An outside location in a town or city street where the caller has deliberately disabled his handset data connection.
SCEN_009	Abroad and urban with mobile data disabled. An outside location in a town or city street not in the home country of the caller's MNO. To avoid extra charges, the caller has disabled his handset data connection.
SCEN_010	Caller's handset in battery saving mode. The caller has configured his handset so as to save battery power. Only WiFi and Cell-ID methods are enabled.
SCEN_011	Caller's handset in privacy conscious settings. The caller has configured his handset so as to protect his private life. Only stand-alone GNSS is enabled or can be activated.
SCEN_012	SIMless user. A caller in a rural environment who makes an emergency call with a handset without SIM card. This user scenario is limited to country/region where emergency call without SIM card is foreseen by legislation.

For handset based location methods (Generic Test – Section 2), each User Scenario to be tested by a pilot will be tested for the three possible android location settings types.

Furthermore, the handset location settings will always be set to "High accuracy" for the offline tests of the User Plane Network based location solution. So, since SCEN_010, and SCEN_011 are based on Android location settings (already covered by the generic test for each User Scenario, and not relevant for the tests of the User Plane Network based location method), and do not depend on the location environment of the caller, they will not appear in the following sections and will be covered in the tests of the other User Scenarios.

7.1 UK PILOT (BT)

This section aims at defining the tests that will be performed in the frame of the UK pilot:

- One section per test.
- For each test, the list of User Scenarios to be tested.

UK pilot will test handset derived location data delivered to the PSAP via SMS to number 112 (using Advanced Mobile Location – AML). UK pilot will receive and decode Google's Android AML location data from Data SMS. UK pilot will upgrade its current AML system in order to handle international roaming location transmission by SMS, and also to be able to receive AML location data sent by HTTPS. The location server is at national level. Six PSAPs will receive the calls which are routed normally. All these PSAPs have national coverage. Although stage 1 PSAP is not equipped with a GIS, the location received using AML could be mapped for HELP112 pilot. All PSAP involved in HELP112 pilot are able to retrieve caller's Cell-Id based location through the network. Stage 1 PSAP is pushed with location data from AML location server, and then these location data are pulled by Stage 2 PSAP. HELP112 tests will be done in October 2016.

In addition to the tests planned in the frame of HELP112 project, BT and EENA are in discussion with Google to test AML for 112SMS (service for deaf and hard of hearing people) though likely to be after HELP112 closes.

7.1.1 Handset based Location method and SMS transmission

In order to test the Handset based location method, the tester in the UK pilot will perform the "Generic test of estimate and transmission of handset based location data to emergency services" (Section 2) using a HELP112 solution implementing the SMS transmission method. This solution is already deployed in UK since UK emergency services already use AML in its SMS version which is fully compliant with the HELP112 solution using an SMS to transmit the location information described in D3.1 and D3.2.

This will therefore allow to perform the test of the transmission of location data using SMS (Section 3) for some User Scenarios among the ones used to test the Precision/Accuracy location transmitted to emergency services, computed using handset based location methods.

This test will be performed using:

- 4 phones with different capabilities in terms of positioning methods (GNSS multi constellation, WiFi, …), and with SIM cards from different local network providers (with data subscription).
    - Samsung Galaxy J3 (A-GPS+GLONASS): Three SIM card.
    - LG K8 (A-GPS+GLONASS): EE SIM card.
    - HTC Desire 530 (A-GPS+GLONASS): Vodafone SIM card.
    - BQ Aquaris X5 plus (A-GPS+GLONASS+Galileo). HELP112 consortium is in contact with BQ in order to get this phone with the appropriate firmware (upper than 1.5.0) in the timeframe of the project, and thus be able to test Galileo added value in an E112 end-to-end solution) – The results obtained using this phone will be compared to the results obtained using the other phones in order to assess the benefits brought by Galileo in the location estimate process (precision/accuracy, TTFF, sensitivity).

for the following User Scenarios:

- SCEN_001
- SCEN_002
- SCEN_003
- SCEN_004
- SCEN_005
- SCEN_006
- SCEN_007
- SCEN_008

7.1.2 International roaming enabled SMS transmission

To perform this test (Section 4) in the UK pilot (BT) acting as the Visited Network, the Lithuanian pilot (112ERC) will provide BT with 2 Lithuanian SIM cards from mobile network provider Omnitel, acting as the Home Network.

One phone will be used to perform this test:

- Samsung Galaxy J3 (A-GPS+GLONASS).

