

Using Hemisphere GNSS Products in Challenging Environments

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THE ISSUE:

GPS receivers compute positions by making distance measurements to the GPS satellites. The more precisely those measurements can be made, the more accurate and stable the position solution will be. If a user is in an environment where other objects are above or around the antenna, such as under trees, the measurement quality will suffer. This document discusses some strategies to improve the measurements and produce the best possible accuracy for those situations.

While tree cover is often one of the more common areas to expect problems with tracking satellites, there are other situations that may share similarities. For example, an antenna under a helicopter's rotating blades may have reduced signal quality. A receiver at street level surrounded by tall buildings will have signal concerns. Even a receiver in a wide open area like a playground would have signal concerns if the antenna were mounted at ground level and people were standing next to it. This document will focus on tree cover as a concern, but the principals relate to many other situations.

Generally, under trees, the GPS phase measurement is quite easily interrupted. As a result, it is extremely difficult to use RTK under trees. Performance is very slow and very often unreliable. This virtually defeats the purpose of using RTK under such situations. From a product point of view, this eliminates many of the advantages seen by Eclipse over Crescent, which, considering the purchase price, makes Crescent the most appropriate platform to use under tree cover.

It should be mentioned that the Crescent Vector product relies entirely on the phase data to achieve a heading solution. As such, achieving a valid heading solution under tree cover should not be expected.

The commands discussed in this document apply to both Crescent and Eclipse, but the assumption is that they will be used with Crescent.

Use these commands at your own risk. Be aware that everything comes with a price – you will usually sacrifice accuracy to increase your position solution yield.

CRESCENT FIRMWARE:

It is recommended to use Crescent firmware version 6.8Pa for challenging GPS environments. This is the SBAS firmware. The part number used is 160-0387-000, and the filename is GPSAppSX2_WAAS_68Pa.bin. Contact Technical Support to obtain this firmware and its loading instructions.

Note: THIS MAY NOT BE THE FIRMWARE THAT WAS SHIPPED ON YOUR CRESCENT.

Use the **\$JI** and **\$JAPP** commands to determine if this is the firmware you currently have installed.

SEEING MORE SATELLITES (MASK ANGLE):

The Crescent receiver typically has a 5° mask angle as the default. You may consider dropping this to 0° instead, but this will likely not bring in too many more satellites. Satellites below 5° likely will be obscured behind objects on the horizon.

The primary concern with lowering the angle is that low elevation satellites often suffer from poor signal quality even if they are in clear environments. Bringing in satellite measurements that we already know have poor quality can often make a position solution worse. However, if it makes the difference between seeing “not enough” or “enough” satellites, this will at least offer you the choice to use the potentially poor answer or wait for a more confident solution.

Use this command with caution. **\$JMASK, 0** will allow you to see the most satellites, but your positioning accuracy may not improve due to the noise in the additional measurements. Use **\$JMASK, 5** to set the mask angle back to 5°.

WORKING WITH FEWER SIGNALS (HEIGHT AIDING):

Normally 4 satellite signals need to be available to calculate a full position. That position calculation returns the latitude, longitude, and height. For some users, height is not critical information, and they are willing to accept a poorer height accuracy if it will increase their likelihood of getting a position solution.

The **\$JALT, SATS, 4** command allows the receiver to use the last computed height if the receiver drops below 4 satellites tracking. Essentially this means that in times when you can only see 3 satellites, the receiver will calculate a latitude and longitude, but still use the previously computed height. Note that as you change your altitude while tracking only 3 satellites, your lat / lon solution accuracy will decrease. If you drop to less than 3 satellites, you will not have a solution, and you will start computing lat, lon, and height again once you track 4 or more satellites.

If you want to turn this height-aiding feature off, use **\$JALT, NEVER** which is the default.

SATELLITE SIGNAL LEVELS (FOREST COMMAND)

Under tree cover, typically the satellite’s signal is not blocked entirely, but the signal strength is reduced. This is similar to sunlight. Being under a tree will reduce the amount of direct sunlight exposure, but it will not block it completely. Inside the GPS receiver, there are certain thresholds that look at the incoming signal levels to determine if a signal is worth using or not.

The **\$JMODE, FOREST, YES** command will artificially add 2dB to all satellite signal levels. Note that this will most likely increase your positioning noise in poor conditions vs. not having positions available at all. Use **\$JMODE, FOREST, NO** to return to normal operation.

USING WITH AND WITHOUT DIFFERENTIAL CORRECTIONS (SBAS/DGPS)

Satellite Based Augmentation Systems (SBAS) transmit corrections for large regions, such as North America, Europe, and Japan / Eastern China. On the fringes of these regions, users may see some satellites that corrections are not available for. In some other situations, a different DGPS correction source may be bringing in corrections. Standard procedure is if a receiver has corrections, it will ONLY use satellites that it has corrections for. However, you may be willing to use a combination of corrected and uncorrected satellite ranges.

Use **\$JMODE, MIXED, YES** to allow the use of non-differentially corrected satellites along with the differentially corrected satellites. The non-corrected satellites are de-weighted in the solution though, to help control the positioning accuracy. Use **\$JMODE, MIXED, NO** to turn it off.

Note you may need to verify your **\$JDIFF** settings for this to have an effect. Using **\$JDIFF, NONE** will stop using all corrections (and use the maximum number of satellites, but with no correction data).

Using Different Additional Satellites (SBAS Ranging)

Regardless of where users are in the world, SBAS satellites can be seen, even though the information reported by them is not for the user's region. As an example, in South America the WAAS satellites are visible, but the correction information on them is not about satellites over South America. However, a valid and accurate range measurement can be made to those SBAS satellites.

By using **\$JMODE, SBASR, YES** a user can choose to include SBAS range measurement in their position solution. In some regions the signals being sent by the SBAS satellites are not yet fully implemented and odd positioning may occur if SBAS ranges are used. Use **\$JMODE, SBASR, NO** to discontinue using SBAS ranges.

FURTHER INFORMATION:

Consult www.HemisphereGNSS.com for the latest information, or contact your dealer.

For support via email, please contact TechSupport@HemisphereGNSS.com

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