

How to test a GNSS-based positioning terminal?

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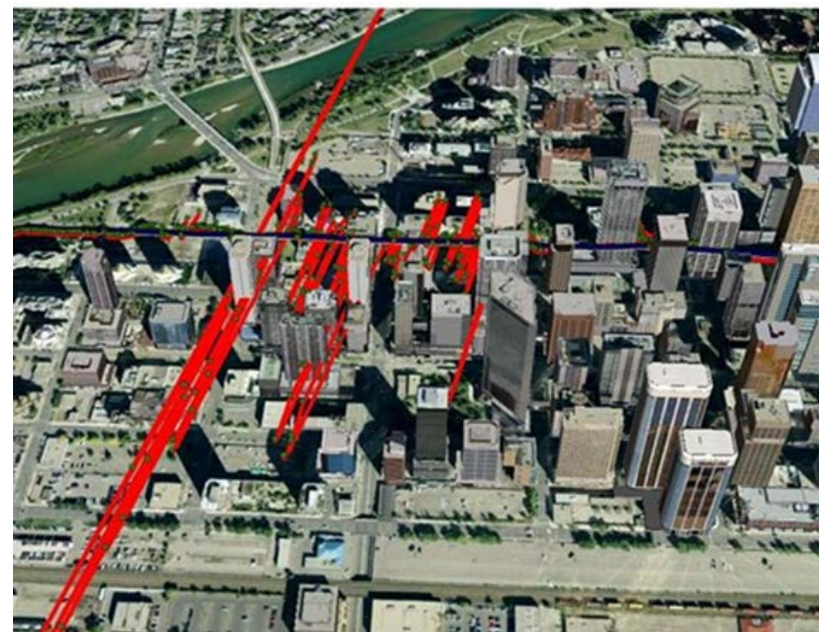
Content

- Why is testing needed
- GNSS Based Positioning Terminal
- Different testing procedures
- Performances



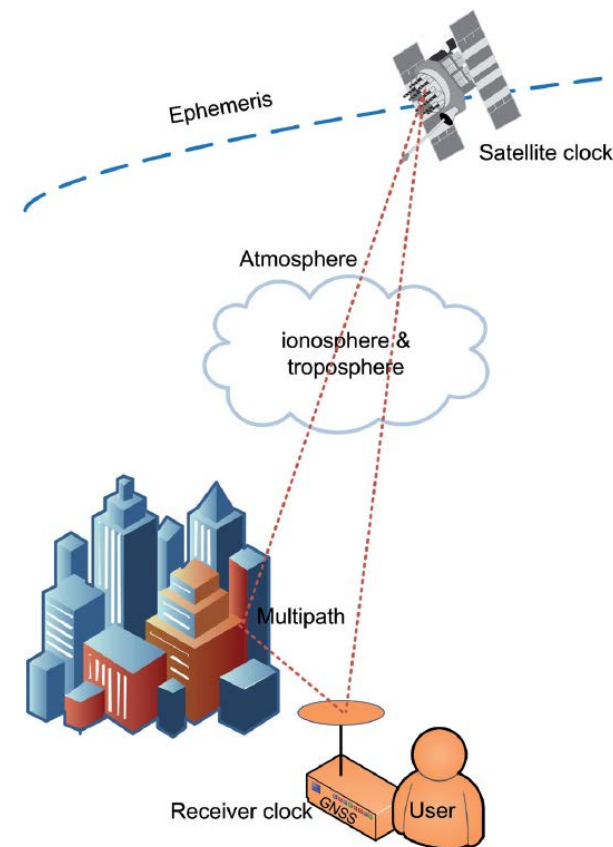
Why is elaborate testing needed

- The standards that are needed for verification of the performance of a positioning terminal should at least answer to the two main questions
 - “What are the performance metrics to use ?”
 - **“What are the tests to perform ?”**
- Positioning performance is affected by e.g. operational environment, interference