The test will be performed for the corresponding User Scenario:

- SCEN_009

7.1.3 User Plane Network Based Location method added value

This test (Section 7) shall be performed for the following User Scenarios:

- SCEN_001 (**Suburban instead of rural**).
- SCEN_002 (**Suburban instead of rural**).
- SCEN_003 (**Suburban instead of rural**).

- SCEN_004
- SCEN_005
- SCEN_006
- SCEN_007
- SCEN_008

It is worth noting that this test will only be conducted if a UK MNO provide Creativity Software with the required full Cell tower database. HELP112 project members are working together in order to get the required information from EE MNO.

7.1.4 Data channel (HTTPS) transmission

This test (Section 5) will be performed using:

- 3 phones with different capabilities in terms of positioning methods (GNSS multi constellation, WiFi, …), and with SIM cards from different local network providers (with data subscription).
    - Samsung Galaxy J3 (A-GPS+GLONASS): Three SIM card.
    - LG K8 (A-GPS+GLONASS): EE SIM card.
    - HTC Desire 530 (A-GPS+GLONASS): Vodafone SIM card.

for the following User Scenarios:

- SCEN_001
- SCEN_004

In addition to the existing User Scenarios, the transmission of HELP112 location data will be tested in international roaming conditions since more than one pilot site are implementing an HELP112 solution using the data channel to transmit the location data to the PSAP. This new User Scenario to be tested during the UK pilot is the following:

Id	User scenario description
SCEN_013	Abroad and urban with mobile data enabled. An outside location in a town or city street not in the home country of the caller's MNO.

In order to test the data channel transmission for this User scenario, AREU (Italian pilot) will provide BT with one or two Italian SIM cards that will be use to perform the test for this User Scenario.

7.2 LITHUANIAN PILOT (112ERC)

This section aims at defining the tests that will be performed in the frame of the Lithuanian pilot:

- One section per test.
- For each test, the list of User Scenarios to be tested.

In line with HELP112 project Lithuanian pilot will test handset derived location data (AML) delivered to the PSAP via SMS to number 112. Lithuanian pilot will receive and decode both handset manufacturer generated AML location information (Sony) from regular Text SMS and Google's Android location data from Data SMS. In order to receive AML data, to decode and display it on a digital map 112ERC's information system required certain modification of its SMS reception module, location server and GIS. SMS reception module has been added in with SMS content scanning and decoding function, while location server and GIS were modified to interpret AML data string and to display coordinates onto digital map. The location server is at national level and test calls along with AML data will be received in both 112ERC's PSAPs in Vilnius and Klaipėda. Both PSAPs are identical by technical architecture and serve half of country each. They are also redundant to each other may serve all country in case of breakdown in one of them. In term of network derived location both 112ERC's PSAPs are initially pushed with location data from a mobile network, however they can also pull (renew) location data from a mobile network while emergency call voice session is open. Both PSAPs are equipped with GIS and there's a plan to make AML data accuracy comparison against network based location information (Cell-ID). There are no plans to cover HTTPS data transmission within the scope of the HELP112 project, however it might be implemented later. HELP112 tests are scheduled from Mid-November to Mid-December 2016.

7.2.1 Handset based Location method and SMS transmission

In order to test the Handset based location method, the tester in the Lithuanian pilot will perform the "Generic test of estimate and transmission of handset based location data to emergency services" (Section 2) using a HELP112 solution implementing the SMS transmission method. This solution is currently implementing in Lithuania by using AML in its SMS version which is fully compliant with the HELP112 solution using an SMS to transmit the location information described in D3.1 and D3.2.

This will therefore allow to perform the test of the transmission of location data using SMS (Section 3) for some User Scenarios among the ones used to test the Precision/Accuracy location transmitted to emergency services, computed using handset based location methods.

This test will be performed using:

- 4 phones with different capabilities in terms of positioning methods (GNSS multi constellation, WiFi, …), and with SIM cards from different local network providers (with data subscription).
    - Sony Xperia X (A-GPS+GLONASS): Tele2 SIM card.
    - HTC One M8S (A-GPS+GLONASS): Tele2 SIM card.
    - Samsung Galaxy S5 (A-GPS+GLONASS+Beidou): Bitė Lietuva SIM card.
    - BQ Aquaris X5 plus (A-GPS+GLONASS+Galileo). HELP112 consortium is in contact with BQ in order to get this phone in the timeframe of the project, and thus be able to test Galileo added value in an E112 end-to-end solution) – The results obtained using this phone will be compared to the results obtained using the other phones in order to assess the benefits brought by Galileo in the location estimate process (precision/accuracy, TTFF, sensitivity).

