Galileo OSNMA:

Join the Public Observation Test Phase and share your feedback!

EUSPA Webinar – 2nd February 2022

Galileo OSNMA: Join the Public Observation Test phase and share your feedback!

1 Welcome & Introduction

- EUSPA & OSNMA team introduction
- Objective of the webinar

10 min

2 Galileo OSNMA

- GNSS Authentication & the Galileo solution: OSNMA
- OSNMA Service and Roadmap

20 min

3 Public Observation Phase

- How to benefit from it
- Guidelines for testing & feedback

55 min

4 Q&A

35 min

Objectives of the OSNMA test phase

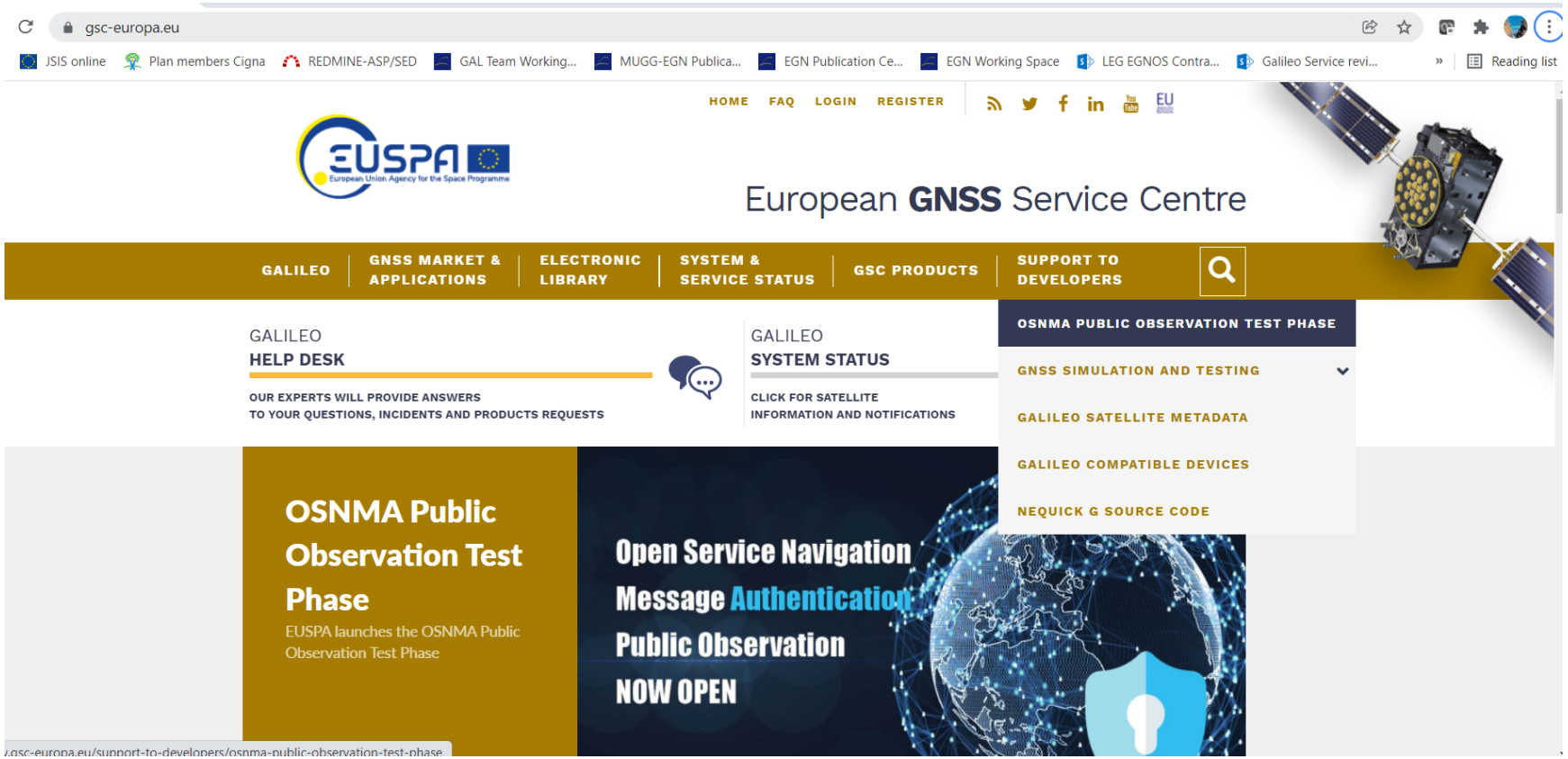
OBJECTIVES

- Validation of critical OSNMA service elements (ICD).
- Complementary performance characterization

- Engage stakeholders
- Build a strong relationships with future OSNMA users
- Foster OSNMA adoption

- Gather lessons learned and recommendations towards OSNMA service provision

How to join the OSNMA test phase



The target users are receiver manufacturers, application developers, members of research institutions, or similar.