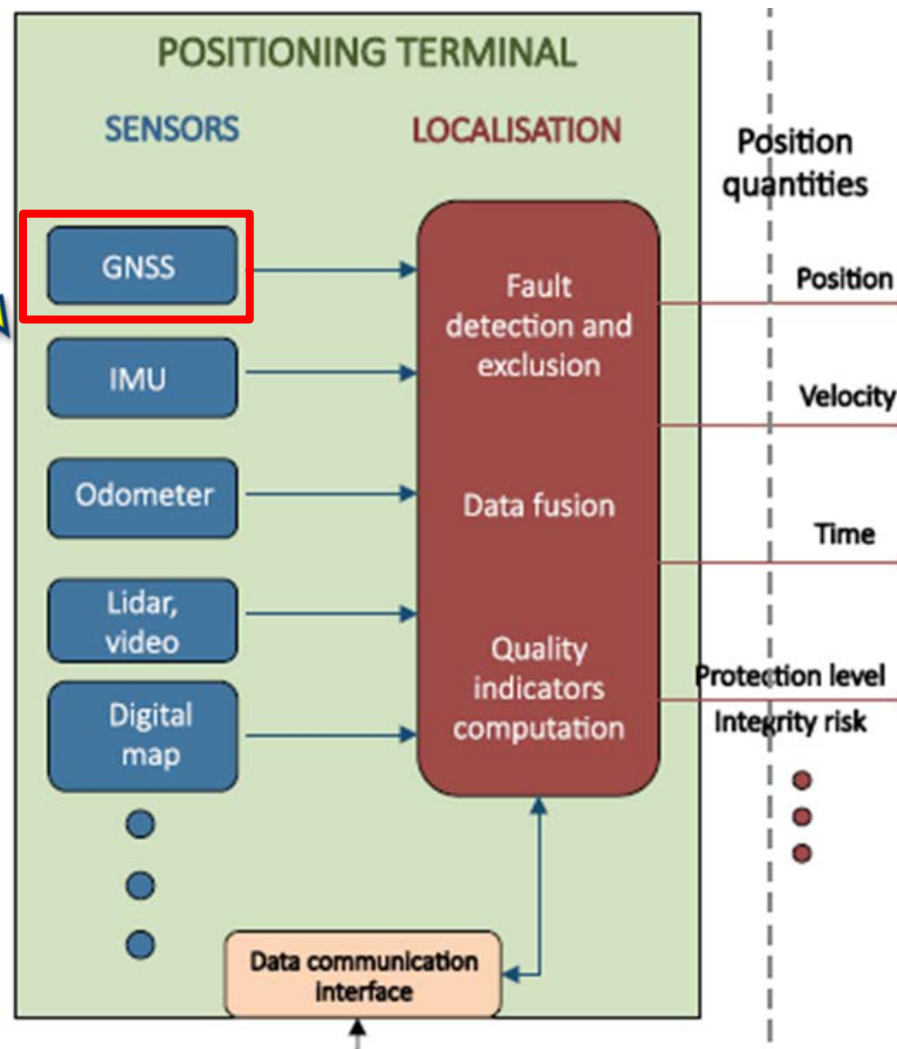
Positioning challenges

- Operational environments
 - Rural, mountaineous, European urban, Modern urban canyon
 - Multipath
 - Signal obstruction
- Interference
 - Jamming
 - Spoofing
 - Unintentional interference
- Basic performance features
- Security performance features