for the following User Scenarios:

- SCEN_001
- SCEN_002
- SCEN_003
- SCEN_004
- SCEN_005
- SCEN_006
- SCEN_007
- SCEN_008
- SCEN_012

7.2.2 User Plane Network-Based Location method added value

This test (Section 7) shall be performed for the following User Scenarios:

- SCEN_001 (**Suburban instead of rural**).
- SCEN_002 (**Suburban instead of rural**).
- SCEN_003 (**Suburban instead of rural**).
- SCEN_004
- SCEN_005
- SCEN_006
- SCEN_007
- SCEN_008
- SCEN_012 (**Will depend on MNO settings**)

For this test, Tele2 (Lithuanian MNO) provided Creativity Software with the required Cell Tower database. CS will therefore be able to conduct the test in the Lithuanian pilot.

7.3 AUSTRIAN PILOT (NNO)

This section aims at defining the tests that will be performed in the frame of the Austrian pilot:

- One section per test.
- For each test, the list of User Scenarios to be tested.

NNO is going to test handset derived location data delivered to the PSAP via HTTPS or data SMS to local numbers - 144: Ambulance – 140: Alpine Rescue – 141: Doctor Service - (using Advanced Mobile Location – AML). NNO will implement an AML location server at National level, so that it could receive and decode Google's AML location data sent either by HTTPS, or data SMS. All PSAPs of Austrian federal states will pull the location data from the location server. They are all equipped with a GIS and are therefore able to display the location of the caller on a map. They are also able

to retrieve caller's Cell-Id based location through the network. HELP112 tests will be performed by NNO in October 2016.

7.3.1 Handset based Location method and SMS or data channel (HTTPS) transmission

In order to test the Handset based location method, the tester in the Austrian pilot will perform the "Generic test of estimate and transmission of handset based location data to emergency services" (Section 2) using a HELP112 solution implementing both the data SMS and the data channel (HTTPS) transmission methods. NNO is on the process of implementing this solution the Google's implementations of AML (data_SMS and HTTPS versions) which are fully compliant with the HELP112 solution using either a SMS or the data channel to transmit the location information described in D3.1 and D3.2.

This will therefore allow to perform the test of the transmission of location data using the data channel (Section 5) and also the test of the transmission of location data using a SMS (Section 3) for some User Scenarios among the ones used to test the Precision/Accuracy location transmitted to emergency services, computed using handset based location methods.

This test will be performed using:

- 3 phones with different capabilities in terms of positioning methods (GNSS multi constellation, WiFi, …), and a SIM card with data subscription from the three different local MNOs (A1, T-Mobile, Drei):
    - Huawei P8-lite (A-GPS+GLONASS).
    - Huawei Mate 8 (A-GPS+GLONASS).
    - HTC 10 (GPS+GLONASS+Beidou).

for the following User Scenarios:

- SCEN_001 (**HTTPS and SMS transmissions to be tested for this scenario**)
- SCEN_002
- SCEN_003
- SCEN_004 (**HTTPS and SMS transmissions to be tested for this scenario**)
- SCEN_005
- SCEN_006
- SCEN_007
- SCEN_008 (**solely for SMS transmission**)
- SCEN_012

The phone number of the caller is not included into the HTTPS location message formatted by Google thunderbird (i.e. the Google's HTTPS AML). Since Austrian network providers do not provide NNO with a database which could allow to link the IMSI of the caller (present in the HTTPS location message) with its phone number (MSISDN), NNO is currently not able to match the

HTTPS location message with its related voice call. NNO is in discussion with Google to find a solution to this major issue.

7.4 ITALIAN PILOT (AREU)

This section aims at defining the tests that will be performed in the frame of the Austrian pilot:

- One section per test.
- For each test, the list of User Scenarios to be tested.

AREU will test handset derived location data delivered to the PSAP via HTTPS to number 112 (using Advanced Mobile Location – AML). AREU will upgrade its current location server used for their emergency App WhereAREU, so that it could receive and decode AML location data sent by HTTPS. The location server is at regional level and location will be pulled by PSAPs. Three PSAPs in Lombardia (Brescia, Milano, Varese) and one in Rome will receive the calls which are routed normally depending on the location from where the call is initiated. All these PSAPs are equipped with a GIS and are therefore able to display the location of the caller on a map. They are also able to retrieve caller's Cell-Id based location through the network. In addition to the comparison between the location estimate provided by AML and the location provided by the network using the Cell-Id, AREU is proposing to compare the location returned by AML with the location returned by the 112App WhereARU, since when an emergency call is made using WhereARU, the two services (WhereARU and AML) will work in parallel. HELP112 tests will be done by AREU by November 2016.