Extensive documentation provides details on OSNMA implementation, user interface and crypto material

Available documents

- Galileo OSNMA User Interface Control Document (ICD) for the Test Phase

  Specifies the interface between the Galileo Space Segment and the Galileo User Segment and crypto material retrieval

- Galileo OSNMA Receiver Guidelines for the Test Phase

  Instructions for the user segment implementation of the OSNMA functionality, including requirements, interfaces, and steps to be followed

- Technical presentation

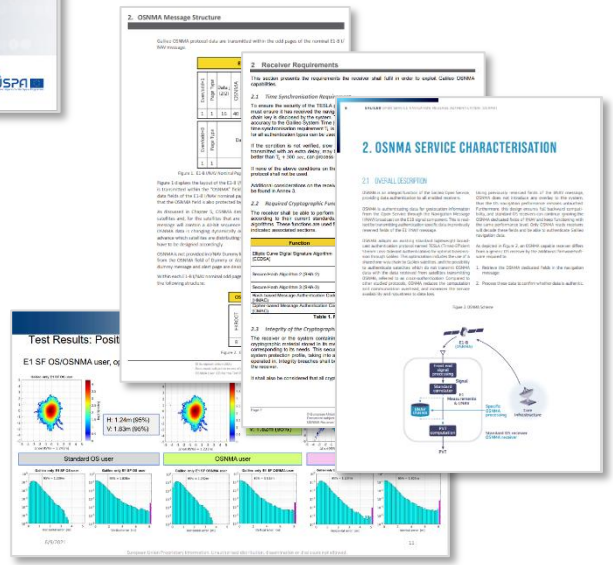
  OSNMA Typical Performance and foreseen changes to the Galileo OSNMA User ICD for Service provision phase

- OSNMA Info Note

  Description for the Service provision phase, including high-level details about the keys' authentication process, receiver compatibility, user interface and target markets

Multiple documents and presentations available

Detailed information on OSNMA capabilities



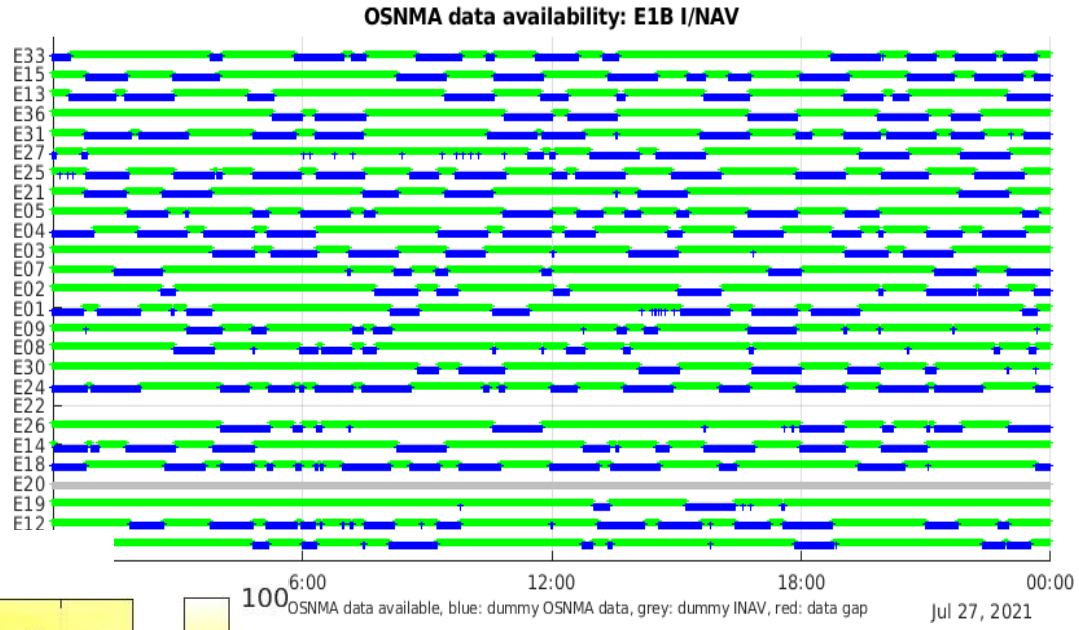
OSNMA Typical performance

OSNMA SiS Parameter	Configuration
Digital signature	ECDSA P-256
Hash function for TESLA chain	SHA-256
Key size	128 bits
MAC function	HMAC-SHA-256
Tag size	40 bits (target security level 80 bits)
Number of Tags per subframe	6
Tag sequence (over 2 subframes)	[00S, 00E, 04S, 00E, 12S, 00E] ; [00S, 00E, 00E, 12S, 00E, 12E]