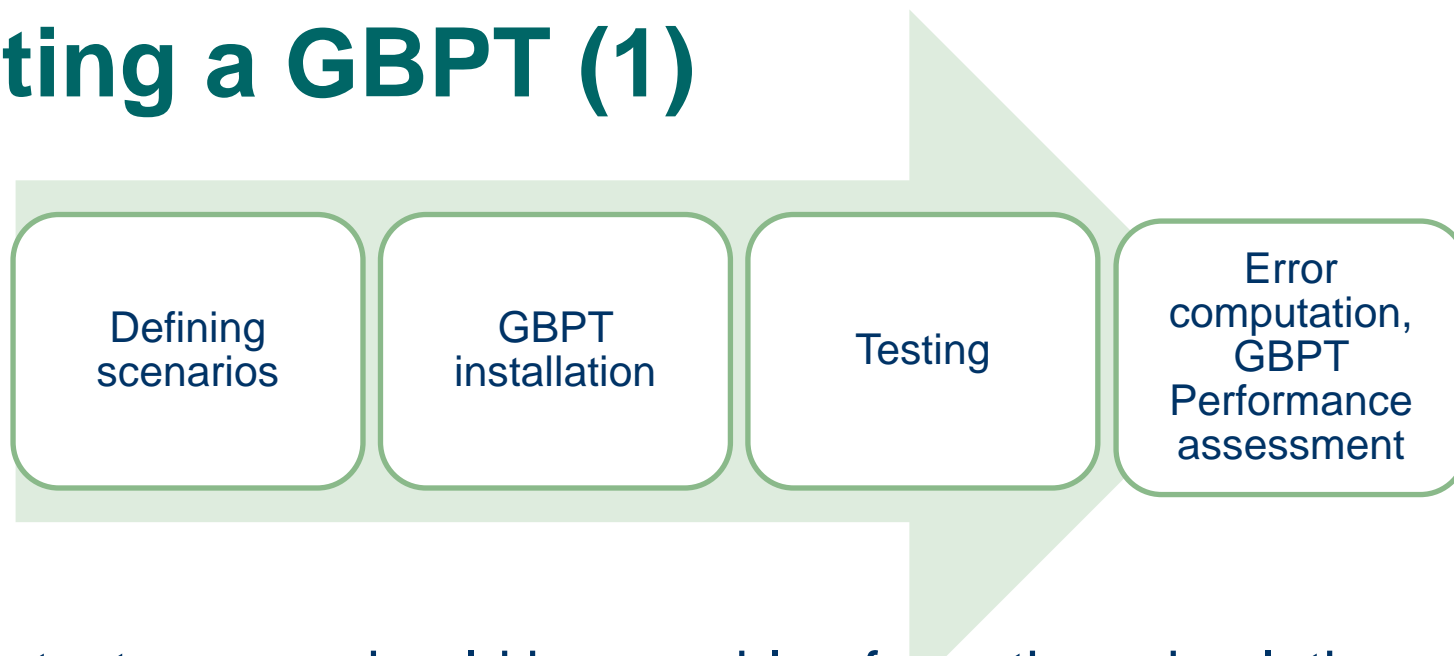


GNSS Based Positioning Terminal (GBPT)

GBPT in SaPPART =
Contains at least a
GNSS receiver



Testing a GBPT (1)



- The test means should be capable of creating, simulating or reproducing the operational conditions of use
- Three different types of tests
 - Laboratory tests
 - Field tests
 - Record and replay tests



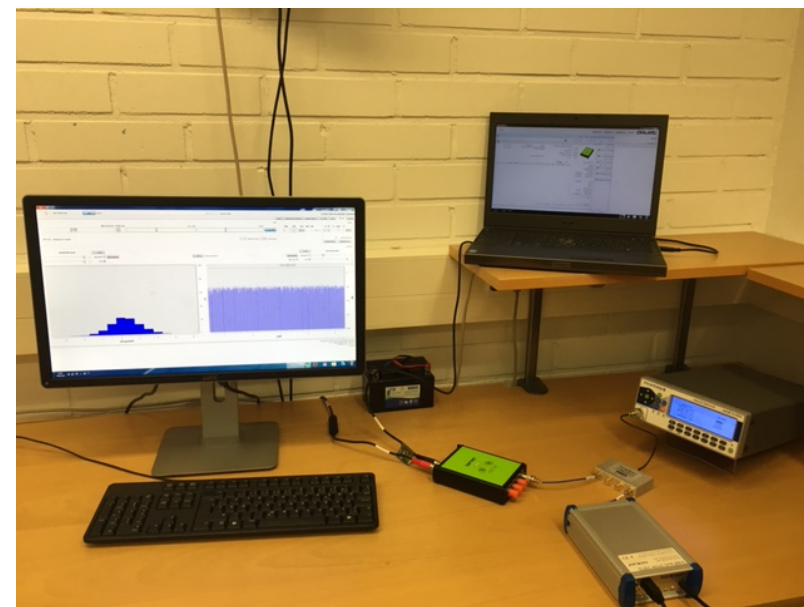
Testing a GBPT (2)

- Defining Scenarios
 - Operational environments to be assessed
 - Other operational conditions (interference etc), time of the test,...
 - Equipment to be tested, duration, ...
- GBPT installation represented for each method
- Testing = doing the actions based on the defined scenarios
- Error computation
 - Comparing the obtained position solution to the reference trajectory
 - Computing desired metrics