7.4.1 Handset based Location method and data channel (HTTPS) transmission

In order to test the Handset based location method, the tester in the Italian pilot will perform the "Generic test of estimate and transmission of handset based location data to emergency services" (Section 2) using a HELP112 solution implementing the data channel (HTTPS) transmission method. The Italian pilot is on the process of implementing this solution by modifying the 112App WhereAREU location server and integrating AML in its next generation HTTPS version which is fully compliant with the HELP112 solution using the data channel to transmit the location information described in D3.1 and D3.2 as part of architecture 4.

This will therefore allow to perform the test of the transmission of location data using the data channel (Section 5) for some User Scenarios among the ones used to test the Precision/Accuracy location transmitted to emergency services, computed using handset based location methods.

This test will be performed using:

- 2 phones with different capabilities in terms of positioning methods (GNSS multi constellation, WiFi,…), and with SIM cards from a local network provider (with data subscription):
    - Samsung I9300 Galaxy S3 (A-GPS+GLONASS): TIM SIMcard.
    - OnePlus 3 (A-GPS+GLONASS+Beidou): TIM SIMcard.

for the following User Scenarios:

- SCEN_001
- SCEN_002
- SCEN_003
- SCEN_004
- SCEN_005
- SCEN_006
- SCEN_007

7.5 SUMMARY OF PILOTS DEPLOYMENTS AND TESTS

7.5.1 Technologies to be tested and implementation required in each PSAP

HELP112 implementation in pilot PSAP Third parties like MNOs, OS providers, or handset manufacturers involved in the end-to-end implementation of the solution are not included here)	**Tech 1 – AML data SMS (Google)**	**Tech 2 – AML SMS (Sony and/or Samsung)**	**Tech 3 – AML data SMS roaming enabled (location SMS sent to a long number)**	**Tech 4 – AML HTTPS (Google thunderbird)**	**Tech 5 – Galileo added-value using the BQ Aquaris X5 plus and AML data_SMS**	**Tech 6 – User Plane Netwotk Based Location**
UK (BT)	Use of existing AML location server. Add decoding of Google data SMS onto the AML reception system.	Use of existing SMS AML infrastructure.	Implement foreign caller MSISDN to match AML SMS and voice call.	Implement a web application that receives the HTTPS message from Google thunderbird, reformats them to match the interface for AML SMS messages and then forward them onto the existing AML reception system (Use of the same location server than with SMS AML).	These tests require no additional implementation at PSAP level.	Offline tests. No additional implementation at PSAP level.
Italy (AREU)	N/A	N/A	N/A	Modification of WhereAreU server to receive HTTPS post from Google thunderbird. Integration with PSAP platform for delivering AML location to operators.	N/A	N/A
Lithuania (112ERC)	Use of the AML infrastructure implemented for	Upgrade of the existing 112 SMS module (for death	N/A	N/A	These tests require no additional	Offline tests. No additional implementation

	the reception of regular AML SMS, and decoding of Google AML data SMS.	and earing people) in order to receive and decode AML SMS and route the AML information to the PSAP call taker. Integration of AML information into the PSAP CAD system			implementation at PSAP level.	at PSAP level.
Austria (NNO)	Use of the AML infrastructure implemented for the reception of regular AML SMS, and decoding of Google AML data SMS.	Implementation of the AML SMS infrastructure integrating the AML SMS gateway, the AML location server, and the implementation into the PSAP CAD system.	N/A	Integration of the reception and the decoding of AML HTTPS post message into the infrastructure used for AML SMS and data SMS.	N/A	N/A