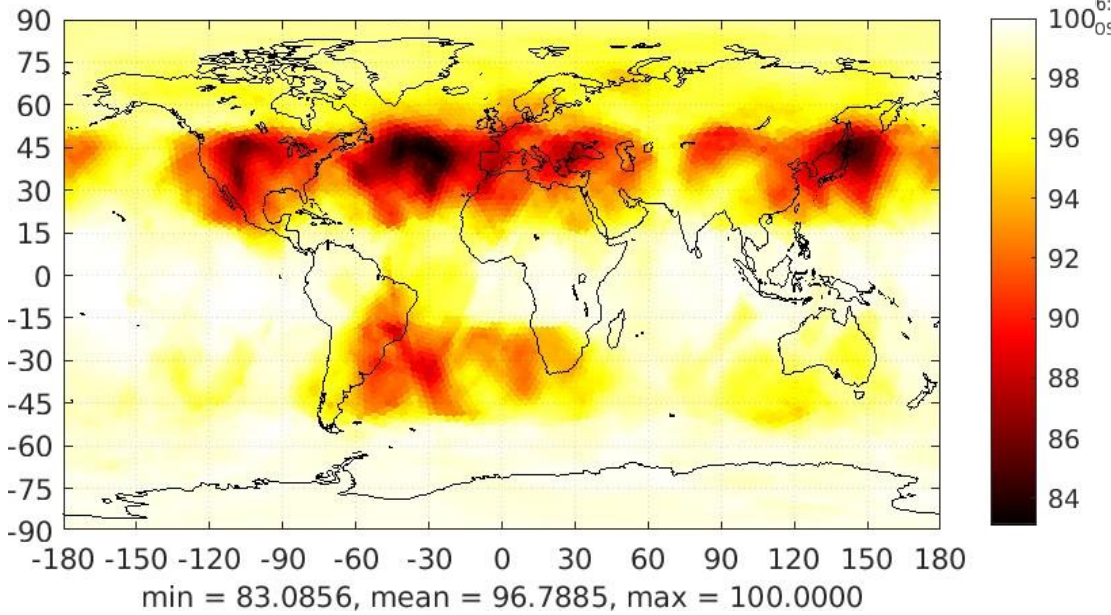
Tag sequence first subframe					
00S	00E	04S	00E	12S	00E
Tag sequence second subframe					
00S	00E	00E	12S	00E	12E

OSNMA Typical performance

OSNMA data broadcast from Galileo satellites is not continuous



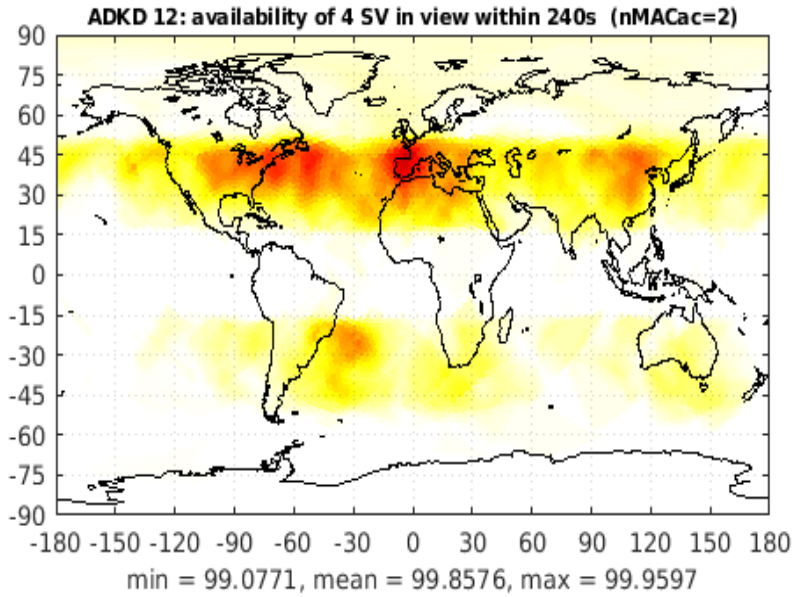
Green: OSNMA data available.
Blue: No OSNMA data