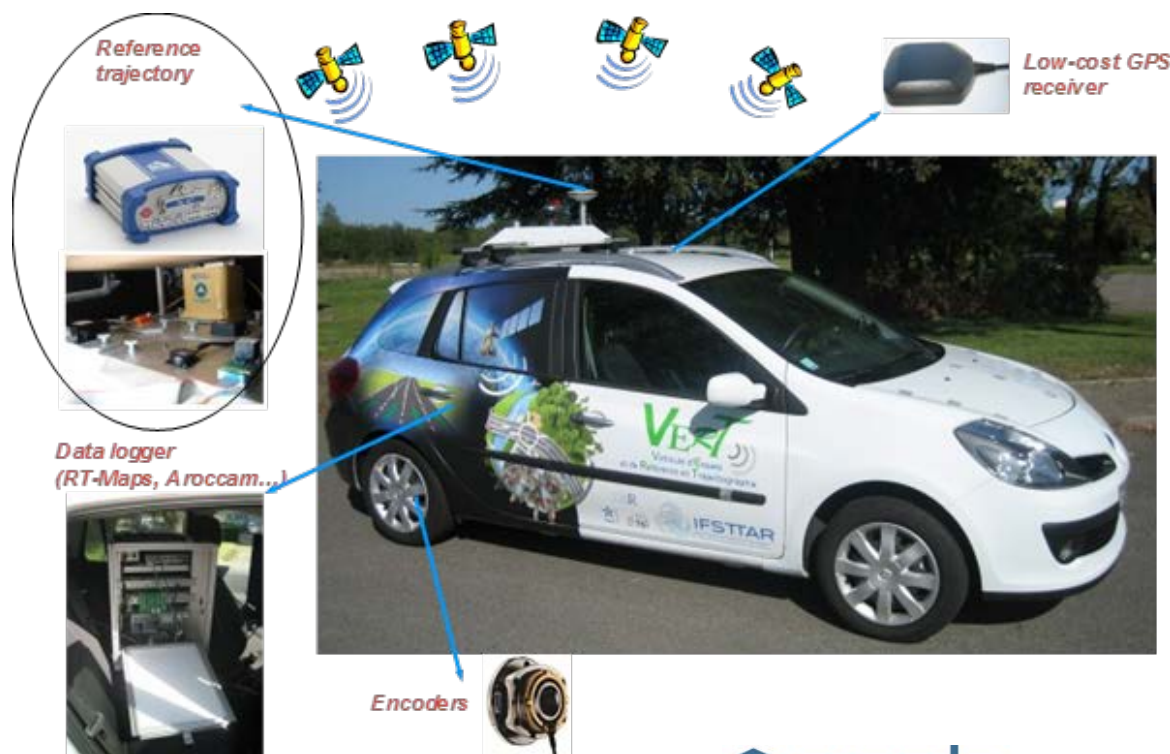
Laboratory tests

- Radio Frequency (RF) output is determined by using mathematical models
- Signals produced by Radio Frequency Constellation Simulators (RFCS)
- Special setup
 - an anechoic chamber
 - a cable, direct connection from the simulator to the GNSS antenna



Field tests

- A test vehicle equipped with the GBPT and the Reference Trajectory Measurement System (RTMeS)
- Tests executed using the defined scenarios
 - Trajectories
 - On-board equipment installations