7.5.2 User Scenarios

Id	User scenario description
SCEN_001	Rural countryside with GNSS/A-GNSS available but no WiFi available. An outside location far away from buildings or constructions that could block GNSS.
SCEN_002	Rural building with all location methods available. An outside location out of town and over 3 meters away from buildings that could block GNSS, but where WiFi signals are present. For example, in a village within WiFi range of house with a WiFi router.
SCEN_003	Rural car with GNSS/A-GNSS available but no WiFi available. A location in the open countryside and inside a parked car far away from buildings or constructions that could block GNSS.
SCEN_004	Urban with GNSS/A-GNSS available but disrupted and WiFi available. An outside location in a town or city street where WiFi signals are present and GNSS signals are disrupted by buildings.
SCEN_005	Motorway or Dual carriageway with GNSS/A-GNSS available but no WiFi available. While driving different sides of a carriageway where GNSS signals are available.
SCEN_006	House location with all location methods available. A location inside a house that has WiFi and in a location that offers a partial satellite coverage.
SCEN_007	Office location with WiFi available but no GNSS available. A location inside an office, which itself is deep inside a building where GNSS signals cannot reach, but WiFi is present.
SCEN_008	Urban with mobile data disabled. An outside location in a town or city street where the caller has deliberately disabled his handset data connection.
SCEN_009	Abroad and urban with mobile data disabled. An outside location in a town or city street not in the home country of the caller's MNO. To avoid extra charges, the caller has disabled his handset data connection.
SCEN_012	SIMless user. A caller in a rural environment who makes an emergency call with a handset without SIM card. This user scenario is limited to country/region where emergency call without SIM card is foreseen by legislation.
SCEN_013	Abroad and urban with mobile data enabled. An outside location in a town or city street not in the home country of the caller's MNO.

7.5.3 Pilots deployment

Scenario Id	UK pilot						Lithuanian pilot						Austrian pilot						Italian pilot					
	TECH_1	TECH_2	TECH_3	TECH_4	TECH_5	TECH_6	TECH_1	TECH_2	TECH_3	TECH_4	TECH_5	TECH_6	TECH_1	TECH_2	TECH_3	TECH_4	TECH_5	TECH_6	TECH_1	TECH_2	TECH_3	TECH_4	TECH_5	TECH_6
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SCEN_013																								

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APPENDIX A: COMPLIANCE MATRIX OF THE RESULTS OBTAINED FOR EACH USER SCENARIO TESTED WITH ACCURACY AND RESPONSE TIME REQUIREMENTS.

Compliance between the results obtained for the User Scenarios tested with the Accuracy/Precision requirements, and the response time requirements.

Keep the columns related to the HELP112 scenarios tested in your pilot and the "Overall" column (There are three different ways to understand "Overall": All Urban User Scenarios taken into account in the case of ACCU_002 and ACCU_003 – All Rural User Scenarios taken into account in the case of ACCU_004 and ACCU_005 – All User scenarios taken into account in the case of ACCU_006, RESP_001, and RESP_002).

For each User Scenario tested and each requirement, fill the following table with:

- "Yes" if compliant or "No" if not compliant.
- The percentage of call compliant with the User Requirement for the User Scenario.

		HELP112 User Scenarios tested													
Id	**Requirement description**	**SCEN 001**	**SCEN 002**	**SCEN 003**	**SCEN 004**	**SCEN 005**	**SCEN 006**	**SCEN 007**	**SCEN 008**	**SCEN 009**	**SCEN 012**	**SCEN 013**	**SCEN 014**	**SCEN 015**	**Overall**
ACCU_002	The confidence radius of the location measured shall be less than 30 meters in urban areas for 67% of calls.	N/A	N/A	N/A		N/A					N/A		N/A	N/A	
ACCU_003	The confidence radius of the location measured shall be less than 100 meters in urban areas for 95% of calls.	N/A	N/A	N/A		N/A					N/A		N/A	N/A	
ACCU_004	The confidence radius of the location measured shall be less than 30 meters in rural areas for 67% of calls.				N/A		N/A	N/A	N/A	N/A		N/A			

		HELP112 User Scenarios tested													
Id	**Requirement description**	**SCEN 001**	**SCEN 002**	**SCEN 003**	**SCEN 004**	**SCEN 005**	**SCEN 006**	**SCEN 007**	**SCEN 008**	**SCEN 009**	**SCEN 012**	**SCEN 013**	**SCEN 014**	**SCEN 015**	**Overall**
ACCU_005	The confidence radius of the location measured shall be less than 50 meters in rural areas for 95% of calls.				N/A		N/A	N/A	N/A	N/A		N/A			
ACCU_006	The accuracy of location estimate should always be less than its precision, i.e. the actual position should always be within the radius define by the precision criterion.														
RESP_001	The response time shall be less than 5 seconds for a Cell-ID location solution.														
RESP_002	The response time shall be less than 30 seconds for any solution that provides more accurate and precise caller location and satisfies the precision and accuracy requirements.														

APPENDIX B: COMPLIANCE MATRIX OF THE RESULTS OBTAINED FOR EACH POSITIONING METHOD WITH ACURRACY AND RESPONSE TIME REQUIREMENTS.

