

SE-NAV is a new product dedicated to the assessment of GNSS signals reception in stringent environment. This software predicts the performance of systems such as GPS, COMPASS or GALILEO integrated into 3D virtual scenes representatives of real urban areas. SE-NAV provides user with output to estimate and to locally improve the signal reception in a given environment.

About GNSS reception in stringent environments SE-NAV key features:

The propagation of GNSS signals in constrained environments is disrupted by two intrinsic phenomena :

- The presence of obstacles (e.g buildings, moving objects, receiver carrier, etc...) hides the signal, induces shadowing effects and therefore, decreases the availability of the system.
- Interaction between the signal and the environment generates multipaths (reflections, diffractions, transmissions...) that lower the accuracy of the system and weaken the receiver power (fading effects).

Besides, the lack of integrity of some systems is a major problem that shall be solved, especially for safety-of-life application.

As geolocalized services are mainly used in urban constrained environments, it is therefore crucial to assess signal reception (received power, stability, reliability...) in order to improve it.

To address this topic, SE-NAV deterministically simulates the propagation of a GNSS signal in a 3D virtual scene. It provides the user with all the tools necessary to assess availability and accuracy of a system.



SE-NAV simulation in Toulouse downtown. White rays model the direct paths of the GPS satellites seen by the receiver. Blue and red rays are multipaths.

Deterministic Method

SE-NAV uses the deterministic method of Ray Tracing to compute the shadowing effects and the multipaths generated by the objects of the environment. Thanks to new computation techniques based on GPU resources, it provides users with full coverage maps in record time.

Environment Modeling

SE-NAV includes a high-performance render engine that displays a 3D scene as well as 3D information such as the hiding mask, the multipaths reaching the receiver or the coverage rate within a given area. The electromagnetic parameters of each object of a scene are easily configurable by the user thanks to an intuitive interface.

High-Fidelity Input

SE-NAV provides numerous parameters to configure a given GNSS system. In particular, the user can either build his/her own constellations or import almanacs. The user can also set the ionospheric and tropospheric models in order to calculate the resulting errors. The receiver associated to the GNSS system is also configurable.

Variety of Output

SE-NAV produces numerous business oriented data stored in ASCII files (MATLAB™ or SCILAB™ format). Indeed, SE-NAV computes the complete link and error budgets of each transmission channel. It also calculates visibilities, DOPs and Doppler shift.

Besides, two kinds of output can be generated depending on the type of simulation: output along a trajectory or coverage within an area.

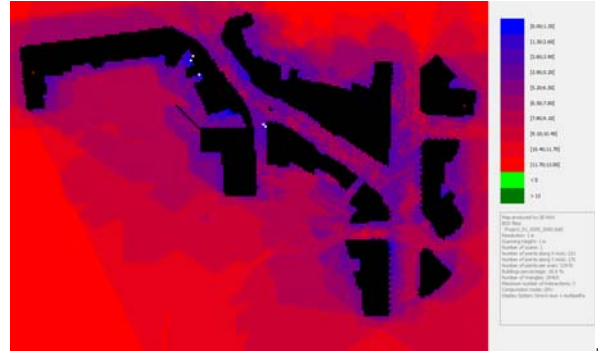
User Friendly Interface

An ergonomic GUI enables the user to easily set the system to be simulated. The configuration of a GNSS system from the emitters (satellites, terrestrial buoys, etc...) is carried out quickly and rationally.

Finally, the software includes a 3D interface to display results and to easily detect the problem areas of the studied scene.

Use-Cases:

- Military applications: mission planning and rehearsal, coverage computation in hostile environment, electronic warfare, and mission follow.
- Integrity assessment in the frame of aeronautical navigation (EGNOS...)
- Protection and rescue : fireman and rescuer of the future, soldier and policeman of the future
- Aid for the development and the deployment of Localized Based Services (LBS): transportation, tourism, environment.
- R&D and/or measurement campaigns dealing with the propagation of navigation signals in urban environment.
- Operational Conditions Maintenance of space and terrestrial systems.



Sample of GPS coverage, computed by SE-NAV using a virtual 3D mockup of Toulouse downtown. Blue areas indicate availabilities problem.

SE-NAV Versions:

OKTAL-SE offers two SE-NAV Versions: Standard and Advanced.

Features	Standard Version	Advanced Version
Kernel (Orbit computation, Ray Tracing calculation)	✓	✓
Constellation design capabilities	✓	✓
3D display of scene and results	✓	✓
3D multipaths display	✓	✓
Advanced emitters sets: repeaters, pseudolites, ...		✓
Custom 3D terrain import		✓
3D visibility mask display		✓
Physical material manipulation		✓
Electromagnetic settings		✓

Output	Standard Version	Advanced Version
Visibilities reports	✓	✓
Dilution Of Precision (DOP) reports	✓	✓
Multipaths delays reports	✓	✓
Error budget assessment reports		✓
Signal to Noise Ratio computation		✓
Doppler shift reports		✓

Import files:

To carry out simulations, SE-NAV loads:

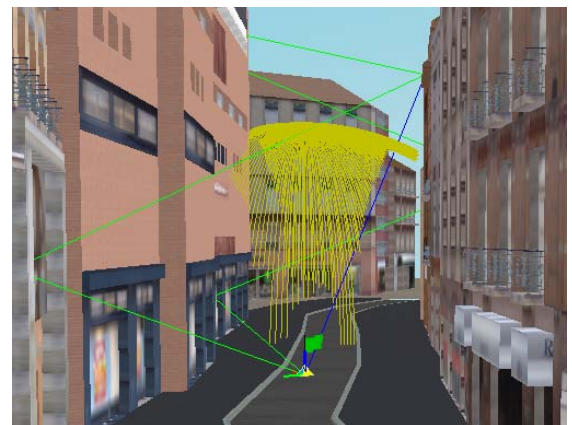
- Almanacs (YUMA format)
- 3D terrains (SDM format)
- 3D antenna patterns

In addition, SE-NAV is fully compliant with the data produced by SE-WORKBENCH™.

Contacts:

To obtain more information about SE-NAV:

- call OKTAL-SE representative: +33 5 67 70 01 93
- contact the local reseller of OKTAL-SE in your country: www.oktal-se.com
- visit the SE-NAV website: www.oktal-se.com/se-nav



Terrestrial beacons emission and visibility diagram