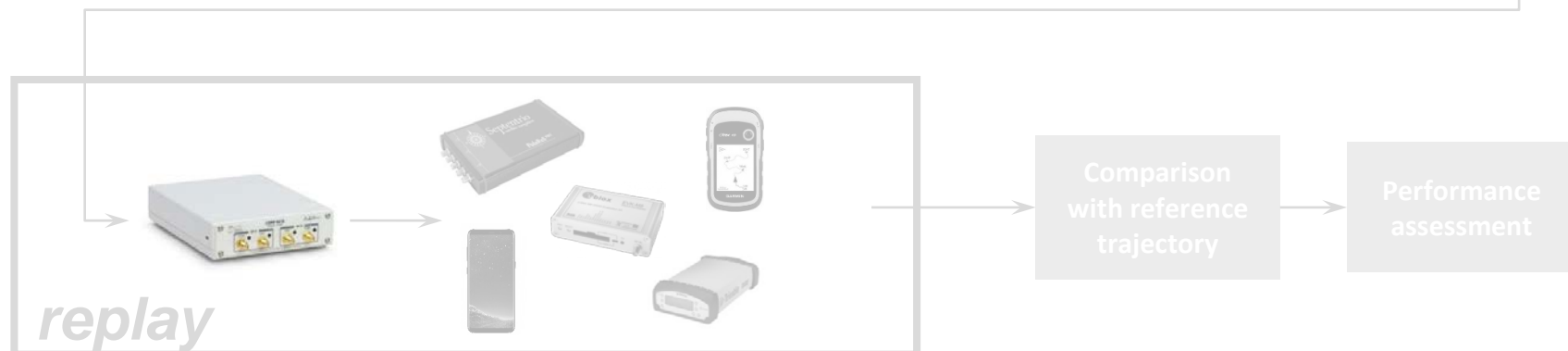
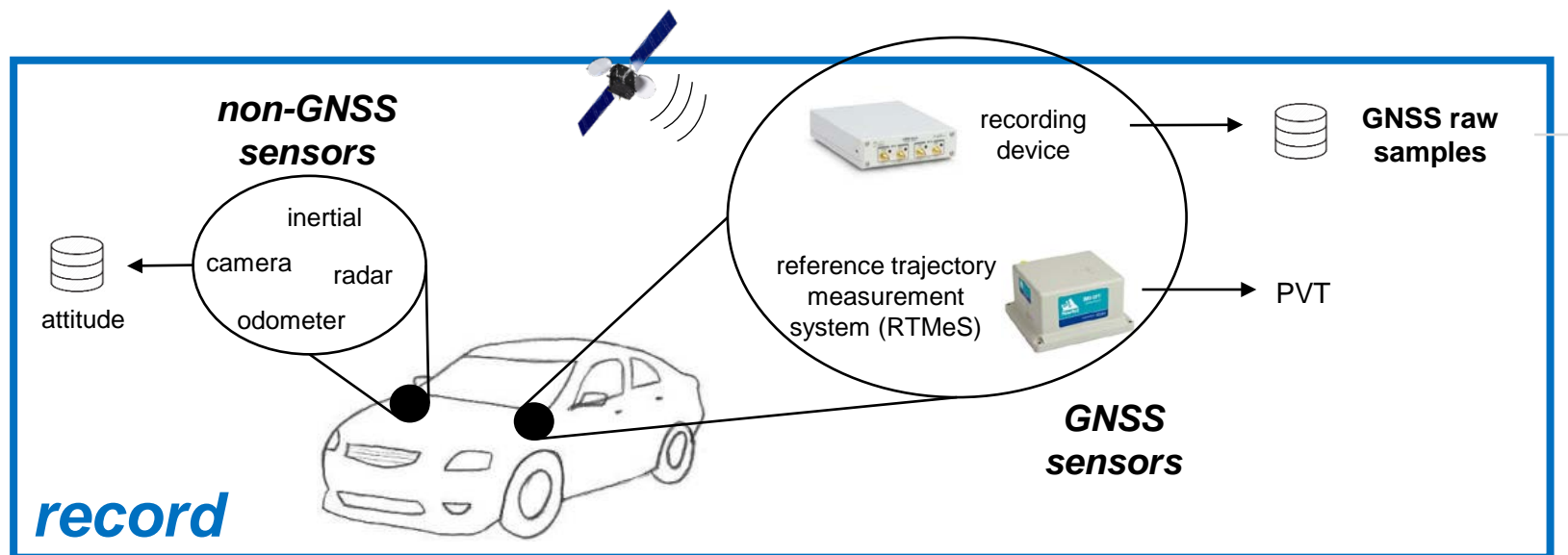