Compliance between the results obtained for each location method returned by AML with the Accuracy/Precision requirements, and the response time requirements.

For ACCU_002 and ACCU_003, only the results obtained in the tested Urban environments are taken into account.

For ACCU_004 and ACCU_005, only the results obtained in the tested Rural environment are taken into account.

For each location method returned by AML during the tests and each requirement, fill the following table with:

- "Yes" if compliant or "No" if not compliant
- The percentage of call returning this location method which are compliant with the User Requirement.

		HELP112 User Scenarios tested		
Id	**Requirement description**	**GNSS**	**Wi-Fi**	**Cell-Id**
ACCU_002	The confidence radius of the location measured shall be less than 30 meters in urban areas for 67% of calls.			
ACCU_003	The confidence radius of the location measured shall be less than 100 meters in urban areas for 95% of calls.			
ACCU_004	The confidence radius of the location measured shall be less than 30 meters in rural areas for 67% of calls.			
ACCU_005	The confidence radius of the location measured shall be less than 50 meters in rural areas for 95% of calls.			
ACCU_006	The accuracy of location estimate should always be less than its precision, i.e. the actual position should always be within the radius define by the precision criterion.			

		HELP112 User Scenarios tested		
Id	**Requirement description**	**GNSS**	**Wi-Fi**	**Cell-Id**
RESP_001	The response time shall be less than 5 seconds for a Cell-ID location solution.			
RESP_002	The response time shall be less than 30 seconds for any solution that provides more accurate and precise caller location and satisfies the precision and accuracy requirements.			

APPENDIX C: COMPLIANCE MATRIX OF THE RESULTS OBTAINED IN INDOOR/OUTDOOR ENVIRONMENTS WITH ACCURACY/RESPONSE TIME REQUIREMENTS.

Compliance between the results obtained for Indoor and Outdoor environments (among the HELP112 User Scenarios tested) with the Accuracy/Precision requirements, and the response time requirements.

Among the HELP112 User Scenarios tested in your pilot, group the results obtained in Indoor environment and the results obtained in Outdoor environment, and fill the following table with:

- "Yes" if compliant or "No" if not compliant.
- The percentage of call compliant with the User Requirement for the User Scenario.

Please note that ACCU_002 and ACCU_003 are only related to Urban environment, and that ACCU_004 and ACCU_005 are only related to Rural environment.

		HELP112 Indoor and Outdoor environments tested	
Id	**Requirement description**	**Indoor**	**Outdoor**
ACCU_002	The confidence radius of the location measured shall be less than 30 meters in urban areas for 67% of calls.		
ACCU_003	The confidence radius of the location measured shall be less than 100 meters in urban areas for 95% of calls.		
ACCU_004	The confidence radius of the location measured shall be less than 30 meters in rural areas for 67% of calls.		
ACCU_005	The confidence radius of the location measured shall be less than 50 meters in rural areas for 95% of calls.		
ACCU_006	The accuracy of location estimate should always be less than its precision, i.e. the actual position should always be within the radius define by the precision criterion.		
RESP_001	The response time shall be less than 5 seconds for a Cell-ID location solution.		

		HELP112 Indoor and Outdoor environments tested	
Id	**Requirement description**	**Indoor**	**Outdoor**
RESP_002	The response time shall be less than 30 seconds for any solution that provides more accurate and precise caller location and satisfies the precision and accuracy requirements.		

APPENDIX D: COMPLIANCE MATRIX OF THE RESULTS OBTAINED WITH EACH PHONE TESTED AND THE ACCURACY/RESPONSE TIME REQUIREMENTS.

Compliance between the results obtained with each phone tested with the Accuracy/Precision requirements, and the response time requirements.
For ACCU_002 and ACCU_003, only the results obtained in the tested Urban environments are taken into account.
For ACCU_004 and ACCU_005, only the results obtained in the tested Rural environments are taken into account.
For each phone used during the tests and each requirement, fill the following table with:

- "Yes" if compliant or "No" if not compliant
- The percentage of call compliant with the User Requirement when using this phone.

		HELP112 User Scenarios tested					
Id	**Requirement description**	**Name of phone 1**	**Name of phone 2**	**Name of phone 3**	**Name of phone 4**	**Name of phone 5**	**Name of phone 6**
ACCU_002	The confidence radius of the location measured shall be less than 30 meters in urban areas for 67% of calls.						
ACCU_003	The confidence radius of the location measured shall be less than 100 meters in urban areas for 95% of calls.						
ACCU_004	The confidence radius of the location measured shall be less than 30 meters in rural areas for 67% of calls.						

