RTK ASSIST and RTK ASSIST PRO
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Overview

Hexagon | NovAtel’s RTK ASSIST and RTK ASSIST PRO empower RTK users to seamlessly operate with centimetre-level accuracy during RTK correction signal outages caused by radio connectivity issues or wireless or cellular signal disruptions. RTK users can continue their operation without being impacted by signal outages, leading to increased productivity. RTK ASSIST and RTK ASSIST PRO are supported through NovAtel’s satellite-based correction services and thus do not require any local infrastructure. RTK ASSIST is currently available for OEM6 and OEM7 product lines and RTK ASSIST PRO is available on OEM7 for eligible hardware and firmware models.

How it Works

RTK ASSIST and RTK ASSIST PRO work by using the precise GNSS correction data delivered by the geostationary (GEO) satellites¹ to maintain centimetre-level accuracy in the absence of RTK corrections. These corrections are received through L-band tracking and subsequently used by the position engine to maintain centimetre-level accuracy.

Figure 1: Global coverage map for correction delivery

Coverage areas for specific beams can be viewed here.

¹ GNSS correction service is provided by TerraStar.
RTK ASSIST

RTK ASSIST operates seamlessly in the background for up to twenty minutes from the onset of an RTK outage. After that, the position type will transition to the next most accurate available. Datum differences or biases are automatically compensated for when transitioning between position types. The algorithm is designed to facilitate smooth transitions during RTK outages. However, as with any carrier phase-based positioning, there is a possibility that a position jump may occur due to an incorrect ambiguity fix. The positioning solution will transition back to using RTK corrections once connection has been re-established with the correction source.

As the RTK ASSIST technology uses the precise correction data delivered via geostationary satellites, any obstructions (i.e., buildings, grain tanks, tree lines) can potentially degrade or block the satellite signals. Depending on the L-band signal blockage duration, the position error will increase over time. If L-band signals are lost for more than 2 minutes, RTK-level accuracies cannot be maintained and RTK ASSIST will disengage. The resulting position type will be determined by the accuracy level of the solution at the time RTK ASSIST becomes inactive.

The RTK ASSIST functionality will engage if there is L-band tracking and the GNSS receiver has had at least one RTK fix prior to the outage.

Users can expect centimetre-level accuracy during the RTK outage when using RTK ASSIST. However, the accuracy will degrade as the outage duration increases but will stabilise (approximately 4 cm RMS). If the RTK outage occurs in the first 30 minutes of operation, further degradation (approximately 20 cm RMS) may be observed.

RTK ASSIST PRO

Similar to RTK ASSIST, RTK ASSIST PRO will operate seamlessly in the background, however without limit after the onset of an RTK outage. RTK ASSIST PRO leverages multi constellation support to provide highly accurate and reliable positioning in RTK correction outages.

RTK ASSIST PRO also provides standalone centimetre-level positioning in areas where RTK is no longer practical or beneficial. Standalone positioning is provided at the TerraStar-C PRO level. When operating without an initial RTK fix, the user may require nudging to handle datum offsets. Please refer to TerraStar on OEM7 for information on TerraStar-C PRO.
Operating Modes

RTK ASSIST operates in two different modes: Coast and Full Assist.

Coast

Coast is available as soon as the RTK ASSIST corrections are received from the L-band satellite. In this position mode, error growth during the RTK outage is slightly greater when compared to Full Assist mode. When in this mode, RTK will not resume following a full GNSS signal outage until after RTK corrections are restored.

Full Assist

Full assist provides the lowest position error growth during RTK correction outages and makes it possible for RTK to resume even if there are complete GNSS signal outages during the RTK ASSIST period. This mode requires a convergence period of approximately 30 minutes from navigation start.

Requirements for Using RTK ASSIST and RTK ASSIST PRO

The RTK ASSIST functionality requires the receiver to be enabled for both RTK positioning and L-band tracking. These requirements can be checked against the model of the receiver and determine that options for L-band and RTK are both enabled.

OEM6

The firmware requirement for RTK ASSIST is 6.710 (OEM060710RN0000) or later.

Based on the OEM6 model structure, firmware Option 4 must be RTK (i.e., “R”), the firmware Option 2 must be “2” or higher, and the firmware Option 3 should be “L” or “J”. For example:

- OEM628-D2L-R0G-TT0
- OEM628-D2J-RPR-TTN
- SM6L-D2L-RPG-0T0

![Figure 3: OEM6 model structure and firmware model options for RTK ASSIST](image)

The “L” or “J” option enables L-band tracking, and the “R” option allows the receiver to use RTK ASSIST service. However, the user must configure the receiver to track the L-band signal (see Enable L-band Tracking) and an RTK ASSIST subscription must be purchased and activated before the receiver will start using the corrections and providing RTK ASSIST functionality.
To use the RTK ASSIST service, the channel configuration options for dual-frequency (L1 & L2) tracking must be included in the model, as well as a minimum of GPS+GLONASS tracking. To allow for this, the first two firmware options must be a minimum of “D” and “2” as shown in the examples and Figure 3 above.

**OEM7**

The firmware requirement for RTK ASSIST is 7.02 (OM7MR0200RN0000) or later.