Record and replay tests 1

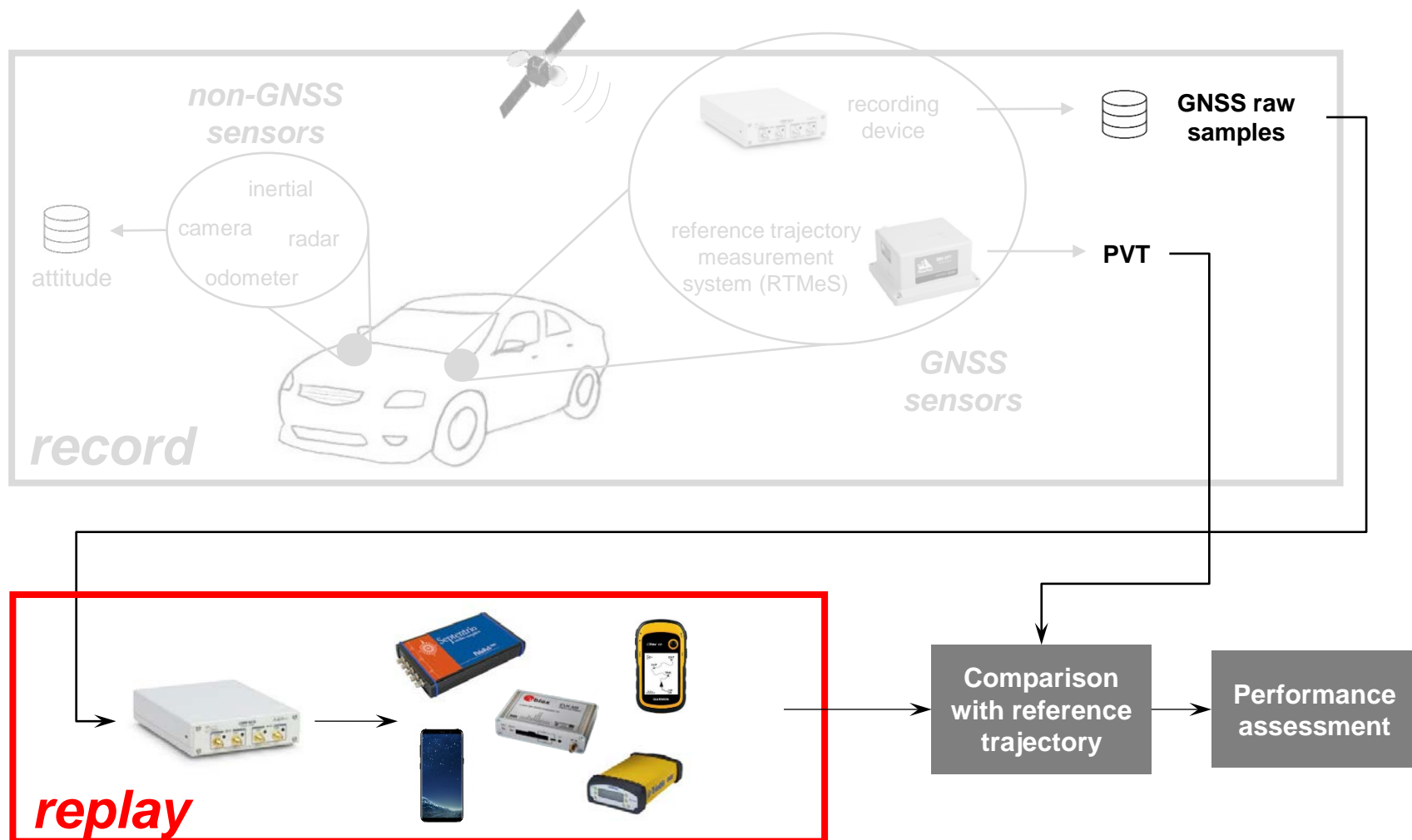
- Combination of field and laboratory tests
- Raw GNSS signals collected using a radio front-end
- One strength is that Software Defined Radio may be used for processing the signals