		HELP112 User Scenarios tested					
Id	**Requirement description**	**Name of phone 1**	**Name of phone 2**	**Name of phone 3**	**Name of phone 4**	**Name of phone 5**	**Name of phone 6**
ACCU_005	The confidence radius of the location measured shall be less than 50 meters in rural areas for 95% of calls.						
ACCU_006	The accuracy of location estimate should always be less than its precision, i.e. the actual position should always be within the radius define by the precision criterion.						
RESP_001	The response time shall be less than 5 seconds for a Cell-ID location solution.						
RESP_002	The response time shall be less than 30 seconds for any solution that provides more accurate and precise caller location and satisfies the precision and accuracy requirements.						

APPENDIX E: COMPLIANCE MATRIX OF THE TECHNICAL SOLUTIONS IMPLEMENTED WITH THE USER REQUIREMENTS.

Compliance between the technical solution implemented and the HELP112 User Requirements not related to the location estimate process (response time requirements are included in order to show the impact of the transmission method on the delay to transmit the location data from the handset to the PSAP).

In the following table, keep the columns related to the technical solutions tested in your pilot, and then for each technical solution tested and each requirement, fill the table with:

- "Yes" if compliant or "No" if not compliant.
- A justification of the compliance or the reason why the technical solution is not compliant with the User Requirement.

		Technologies tested				
Id	**Requirement description**	**AML dataSMS**	**AML dataSMS roaming**	**AML SMS**	**AML HTTPS**	**AML dataSMS + User Plane Network Based Location Solution**
ACCE_001	The HELP112 solution shall be available for the widest range of handset types.					
ACCE_002	The process to initiate the estimate and transmission of the caller location to the PSAP shall be initiated without the need for caller intervention.					
ACCU_001	The precision of the estimated location shall be transmitted in metres.	Yes	Yes	Yes	Yes	Yes
ACCE_004	The location process and the transmission of location data to the PSAP shall not interfere with the voice call.					

Id	Requirement description	Technologies tested				
		AML dataSMS	AML dataSMS roaming	AML SMS	AML HTTPS	AML dataSMS + User Plane Network Based Location Solution
AML_001	HELP112 shall study the possibility to transmit extra data related to the caller's location in addition to the ones already expected in the current AML solution, such as Cell-ID, Radio Measurement Report, floor, and altitude when available.	No	No	No	No	Yes (Radio Measurement Report)
AML_002	HELP112 shall examine ways to configure the AML solution to be triggered when an emergency SMS is sent. **(Under implementation at Google side)**	No	No	No	No	No
BATT_001	The HELP112 solution shall ensure that in cases of low battery power level, priority shall be given to the emergency voice call.	Yes	Yes	Yes	Yes	Yes
BATT_002	In the HELP112 solution, the battery power level needed and expected to use either A-GNSS, stand-alone GNSS, or WiFi without GNSS, shall be different for each type of location solution, and dependant on the battery capacity of the handset.	Yes	Yes	Yes	Yes	Yes

		Technologies tested				
Id	**Requirement description**	**AML dataSMS**	**AML dataSMS roaming**	**AML SMS**	**AML HTTPS**	**AML dataSMS + User Plane Network Based Location Solution**
CHAR_001	The HELP112 solution shall ensure that the data channel is used for the processes of estimating and transmitting the location if and only if the data connection is already activated on the handset.	Yes	Yes	Yes	Yes (But the AML message is not sent when the data connectivity is unavailable or switched OFF)	Yes
CHAR_002	The HELP112 solution shall ensure that if a SMS is used to transmit the location information to the PSAP, it shall be recognised as an E112 SMS by the network and shall be free of charge for the caller.	Yes	No (**Currently the SMS sent to a long number instead of 112 in case of international roaming is not free of charge**)	Yes	N/A (**Currently the HTTPS location message sent to the PSAP is not free of charge**)	Yes
LOCA_001	The HELP112 solution shall estimate the caller location by the GNSS capabilities of the handset if available and if the battery power level is sufficient.	Yes	Yes	Yes	Yes	Yes
LOCA_002	The HELP112 solution shall make use of, trial and demonstrate the advantages of estimating the caller location by EGNOS and Galileo.	N/A	N/A	N/A	N/A	N/A
LOCA_003	The HELP112 location solution shall combine multiple positioning methods, when possible, in order to fit the requirements as widely as possible.	Yes	Yes	Yes	Yes	Yes