The firmware requirement for RTK ASSIST PRO on OEM7 is 7.05 (OM7MR0500RN0000) or later.

Based on the OEM7 model structure, a minimum of dual-frequency is required, represented by the “D” or “F” in the 2nd character. An RTK model is also required, i.e “R” in the 4th character. For example:

- OEM729-DFN-RNN-CBN

Full information on the OEM7 model structure and firmware model options can be found [here](#).

With an RTK ASSIST PRO subscription and the new 7.08.14 FW, a feature called SMCC (Subscription Managed Channel Configuration) is available which will automatically update the channel configuration to the following:

- MFN -> MF config (6)
- MFD -> MF config (6)

This can be disabled if it is not your preferred configuration. It is recommended for best PPP performance; however, it is understood that if you are using RTK, you may have different channel configuration requirements for your RTK source.

**RTK ASSIST and RTK ASSIST PRO Subscriptions**

A valid subscription is required to use RTK ASSIST services. To purchase an RTK ASSIST subscription, contact your NovAtel dealer or sales office. NovAtel’s eStore also allows purchasing of RTK ASSIST subscriptions.

NovAtel Customer Support can provide free 3 or 5-day trial RTK ASSIST subscriptions for test and demonstration purposes. Users cannot subscribe to both RTK ASSIST and TerraStar (e.g. TerraStar-L) subscriptions simultaneously.

The receiver’s NovAtel Product Serial Number (PSN) or TerraStar Product Activation Code (PAC) is needed to obtain a demo or purchase subscription. Before contacting your NovAtel sales office, obtain the PSN for the receiver you wish to activate using the command `LOG VERSION`.

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4 Contact [support@novatel.com](mailto:support@novatel.com) for more details. Maximum of 3 test subscriptions will be provided per receiver.
To verify an RTK ASSIST subscription, users can use the **TERRASTARINFO** log as demonstrated below:

**LOG TERRASTARINFO**

```
< TERRASTARINFO COM1 0 87.0 FINESTEERING 1919 247530.423 02000020 a7ce 32768 "QU075:2185:6222" PAYG 00000800 0 0 0 LOCAL AREA 51.11639 -114.03806 2
```

<table>
<thead>
<tr>
<th>Bits</th>
<th>Mask</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-8</td>
<td>0x000001FF</td>
<td>Reserved</td>
</tr>
<tr>
<td>9</td>
<td>0x00000200</td>
<td>TerraStar-C</td>
</tr>
<tr>
<td>10</td>
<td>0x00000400</td>
<td>TerraStar-L</td>
</tr>
<tr>
<td>11</td>
<td>0x00000800</td>
<td>RTK ASSIST</td>
</tr>
<tr>
<td>12</td>
<td>0x00001000</td>
<td>RTK ASSIST PRO</td>
</tr>
<tr>
<td>13</td>
<td>0x00002000</td>
<td>TerraStar-C PRO</td>
</tr>
<tr>
<td>12-31</td>
<td>0xFFFFF000</td>
<td>Reserved</td>
</tr>
</tbody>
</table>

The bit mask (0x00000800) indicates that the receiver has a TerraStar RTK ASSIST service.

### Verifying RTK ASSIST

Users can check the status of their RTK ASSIST solution by looking at the **RTKASSISTSTATUS** log.³

**LOG RTKASSISTSTATUS**

```
< RTKASSISTSTATUS COM1 0 68.0 FINESTEERING 1919 166861.000 00040020 80fe 46774
ACTIVE COAST 1085.0 21.0
```

**ACTIVE**: The active keyword indicates that RTK ASSIST is engaged and currently providing positioning. This field will report **INACTIVE** when not being used.

**1085.0**: This is the time remaining (seconds) in the RTK ASSIST mode before transitioning to the next most accurate available positioning mode. The maximum is 20 minutes (1200 seconds) for RTK ASSIST, and unlimited for RTK ASSIST PRO.

**21.0**: The corrections age reported in the RTKASSISTSTATUS log should typically be below 30 seconds. If the age exceeds this value, then L-band tracking is likely being degraded. The most likely cause of degraded L-band tracking is obstructions between the antenna and the L-band satellite.

An alternative way to see if RTK ASSIST is active for users using the **BESTPOS** log is to look at Field #20 (Extended Solution Status) to see if bit four is active.

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³ Users can find the relevant logs and commands in the user manual for their product.


OEM7: [http://docs.novatel.com/OEM7/Content/Home.htm](http://docs.novatel.com/OEM7/Content/Home.htm)
Enable L-band Tracking

Before a receiver can start using corrections through a TerraStar service, it first must be configured to track the L-band beams from the TerraStar geosynchronous satellites. For this, the “ASSIGNLBANDBEAM” command is used. The factory default setting for “ASSIGNLBANDBEAM” is “IDLE”, which means that the receiver will not track an L-band signal unless configured to do so.

To enable L-band tracking, the AUTO setting is recommended in most cases.

```
ASSIGNLBANDBEAM AUTO
```

The AUTO setting allows the receiver to automatically track the highest elevation TerraStar satellite for best performance. The receiver firmware includes a default list of TerraStar satellites beams (see LBANDBEAMTABLE).

