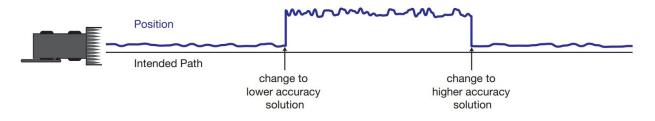# APN-075: STEADYLINE®

Contents

What does STEADYLINE do?

NovAtel's STEADYLINE technology reduces position jumps that can occur when a GNSS receiver changes positioning modes.

A receiver will change its positioning mode depending upon the solution it is able to compute. The type of positioning solution the receiver can compute depends upon:

1. Number of satellites tracked by the receiver
2. Quality of the signals from those satellites
3. Availability of correction signals
4. Positioning types supported by the software model activated on the receiver

This effect is especially evident when a receiver transitions from a high accuracy RTK position solution to a lower accuracy solution such as PPP, DGPS, GLIDE+SBAS or even autonomous GLIDE™ as shown in Figure 1 below:

Figure 1 - Positioning Change without STEADYLINE

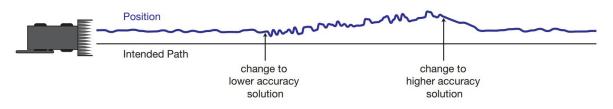Smooth transitions are extremely important for precision steering applications where sudden jumps are disruptive.

PREFER ACCURACY

In PREFER ACCURACY mode, the positioning mode change depends on the accuracy level of the positioning modes as seen in Figure 2 below.

When the position mode changes from a more accurate to a less accurate mode the receiver maintains the offset calculated to limit a potential real position jump. The receiver continues to apply the position offset to all positions calculated in the new positioning mode.

When the position mode changes from a less accurate to a more accurate mode the receiver transitions to the higher accuracy solution, the position offset is applied to the calculated position to limit a potential real position jump. The position then slowly transitions to the new position type over a user specified period.

Figure 2 – STEADYLINE PREFER ACCURACY Mode Operation

What does STEADYLINE not do?

STEADYLINE is NOT a bridging technology in the true sense in that it will not continue to provide you positions when you lose all GNSS signals. It will bridge short RTK correction outages, but the accuracy of the position solution will eventually be that of the next best positioning mode available.

In an example where RTK corrections are lost and the position switches from an RTK position type (NARROW_INT) to standalone (SINGLE_POINT), the receiver accuracy level also changes from RTK (centimeter) to standalone (meter or sub-meter accuracy). Although STEADYLINE smoothed the jump between the centimeters to sub-meter solution, the transition to the sub-meter solution still means sub-meter accuracy. Using GLIDE with STEADYLINE will further smooth the position, but the longer the receiver is providing a sub-meter solution, the more the error will grow.

In what applications should STEADYLINE not be used?

STEADYLINE should not be used as a long duration high accuracy bridging solution if GLIDE is the only other positioning type supported on the receiver.

Under what conditions can STEADYLINE be used?

STEADYLINE works best when supporting a high-accuracy GNSS position type such as RTK or TerraStar-C.

What is STEADYLINEDIFFERENTIALTIMEOUT?

NovAtel's STEADYLINE can extend the reporting of RTK position types after transition to GLIDE mode using the new STEADYLINEDIFFERENTIALTIMEOUT function.

1. Ability to propagate position during brief satellite outages
2. Improved smoothing to remove position spikes within position engines

The STEADYLINEDIFFERENTIALTIMEOUT specifies how long STEADYLINE will report RTK or PPP solutions after a loss of corrections. However, this new timeout is also logically OR'd with the RTKTIMEOUT & PPPTIMEOUT. This means that STEADYLINE will report an RTK or PPP position type based upon the longest timeout: either STEADYLINEDIFFERENTIALTIMEOUT or PPPTIMEOUT or RTKTIMEOUT.

Example 1 – STEADYLINEDIFFERENTIALTIMEOUT > RTKTIMEOUT

In this example, STEADYLINE is enabled to use the PREFER_ACCURACY mode and STEADYLINEDIFFERENTIALTIMEOUT is set to a value higher than the RTKTIMEOUT.
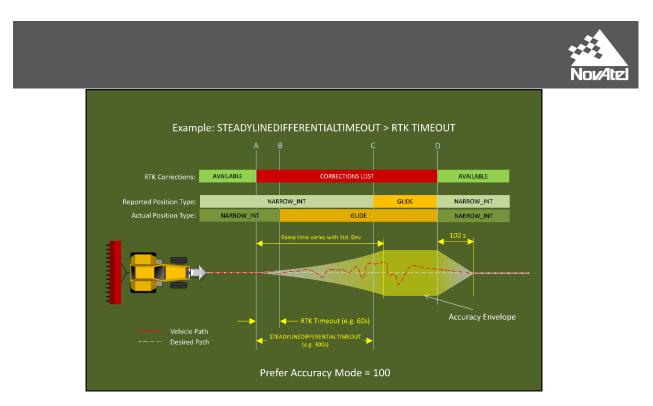
Receiver settings:
STEADYLINE PREFER_ACCURACY 100
STEADYLINEDIFFERENTIALTIMEOUT 300
RTKTIMEOUT 60
PDPFILTER ENABLE
PDPMODE GLIDE AUTO

At point A in Figure 4 below, RTK corrections are lost and the differential age increases. STEADYLINE switches over to use the GLIDE solution at point B when RTKTIMEOUT expires, but the receiver will continue to report a position type of NARROW_INT for the duration of the STEADYLINEDIFFERENTIALTIMEOUT (e.g. 300 seconds) as long as it is the most accurate position type available. When the STEADYLINEDIFFERENTIALTIMEOUT expires at point C, the reported position type will change to GLIDE. Note that even though the RTKTIMEOUT will expire at point B this timeout is shorter than STEADYLINEDIFFERENTIALTIMEOUT, and the position type reported will continue to be NARROW_INT as long as it is the most accurate position type available.