OSNMA data availability from at least 4 SV > 5°

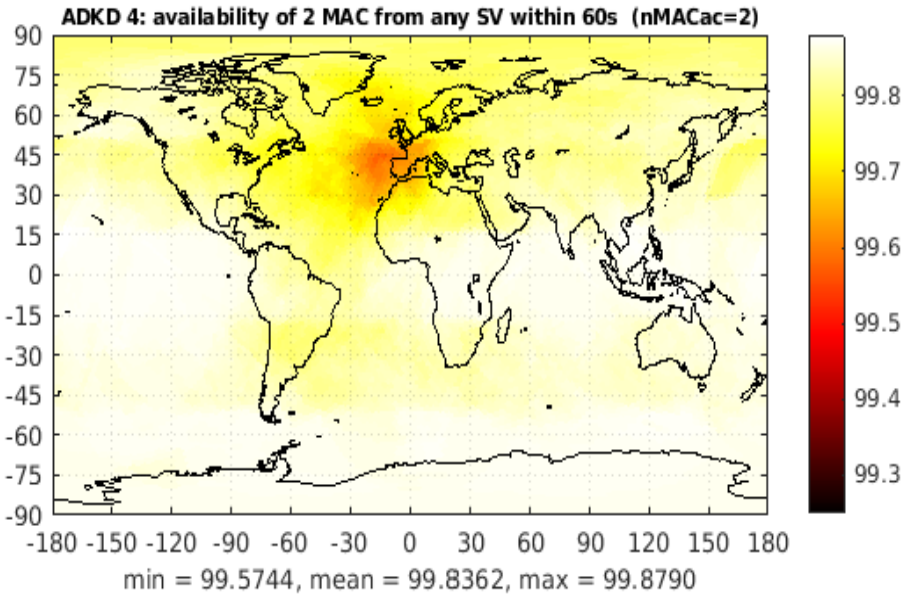
OSNMA Typical performance

Tags for I/NAV ephemeris and clock correction (ADKD#12) for at least 4 SV in view (every 240 secs), August 2021



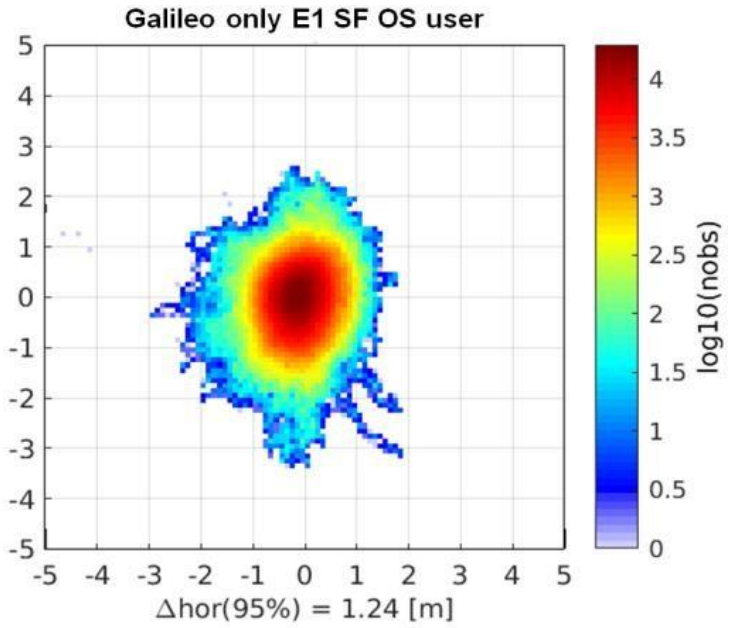
WUL: 99.08%
AUL: 99.86%
BUL: 99.96%

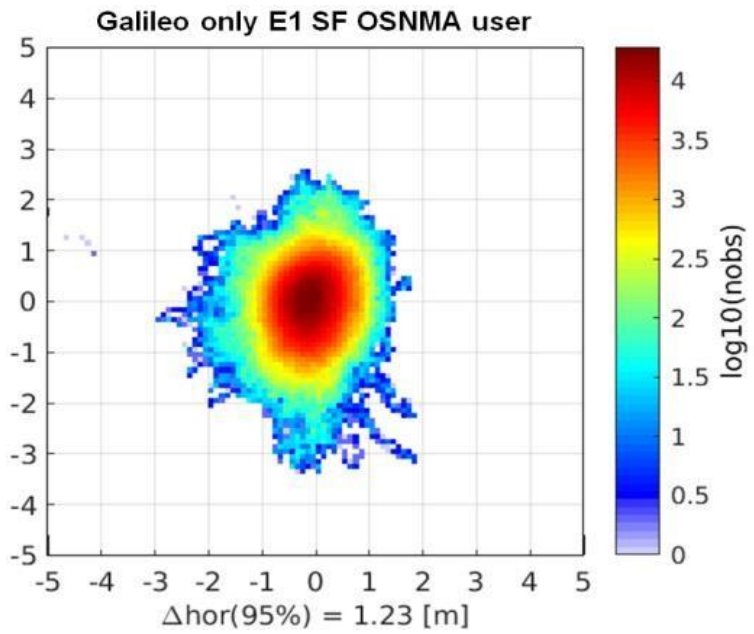
Tags for timing parameters from at least 1 SV in view (every 60 secs), August 2021



WUL: 99.57%
AUL: 99.84%
BUL: 99.88%

OSNMA Typical performance





H: 1.24m (95%)
V: 1.83m (95%)