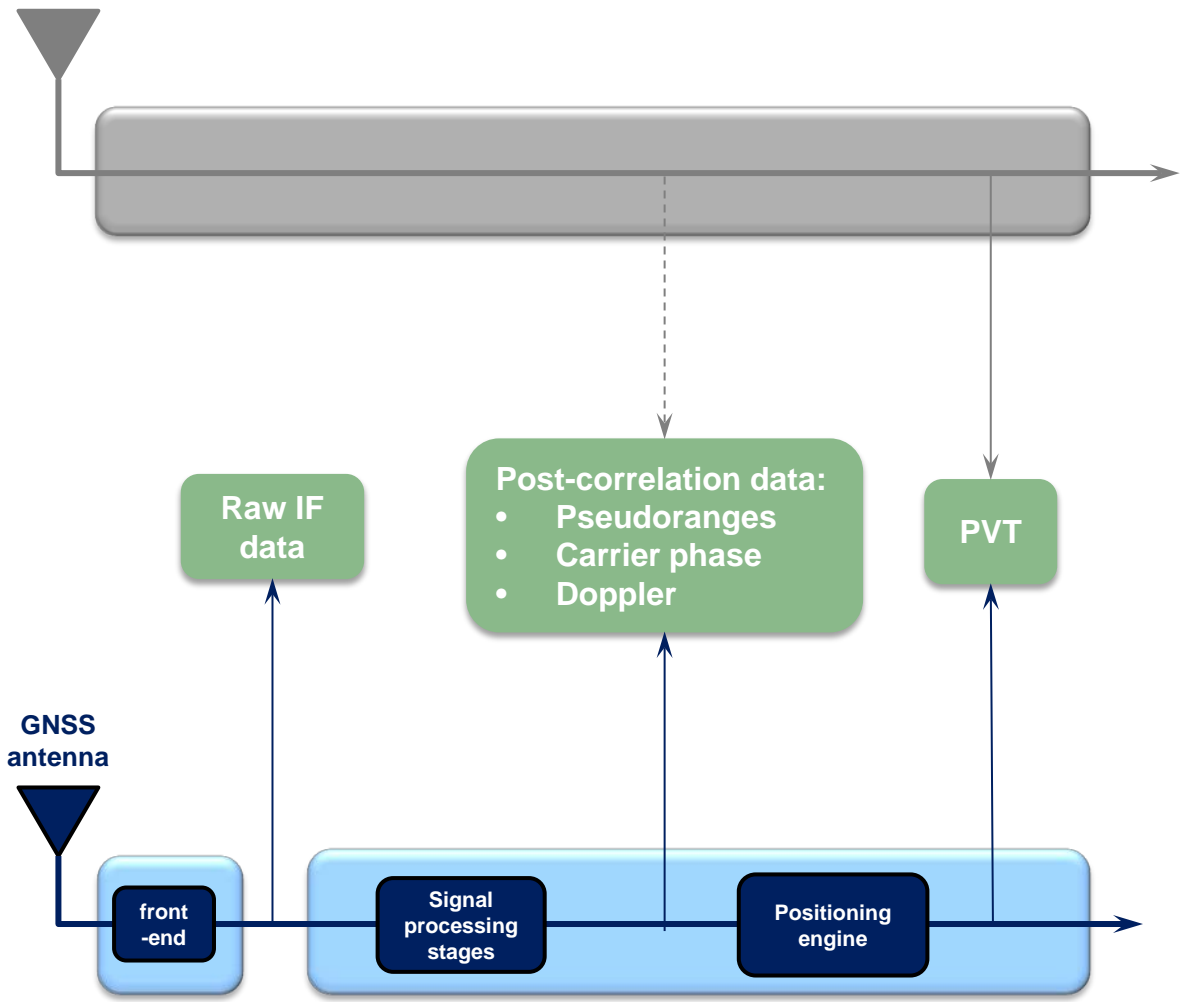
Record and replay tests 2



Record and replay tests 2



Software Defined Radio (SDR)



*GNSS
Commercial
receiver*

*GNSS SDR
receiver*

Comparison of test methods

APPROACH	Cost	Realism	Complexity	Repeatability	Valid for Hybrid
Field tests	High	High	High	Low	Yes
Lab tests	Low	Low	Medium	High	Medium
Record & replay tests	Medium	High	Medium	High	Medium