When RTK corrections return at point D and the receiver fixes to an RTK position, the NARROW_INT position type will be reported again and STEADYLINE will smoothly transition back over 100s (in this example) from the GLIDE position to the RTK position.

It should be noted that the standard deviations will increase up to those reported by the GLIDE engine even though the reported position type is NARROW_INT.

Figure 3 – STEADYLINE PREFER ACCURACY (STEADYLINEDIFFERENTIALTIMEOUT > RTKTIMEOUT)

If RTK corrections return before the STEADYLINEDIFFERENTIALTIMEOUT expires, the NARROW_INT position type will continue to be reported as long it is the most accurate position type available as shown in Figure 5 below. When corrections return at point B, STEADYLINE will smoothly transition back to the RTK accuracy solution over 100 seconds.
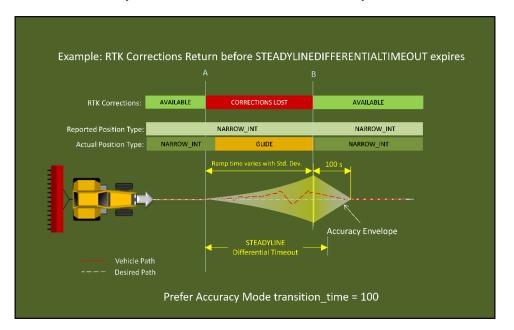

Figure 4 – STEADYLINE PREFER ACCURACY (RTK Corrections Returns Before Timeout)

Example 2 – RTKTIMEOUT > STEADYLINEDIFFERENTIALTIMEOUT

In this example, STEADYLINE is setup to use the PREFER_ACCURACY mode and RTKTIMEOUT is set to a value higher than the STEADYLINEDIFFERENTIALTIMEOUT.

Receiver settings:
STEADYLINE PREFER_ACCURACY 100
STEADYLINEDIFFERENTIALTIMEOUT 30
RTKTIMEOUT 120
PDPFILTER ENABLE
PDPMODE GLIDE AUTO

At point A, as shown in Figure 6 below, RTK corrections are lost and the differential age begins to increase. STEADYLINE switches over to use the GLIDE solution after RTKTIMEOUT expires, but the receiver will continue to report a position type of NARROW_INT for the duration of the RTKTIMEOUT (e.g. 30 seconds) as long as it is the most accurate position type available. At point C, the RTKTIMEOUT expires and the reported position type changes to PDP. Note that even though the STEADYLINEDIFFERENTIALTIMEOUT expired at point B, this timeout is shorter than RTKTIMEOUT, and the position type reported will still be NARROW_INT as long as it is the most accurate position type available.

When RTK corrections return at point D and the receiver fixes to an RTK position, the NARROW_INT position type will be reported again and STEADYLINE will smoothly transition back over 100s (in this example) from the last reported PDP position to the RTK position.

It should be noted that the standard deviations will increase up to those reported by the GLIDE engine even though the reported position type is NARROW_INT.
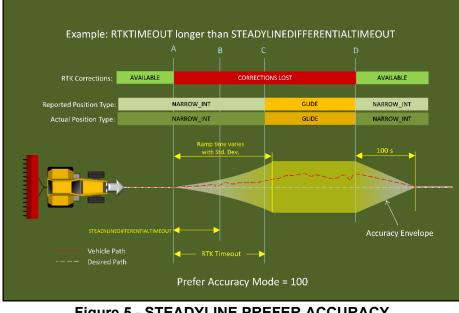

Figure 5 - STEADYLINE PREFER ACCURACY
(RTKTIMEOUT>STEADYLINEDIFFERENTIALTIMEOUT)

Where to go for Support

To help answer questions and/or diagnose any technical issues that may occur, the NovAtel Support website is a first resource: www.novatel.com/support/

Remaining questions or issues, including requests for test subscriptions or activation resends, can be directed to NovAtel Support by visiting https://novatel.com/contactus/contact-support. To enable the online form and submit a ticket, fill the 4 fields and press Submit Form button.

However, before contacting Support, it is helpful to collect data from the receiver to help investigate and diagnose any performance-related issues. In those cases, if possible, collect the following list of logs (the LOG command with the recommended trigger and data rate is included):

LOG VERSIONA ONCE
LOG RXSTATUSA ONCHANGED
LOG RAWEPHEMB ONCHANGED
LOG ALMANACB ONCHANGED
LOG IONUTCB ONCHANGED
LOG GLORAWEPHEMB ONCHANGED
LOG GLORAWALMB ONCHANGED
LOG GLOCLOCKB ONCHANGED
LOG TRACKSTATB ONTIME 10
LOG SATVIS2B ONTIME 60
LOG RANGEB ONTIME 1
LOG BESTPOSB ONTIME 1
LOG MATCHEDPOSB ONCHANGED
LOG PASSTHROUGHB ONCHANGED
LOG RXCONFIGA ONCE

The data described above can be collected using a terminal program that supports binary data logging, or NovAtel's CONNECT utility can be downloaded and installed from the NovAtel website: www.novatel.com/support/info/documents/809.