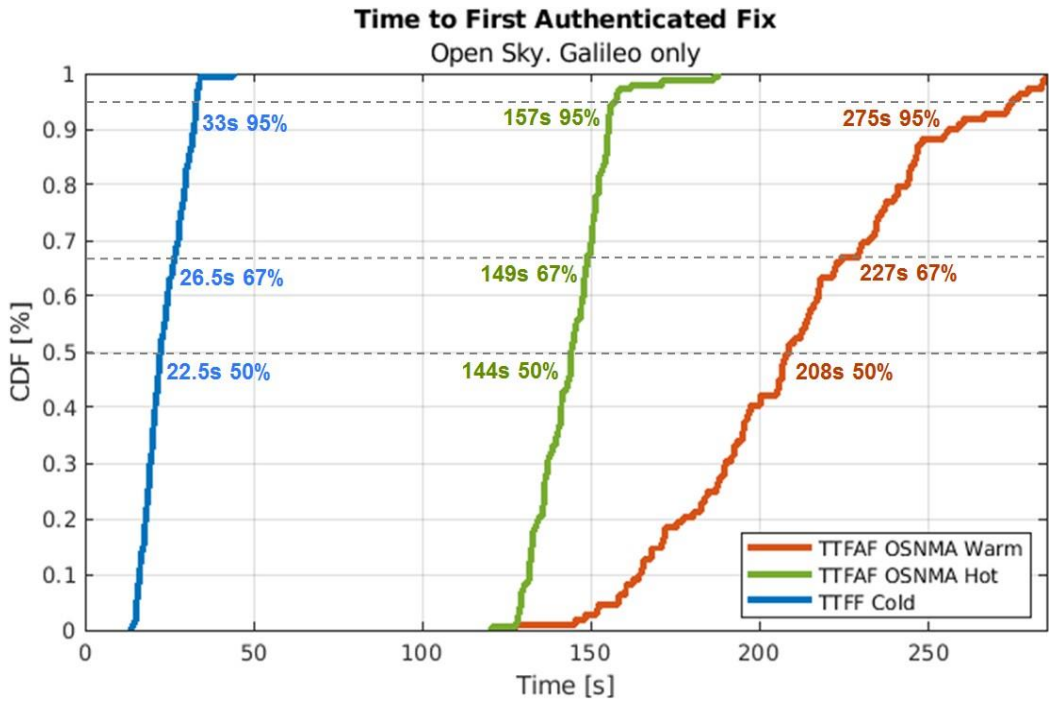
Standard OS user

H: 1.23m (95%)
V: 1.82m (95%)

OSNMA user

E1 Single Freq OS/OSNMA user, open sky, fixed antenna,
Airbus premises Munich, July 2021

OSNMA Typical performance



Startup conditions for OSNMA:

- OSNMA Warm Start: Public Key available; TESLA Root Key not-available at startup
- OSNMA Hot Start: Public Key and Root Key available at startup

Different OSNMA testing configurations will be addressed separately

The testing phase will consist of:

Part 1: OSNMA test via Signal in the Space

- To be conducted by receiver manufacturers and application developers
- Representing their **target use cases/applications**
- **Free choice of scenarios** in terms of:
  - Movement pattern : Static, dynamic
  - Environment: urban, rural, asymmetric
- Performance assessed in terms of OSNMA **accuracy, availability and time to first authenticated fix (TTFAF)**

Share the outcome according to feedback characterization

Support provided by EUSPA in collaboration with JRC

Part 2: Corner test cases

- Specific capabilities devised by EUSPA, with the **support of EC Joint Research Centre**
- Testing of **scenarios not accessible via SiS** such as other NMA configurations, key revocation, etc

Participants are invited to share their experience with OSNMA in various forms profiting from exclusive benefits

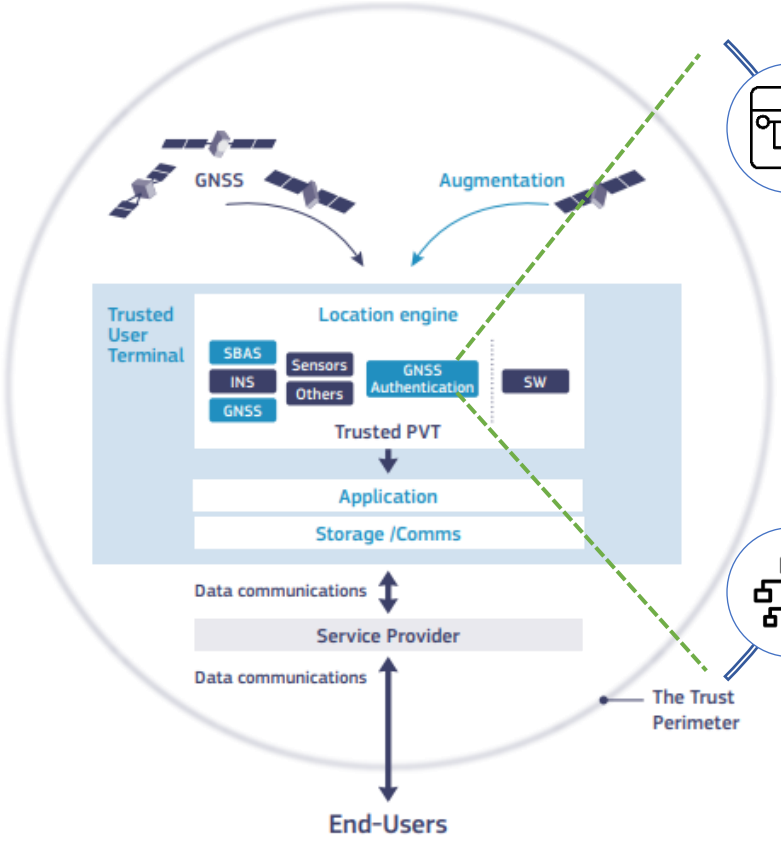
Share your feedback!