The receiver uses its position to determine which TerraStar signal is the best to use in a particular location.

To verify the L-band tracking status, the LBANDTRACKSTAT log can be used. For example:

```
<LBANDTRACKSTAT COM1 0 80.5 FINESTEERING 1835 140789.000 00000020 29fd 13306 < 1 < "98W" 1539902500 1200 974c 00c2 0 345.395 42.398 3.5073 71580.844 1363392 1168 1085 173150784 136010 0.0038
```
This log reports the L-band tracking status of the TerraStar beams. Some important fields are highlighted above for three beams that the receiver is tracking and are described below for beam "98W":

- **98W**: This is the name of the TerraStar beam or transmitting satellite being tracked. Additional details for the tracked beam can be output and viewed with the **LBANDBEAMTABLE** log.
- **00c2**: This is the “Tracking Status Word”. A tracking status of “00c2” indicates that the receiver is tracking and locked onto the TerraStar signal.
- **42.398**: This is the C/No or “Carrier to Noise Density Ratio” (in dB-Hz). The C/No is typically about 40-45 dB-Hz in ideal tracking conditions. A low C/No can result in missed corrections and correspondingly degraded performance.
- **71580.44**: This is the “Lock Time” (in seconds). This field can be monitored to ensure that the L-band signal is being tracked continuously without any loss of lock.

While the actual tracking of the L-band beam does not require a subscription, the receiver will not decode and use the TerraStar service data until a valid subscription has been activated.

### Configuration for RTK ASSIST

To enable RTK ASSIST on a receiver with a valid model and subscription, use the commands provided below.

- **LOG TERRASTARINFO** (indicates a valid RTK ASSIST subscription)
- **ASSIGNLBANDBEAM AUTO** (enables L-band tracking)
- **RTKASSIST ENABLE** (on by default – users can verify by logging the command)
- **RTKASSISTTIMEOUT SUBSCRIPTION_LIMIT** (use the maximum amount of time possible)
- **LOG RTKASSISTSTATUS** (users can verify that RTKASSIST is working when there is no RTK correction signal)

### Subscription Managed Channel Configuration (SMCC)

For the receiver to maximise the benefit of all constellations and frequencies available, it will enable additional channels upon receipt of an RTK ASSIST PRO subscription and a subsequent power cycle or reset. This feature was introduced with firmware version 7.08.10 which is supported on OEM7700, OEM719, OEM729, PwrPak7, and CPT7700. With firmware version 7.08.14, all OEM7 cards are supported.

The SMCC feature automatically changes the channel configuration to the best needed for the subscribed service. This allows the receiver to use the entirety of the applicable correction messages for the given receiver hardware and subscription combination without user intervention or configuration.

**Notes:**

- **SMCC is not enabled with RTK ASSIST**, it applies to an **RTK ASSIST PRO subscription only**.
- **If the channel configuration is changed using SELECTCHANGONFIG, it must be removed using the FRESET command for SMCC to function properly**. The FRESET command will remove all configuration and set the receiver to a factory reset mode.
Table 2: RTK ASSIST PRO SMCC behavior and model requirements

<table>
<thead>
<tr>
<th>Minimum model required to purchase a subscription</th>
<th>RTK ASSIST PRO</th>
</tr>
</thead>
<tbody>
<tr>
<td>OEM7700, OEM719, OEM729, PwrPak7, CPT7700</td>
<td>OEM7720, OEM7500, CPT7, PwrPak7D</td>
</tr>
<tr>
<td>DDN-R</td>
<td>FW 7.08.14 and newer only</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Model that supports full subscription functionality</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>FFN-R</td>
<td>MFN-R</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Once active subscription is received, receiver automatically applies SMCC</th>
<th>The CHANCONFIGLIST log will show the new channel configuration number, as per the table above.</th>
</tr>
</thead>
<tbody>
<tr>
<td>FFN</td>
<td>SMCC is enabled by default. It can be changed using the <strong>TERRASTARAUTOCHANCONFIG</strong> command.</td>
</tr>
<tr>
<td>FF config (7)</td>
<td></td>
</tr>
<tr>
<td>MFN</td>
<td>If a FRESET is sent after SMCC has changed the channel configuration, a power cycle or RESET must be done once the receiver boots for SMCC to re-enable and change the channel configuration as described above.</td>
</tr>
<tr>
<td>MF config (6)</td>
<td></td>
</tr>
<tr>
<td>MFD</td>
<td></td>
</tr>
<tr>
<td>MF config (6)</td>
<td></td>
</tr>
</tbody>
</table>
Support

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

Remaining questions or issues, including requests for test subscriptions or activation resends, can be directed to NovAtel Support.

Before contacting Support, it is helpful to collect data from the receiver to help investigate and diagnose any performance-related issues. A list of appropriate troubleshooting logs can be found on the OEM7 Documentation Portal (the LOG command with the recommended trigger and data rate is included with each log).

The data can also be collected using NovAtel Application Suite.

Documentation

For any questions on logs and commands, please visit the OEM7 Documentation Portal.