Beneficial for testing



Complicates testing



Makes testing challenging



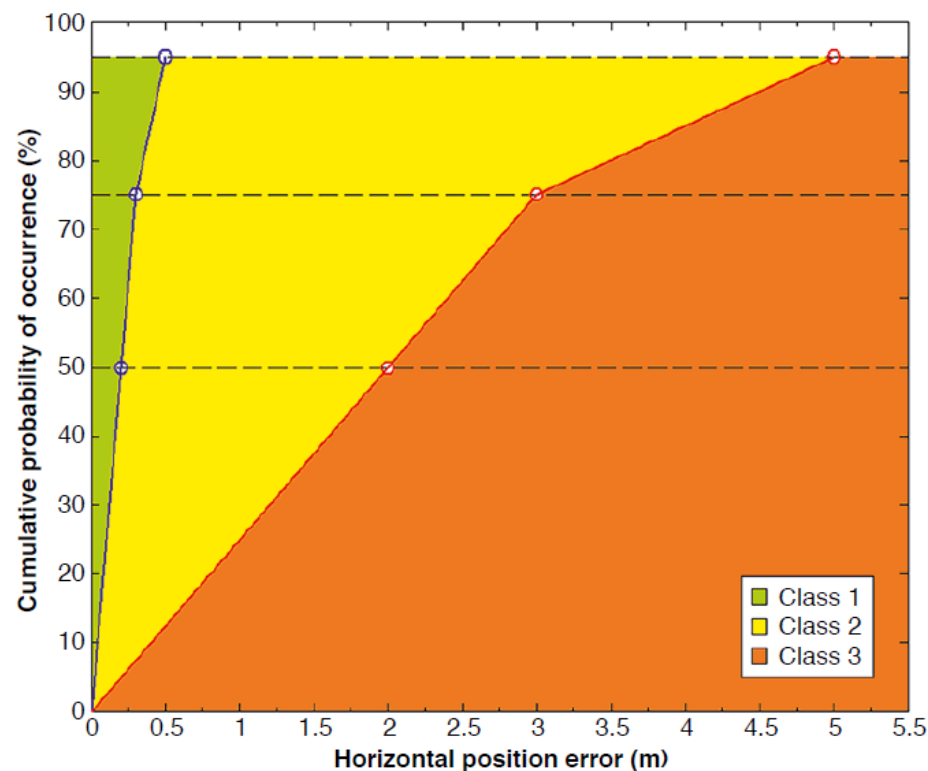
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Definition of performances

- Performance classes define performance of a given device according to predefined limits
- For a given scenario a position terminal will be classified in a certain class according to the results of the measured metric

Horizontal positioning
accuracy

(Source: GMV, GP-START project)

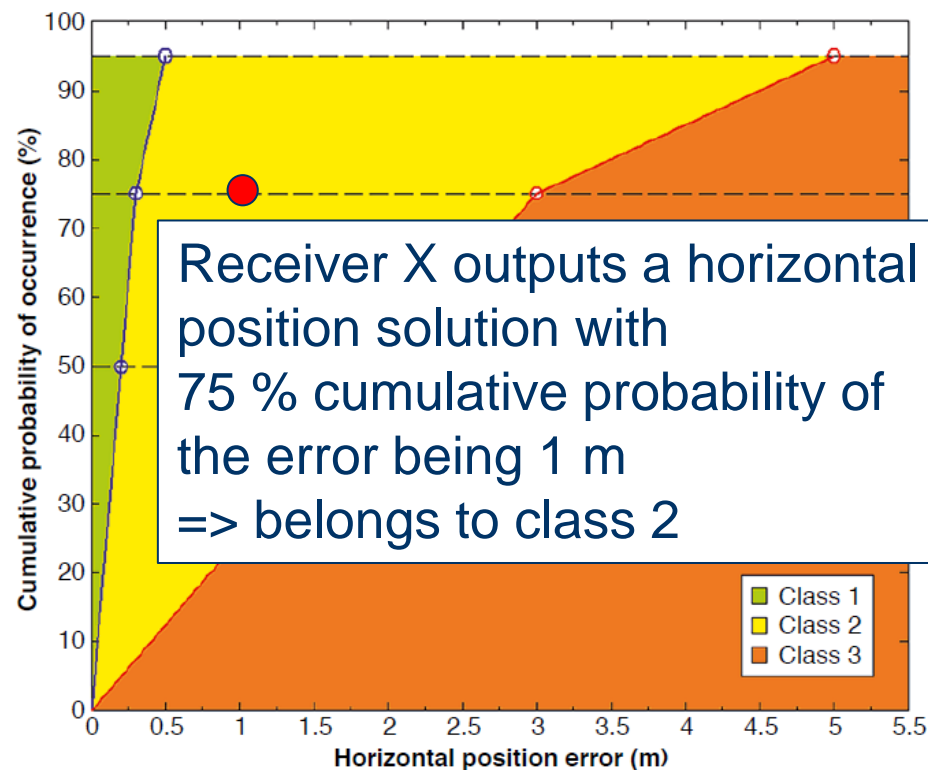


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THANK YOU FOR YOUR ATTENTION !

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