Participants will directly benefit from:

- Inclusion in a **dedicated "OSNMA tested"** area to be created in the EUSPA managed website: https://www.usegalileo.eu/
- **Visibility** of the tested OSNMA-enabled solution on the **two foreseen OSNMA workshops** including individual invitation to share user experience
- Support for a **correct OSNMA algorithm implementation**
- Provide your results by sending it directly to EUSPA Market Development team: MARKET@euspa.europa.eu

The OSNMA SiS Test Phase will be conducted by participants representing their target applications

Suggestions are made to testers



- General
- Movement Pattern
- Test Environment
- Test plan structure

Source: EUSPA- GALILEO OPEN SERVICE NAVIGATION MESSAGE AUTHENTICATION (OSNMA)- 2021

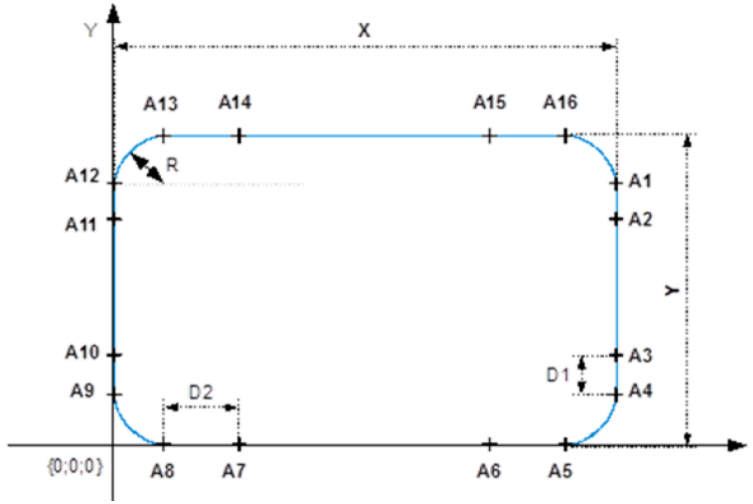
Participants have a free choice of movement patterns

GENERAL

Dedicated test scenarios (field tests)

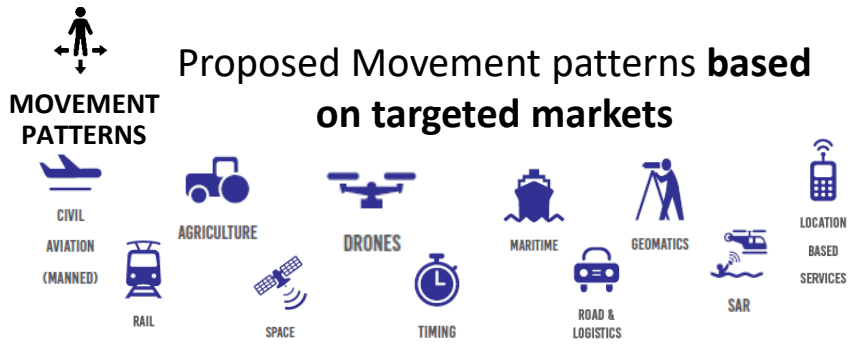
- Inspired by ISO 17025 requirements
- Based on the available OSNMA documents

Example of movement patterns



Source: ETSI- ETSI TS 103 246-3 V1.3.1 (2020-10)

Proposed Movement patterns **based on targeted markets**



Static

- Cadastral Surveying
- GIS
- ….

- Any specified land point

Dynamic

- Agriculture- Automatic Steering
- Automotive- Smart digital tachograph
- UAS- Navigation and traffic management for UAVS
- ….