		Technologies tested				
Id	**Requirement description**	**AML dataSMS**	**AML dataSMS roaming**	**AML SMS**	**AML HTTPS**	**AML dataSMS + User Plane Network Based Location Solution**
LOCA_004	In the case that a location method fails to provide accurate caller location with regards to the accuracy requirements, the HELP112 solution shall ensure that a fall-back location solution would be available to provide a more accurate caller's location than the one estimated by Cell-ID.	No	No	No	No	Yes
PRES_001	The caller location has to be received on the GIS available at the call taker's terminal that has answered the call.					
PRES_002	No additional task shall be assigned to the call taker to get caller's location through the HELP112 solution.					
PRES_003	The caller's location could either be pushed from the HELP112 solution to the call taker CAD, or pulled by the call taker CAD.					
PRES_004	The caller's location data shall use the WGS84 coordinate system.	Yes	Yes	Yes	Yes	Yes

		Technologies tested				
Id	**Requirement description**	**AML dataSMS**	**AML dataSMS roaming**	**AML SMS**	**AML HTTPS**	**AML dataSMS + User Plane Network Based Location Solution**
PRIV_001	The HELP112 solution shall ensure that the caller location is available only to respond to emergency calls. Privacy restrictions for uses not related to emergency calls shall be maintained and strictly enforced.					
PRIV_002	Storage of caller location at the time of the emergency call in the PSAP shall be in agreement with the PSAPs operating policy and the national data protection legislation.					
PRIV_003	The caller's data storage shall be protected from unauthorized access. Only PSAP and legal authorities shall have access to the caller's data.					
PRIV_004	The caller's location data obtained during an emergency call shall not be stored on the handset during or after the call.					
PRIV_005	The caller shall not be able to suppress or degrade the availability of the location information for a 112 call.					
RESP_001	The response time shall be less than 5 seconds for a Cell-ID location solution.					

		Technologies tested				
Id	**Requirement description**	**AML dataSMS**	**AML dataSMS roaming**	**AML SMS**	**AML HTTPS**	**AML dataSMS + User Plane Network Based Location Solution**
RESP_002	The response time shall be less than 30 seconds for any solution that provides more accurate and precise caller location and satisfies the precision and accuracy requirements.					
ROAM_001	HELP112 shall study ways to be robust to a caller from a home HELP112 enabled country A that use the E112 service in a visited HELP112 enabled country B.					
SECU_001	The HELP112 solution shall always be available to the entities authorized to access it. For example it must remain available even if wide-scale attacks are performed, e.g. denial of service, or access with appropriate privileges is gained that can make the service unavailable or unusable.					
SECU_002	HELP112 solution shall be protected from attacks that attempt to block the HELP112 solution to specific callers or to take advantage or profit from transmitting the location to other sources.					

Id	Requirement description	Technologies tested				
		AML dataSMS	AML dataSMS roaming	AML SMS	AML HTTPS	AML dataSMS + User Plane Network Based Location Solution
TRAN_001	HELP112 shall study the possibility of using the IP channel to transmit the caller's location data to the PSAP.	No	No	No	Yes	No
TRAN_002	If the data connectivity is not available or is deactivated on the caller's handset, HELP112 solution shall ensure that a fall-back solution that doesn't use the data channel is available to transmit the location data to the PSAP.	Yes	Yes	Yes	No	Yes

Appendix E: HTTPS location POST message format (Google AEL)

Key Name	Value	Units	Example
v	Version	-	2
emergency_number 911	Emergency number dialed.	-	112
source call	Source of activation (call, sms)	-	Call
time	Timestamp of beginning of call	ms (unix time)	1438101600
gt_location_latitude	Ground truth latitude (for testing)	degrees	37.4217829
gt_location_longitude	Ground truth longitude (for testing)	degrees	122.0884413
location_latitude	Latitude	degrees	37.4217845
location_longitude	Longitude	degrees	122.0847413
location_time	Timestamp of location	ms (unix time)	1438102600
location_altitude	Altitude	meters	4.0
location_floor	Floor number	-	2
location_accuracy	Accuracy	meters	20.0
device_number	Device phone number	-	1438101600
device_model	Device model	-	Motorola Nexus 6
device_imsi	IMSI	-	310260579377451
device_imei	IMEI	-	355458061005220
cell_carrier	Carrier	-	AT&T

Key Name	Value	Units	Example
cell_home_mcc	Home MCC	-	310.
cell_home_mnc	Home MNC	-	260
cell_network_mcc	Network MCC	-	310
cell_network_mnc	Network MNC	-	260