Performance and Interoperability of GPS/Galileo Receivers and Observables

Sleewaegen, J.M.; Simsky, A.

Septentrio, BELGIUM

In the near future, a large variety of new GNSS signals will become available. The most significant additions with respect to the current GPS signals are the introduction of two new frequency bands (E5/L5 and E6), the use of BOC or AltBOC modulations, and the fact that each carrier is modulated by at least two signal components, the so-called Pilot and Data components.

The wide offer of new signals implies that several signal processing and tracking options are available to the receiver developer. For instance, receiver A could track the Pilot component on a given carrier while receiver B tracks the Data component. The new RINEX format v3.0 takes this fact into account and defines different observable codes for all the different tracking options. Although the availability of several observable types per carrier will open up new fields of investigation, it is essential for the user to understand the difference and similarities between them. This is especially true in a heterogeneous multi-receiver network like the IGS, where all instrumental offsets must be minimized.

The paper begins with a description of all civilian Galileo and modernized GPS signal components. The operation principle of a combined GPS/Galileo receiver is described, focusing on the interoperability aspects between both constellations. The different tracking options are presented and compared, and related to the observable types as defined in RINEX v3.0.

The paper then presents the performances of the new signals with respect to tracking noise and multipath on code and phase. It is shown that all new signals significantly outperform the current GPS CA or L2C codes. Especially the unique AltBOC modulation on Galileo E5 is shown to bring unprecedented accuracy.

Finally, an overview of the current Galileo-related developments and activities within Septentrio is presented, with a particular attention to the tests currently underway with the GIOVE-A satellite.