- Pedestrian
- Automotive
- UAS

Other dynamics can be chosen

Source: EUSPA- GALILEO OPEN SERVICE NAVIGATION MESSAGE AUTHENTICATION (OSNMA)- 2021

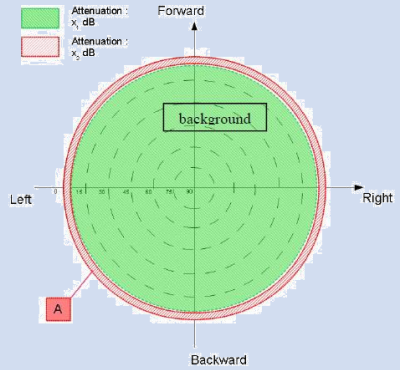
Tests can be conducted in any environment

TEST ENVIRONMENT

Three representative scenarios, depending on target applications (examples only):

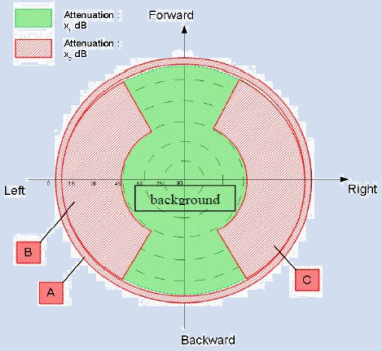
Rural

Typical open view to sky without disruption



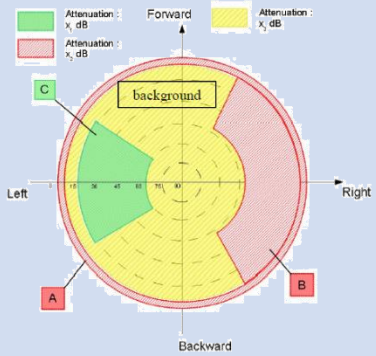
Urban

Obstructions on both sides (buildings or other objects)



Asymmetric

All further environments



Source: NavCert-2021; Source: ETSI- ETSI TS 103 246-3 V1.3.1 (2020-10)

General KPIs are suggested as possibilities for the performance assessment of their implementations

TEST PLAN STRUCTURE

Field tests-General KPIs- Part 1

OSNMA accuracy

- OSNMA Position accuracy

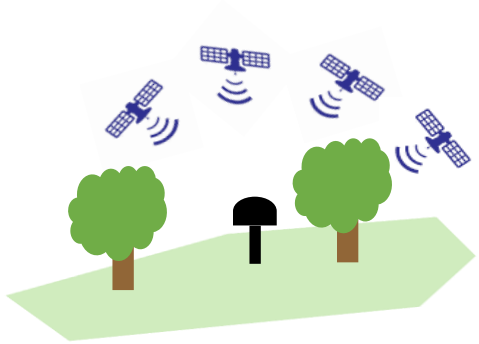
Characterized as the difference between the position from a selected reference and the position output using only data-authenticated satellites provided by the OSNMA receiver at a given time.

The OSNMA position accuracy may be used for **static and mobile user scenarios**.

- OSNMA Velocity accuracy

Characterized as the difference between the velocity from a selected reference and the velocity output using only data-authenticated satellites provided by the OSNMA receiver at a given time.

Velocity accuracy is **only in the scope of mobile user** scenarios.



General KPIs are suggested as possibilities for the performance assessment of their implementations

Field tests-General KPIs- Part 2

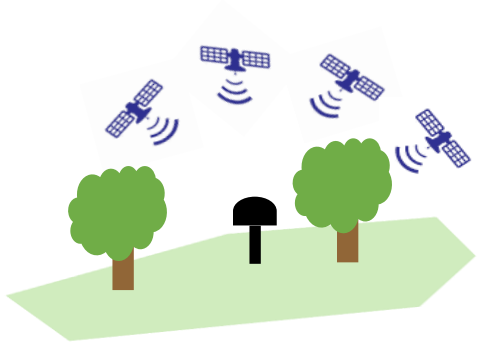
OSNMA availability

Duration in Warm and Hot start scenario till

- First Availability of authenticated output
- Availability of authentication of all SV in view

Warm start
The receiver possesses the public key and can retrieve the DSM-KROOT to verify the tesla root key and proceed with the mack verifications

Hot start
The receiver already possesses a verified tesla root key, so its does not need to retrieve and verify again the DSM-KROOT and can start processing the MACK section



General KPIs are suggested as possibilities for the performance assessment of their implementations

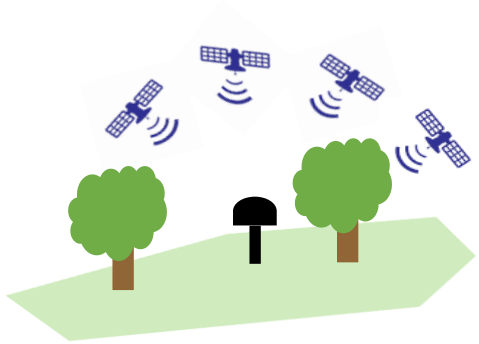
Field tests-General KPIs-Part 3

OSNMA availability

Duration in Warm and Hot start scenario till

- First Availability of authenticated output

- Availability of authentication of all SV in view



Time to first authenticated fix

Characterized by the time required for OSNMA receiver to acquire the satellite signals, navigation data, to authenticate navigation message, calculate and to output the first position solution using only the authenticated navigation parameters.

