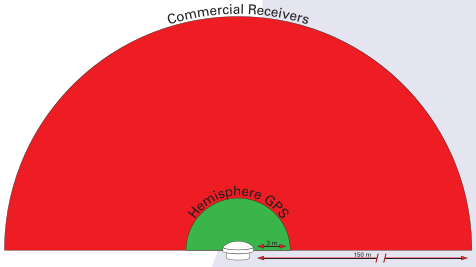
Professional GPS Receivers vs Consumer GPS Receivers

Hemisphere GNSS receivers have a variety of performance advantages over consumer-grade GPS receivers. Consumer-grade GPS receivers are used in non-precision applications such as basic navigation, asset tracking, fleet management, mobile phones and other applications that require less accurate positioning. Hemisphere GNSS receivers are used in precision applications that require reliable positioning in the most demanding applications. For more than 20 years, Hemisphere GNSS has manufactured professional-level GPS receivers for a variety of industries including surveying, precision agriculture, marine navigation, machine control and aerial guidance. The following document defines the major differences between consumer-grade GPS receivers and professional-level Hemisphere GNSS receivers.



Susceptibility to Multipath

Multipath mitigation

Multipath is a major contributor of error in GPS positioning and can reduce accuracy by several meters, depending on antenna surroundings. Error from multipath results when an external object reflects the signal coming from a satellite. This multipath signal is a delayed image of the direct signal and can ultimately cause errors in the receivers measurement. Numerous elements can contribute to multipath including buildings, trees, mountains, metal structures and other environmental factors. Hemisphere GNSS technology uses patented multipath mitigation architecture to significantly reduce multipath errors for reflections more than 3 meters away from the antenna. The multipath mitigation technology typically used in consumer-grade GPS receivers is a basic 'early minus late' technique that is susceptible to multipath reflections up to 150 meters away. This increased susceptibility to multipath significantly reduces the accuracy and reliability consumer-grade receivers have in challenging environments. (See diagram)

Carrier phase and code phase

Hemisphere GNSS Crescent technology uses GPS signal data from both carrier phase as well as code phase; whereas, consumer receivers are only capable of interpreting GPS signal data from code phase. Consumer GPS receivers use a code alignment technique to determine the distance to each satellite. Finding the exact peak on a 300m wavelength results in meter level errors. Hemisphere GNSS uses shorter carrier phase wavelengths to determine the distance to each satellite. Finding the exact peak on a 19cm wavelength results in only centimeter level errors. Hemisphere GNSS Crescent technology also uses carrier phase to aid code phase alignment and dramatically improve the accuracy of its receivers. Through correction options such as DGPS and RTK, Hemisphere GNSS Crescent receivers can be scaled in accuracy from a factory positioning accuracy of 0.6 meters to centimeter level post-processing accuracy. Consumer GPS receivers are not scalable and typically have accuracy ranges between two to five meters.

Communication Ports

Consumer-grade GPS

- RS232 Serial Port

Hemisphere GNSS

- RS232 Serial Port
- USB
- CAN BUS
- NMEA 0183
- NMEA 2000

Hemisphere

Real-time velocity

Another added benefit of Hemisphere GNSS Crescent technology tracking carrier phase is its ability to calculate more accurate real-time speeds. Speed can be estimated by using the frequency shift of the carrier phase cycles for each satellite (Dopplers). This allows Hemisphere GNSS receivers to obtain real-time speed accuracies of 0.1 km/hr, while commercial GPS receivers have real-time speed accuracies of 0.3 km/hr.

Update rate

Control systems and many other applications require fast update rates from GPS receivers. Hemisphere GNSS Crescent receivers can output position up to 20 times per second while consumer GPS receivers typically output position between 1–5 times per second. Faster GPS update speeds provide control loops with more immediate information, which ultimately improves stability. Hemisphere GNSS updates are actual measurements whereas updates from consumer GPS receivers are less accurate extrapolation measurements.

Wider GPS tracking bandwidth

Hemisphere GNSS technology is designed for highly dynamic applications such as aerial guidance. Crescent software is optimized so that it can be used on crop dusting airplanes where pilots are regularly pulling multiple Gs of acceleration, blocking large portions of the sky and traveling at 100's of knots. Hemisphere GNSS Crescent based receivers can track through up to 20 G of acceleration.

Wider RF bandwidth

To determine delay from satellites a replica code is generated and aligned with the satellite code. If the received satellite code is filtered too much the edges of each transition will be rounded. In consumer receivers, this filtering process makes it very difficult to separate multipath from the surrounding area of the antenna. Hemisphere GNSS Crescent based receivers have a much wider RF bandwidth, typically 10 times wider than consumer-grade receivers, this allows for Crescent receivers to separate and reduce errors caused by multipath. Consumer-grade receivers have a narrow bandwidth that makes it impossible to separate multipath from the direct signal.

Heading sensor

Typical consumer-grade GPS receivers can only be used to estimate direction of travel. Consumer receivers require the vehicle or object to be moving in order for the receiver to calculate a direction. Commercial receivers cannot determine if the vehicle is rotating in one spot or what orientation it has during startup. Hemisphere GNSS Crescent Vector based receivers use a patented two antenna and two synchronized receiver system to calculate precise heading and positioning, even while stationary. With synchronized receivers, Vector technology requires fewer satellites to acquire an accurate heading.

To learn more about Hemisphere GNSS advantages, visit *www.hemispheregnss.com* or email *precision@hemispheregnss.com*

DGPS Corrections

Consumer-grade GPS

- No DGPS Correction Available

Hemisphere GNSS

- SBAS
- RTK
- Radio Beacon