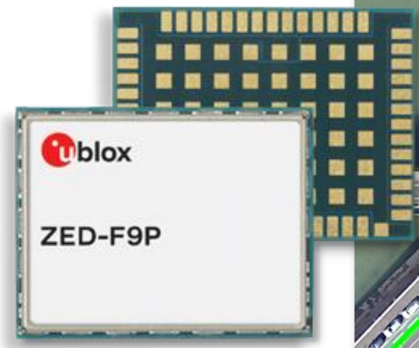
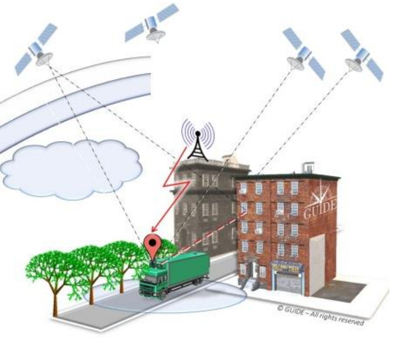
# uBlox F9P

## Assessment of GNSS Performances without NRTK correction



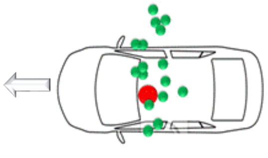




A GNSS receiver is designed to provide spatial positions (x, y, z) and velocities at a given instant.

- The positions are calculated by trilateration of GNSS signals emitted by any 4 available satellites.
- The velocity is obtained by measuring the Doppler effects on the GNSS signals by considering the relative motions of the receiver (antenna) and the satellites.
- Time is measured with very high precision by means of atomic clocks. Its precision determines the quality of the 2 previous measurements (positions & velocities).

The availability of the geolocation service is conditioned by the reception of good GNSS signals. In the event of interruptions or alterations, sensors can take over and estimate the missing data or adjust for incorrect positions.



*e.g. Various positions calculated by onboard receivers. The red point gives the ground truth*

Even with good receiving conditions, many biases degrade the position accuracy. Nevertheless, it is possible to correct the systematic errors by using additional data provided by a fixed station (real or virtual) for performing differential measurements. The receiver under test has been designed to process this correction data in order to provide high precision position measurements.

**However, what happens to the performance of the uBlox F9P receiver when the propagation of the GNSS signals is significantly degraded and prevents the correction of signals? Or simply when communication with the differential correction data service is lost?**

The terrestrial environment is complex with landforms, bridges, buildings, trees and many other obstacles that can affect the quality of the signals received from the satellites. This study analyzes 3 scenarios covering the most common cases near urban agglomerations.

**How do these phenomena impact the positions calculated by the receiver? How resilient is the receiver to environmental conditions? What is its ability to converge to the correct positions, quickly ?**

This test report is accompanied by files (KML) tracing the course of the test vehicle and materializing the calculated positions of several receivers throughout the campaigns. The ground truth is displayed for comparison allowing self-evaluation of errors. To better understand the test conditions, panoramic videos are also available for viewing the contextual surroundings.

### Features of the live assessments

- Position performance
  - Horizontal,
  - Across & Along tracks
  - Vertical
- Velocity performance
- Dynamic behaviour
  - Resilience to error sources
  - Remanence to errors
- TTFF in live
- Hybridization predispositions
- Availability

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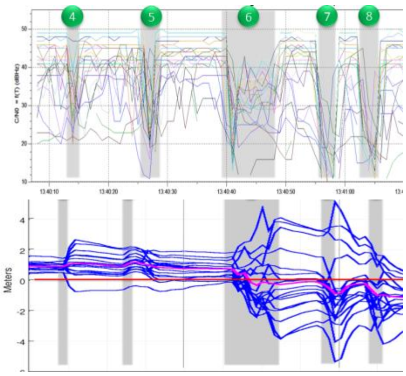
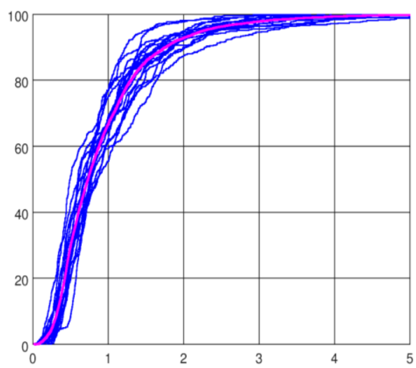
## Assessment of GNSS Performances without NRTK correction

| SCENARIOS *used for testing* | GNSS bands | Band-widths | Quanti-zation | Data | Obstructions | Attenuations | Multipath | Diffraction | Interference |
|---|---|---|---|---|---|---|---|---|---|
| Ring Road – Rangueil | 1585MHz 1210MHz | 100MHz 100MHz | 8bits | KML [Tj,Pt] Pan. Video | 11 Bridges | 1 pseudo tunnel | - | - | - |
| PeriUrban – Pech David | 1585MHz 1210MHz | 100MHz 100MHz | 8bits | KML [Tj,Pt] Pan. Video | - | - | - | 3 tree lined roads | - |
| Urban – Empalot | 1585MHz 1210MHz | 100MHz 100MHz | 8bits | KML [Tj,Pt] Pan. Video | 1 pass under a building | - | 1 urban canyon 1 stop at a red light | 1 Long street driven from south to north | - |



*e.g. Position errors caused by passing under bridges*

| STATS *provided in the report* | HORIZONTAL | | | VERTICAL | VELOCITY |
|---|---|---|---|---|---|
| | Horizontal | Across | Along | | |
| Statistical distribution | ● | ● | ● | ● | ● |
| Trajectory distribution | ● | ● | ● | ● | ● |
| Position distribution | ○ | ● | ● | - | - |
| Cumulative distribution (CDF) | ● | ● | ● | ● | ● |

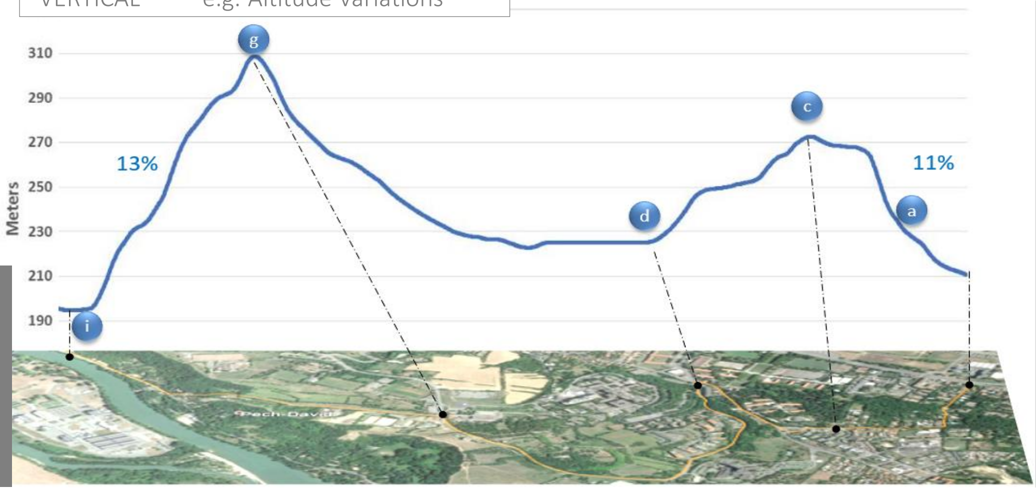


*e.g. Cumulative errors (CDF) from measurements*

HORIZONTAL – e.g. Position distributions



VERTICAL – e.g. Altitude variations





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