OSNMA navigation solution availability

Characterized as the percentage of time that a navigation solution using only data-authenticated satellites is obtained in comparison to the complete time with available position output.

General KPIs are suggested as possibilities for the performance assessment of their implementations

TEST PLAN STRUCTURE

Field tests-General KPIs- Part 4

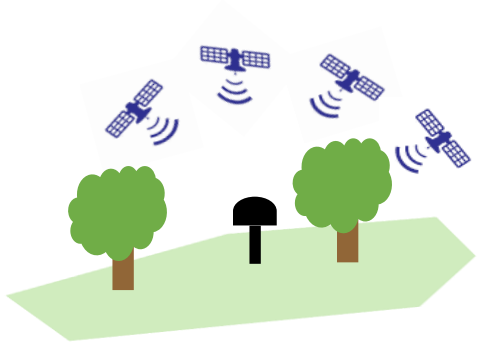
- **OSNMA availability**
  - Continuity of OSNMA supported output with a defined output rate

Time between authentications

At satellite level
characterized as time between consecutive authentications for a satellite that is used in the navigation solution.

At navigation solution level:

- characterized as time between computation of navigation solutions with renewed authenticated navigation data for at least 4 satellites used in the navigation solution.
- Same metrics can be reported as well for the computation of navigation solutions with renewed authenticated navigation data for all the satellites used in the navigation solution.



Participants are encouraged to share the performance statistics of their implementations

TEST PLAN STRUCTURE

Field tests metrics

- **OSNMA accuracy:**
  - 50th, 75th, 95th percentile of calculated **position / speed** error
- **Time to first authenticated fix:**
  - 50th, 75th, 95th percentile for warm and hot start condition
- **OSNMA availability:**
  - Navigation solution availability value
  - 50^{th}, 75^{th}, 95^{th} percentile of the calculated distribution of the time between authentications

Proposed reference in field

- **Static**
  - Timing reference: time output of the receiver via NMEA or an independent clock
  - Position reference: premeasured point
- **Dynamic**
  - Timing reference and position: Independent GNSS based PVT-system

Testers are encouraged to provide the following data:

- Used receiver (low grade (e.g. smartphone), standard (e.g. automotive), high grade (e.g. geodetic)
- Specification of used environment
- Specification of used dynamics
- Recorded trajectory data, nax. Yaw-rate, maximum horizontal speed, ….
- Proposed: Receiver output (NMEA v4.x) of receiver under test and for reference and separate document regarding the comments

Qualitative and quantitative feedback on various OSNMA aspects are welcome

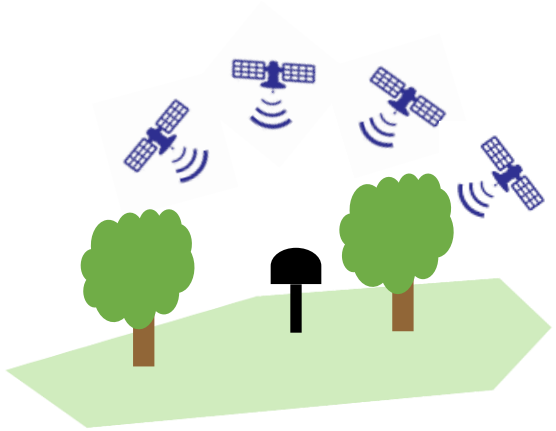
TEST PLAN STRUCTURE

Participants' feedback on tests as questions and comments

- Covering feedback from the participants regarding the content and outcome of the tests, e.g.:

The test covered the expectations	The outcome of the test
☐ Full coverage	☐ Exceeded the expectations
☐ No coverage	☐ Met the expectations
☐ Comments	☐ Didn't meet the expectations
	☐ Comments

….



General feedback on documentation

- Covering feedback from the participants regarding the content of the available documents, e.g.:

Clarity of the document:

Any specific information missing?	Any unclear section/information?
☐ No	☐ No
☐ Yes	☐ Yes
☐ Comments	☐ Comments

Which difficulties/ issues were identified?	How grave were/are these difficulties/issues?
☐ Comments	☐ Comments

Improvements/modifications:

Improvements/modifica-tions needed?	In which area modifications are proposed? Which? Why?
☐ No	☐ (Multiselect)
☐ Yes, needed	☐ Comments
☐ Yes, suggested	

Join the Public Observation Test Phase and share your feedback!

- **Register to the OSNMA Public Observation Test Phase** and profit from a series of exclusive features and benefits;
- **Take the chance** to participate on the testing phase of a long-awaited service that will **differentiate Galileo from any other GNSS system**.
- **Test a one-of-a-kind service** with support on the correct implementation and many opportunities for exchange and discussions;
- **Conduct the tests** according to the conditions and environment that are **most suitable to your applications**;
- If you wish so, be ready **to discuss your experience** on exclusive workshops and profit from the visibility of your OSNMA-enabled solution on a dedicated section on the Use Galileo website.