



Positioning Leadership

APN-043 Rev 1

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L-band Tracking and Data Output without GPS

This application note describes the OmniSTAR demodulator features that allow the receiver to track L-band signals without the assistance of GPS. It is only available with OEMV 3.300 firmware or later.

GPS signals are normally used to steer the receiver's Voltage Controlled Temperature Compensated Crystal Oscillator (VTCXO). With a more accurate VTCXO, the L-band signal can be acquired more readily. However, with the GPS signals gone, the receiver must use a wider and more efficient search algorithm to find the L-band signal.

This feature introduces the NL model which has 1 L-band OmniSTAR-enabled channel. *Table 1*, below, is the VERSION log's *Model Designators* table. Refer to the *OEMV Family Firmware Reference Manual*, available from our website at www.novatel.com. There you can find details on the VERSION log and other commands and logs mentioned in this application note.

Table 1 Model Designators

G	12 L1 or 12 L1/L2 GLONASS channels, frequencies to match GPS configuration
R	Receive RT2 and/or RT20 corrections
I	Synchronized Position Attitude Navigation (SPAN)
J	SPAN supporting 200 Hz IMUs and IGI higher rate IMU (256.144 Hz)
S	Reduces positions and measurement rates to 5 Hz, disables VARF and EVENT signals
A	Application Program Interface (API)
L	1 L-band channel with CDGPS and OmniSTAR HP/XP capability
NL	1 L-band channel with OmniSTAR enabled and no position, velocity, time (PVT) or raw data output
B	1 L-band channel with CDGPS and OmniSTAR VBS capability
F	50 Hz output

When the receiver tracks an L-band signal, CDGPS or OmniSTAR, it saves the TCXO offset in Non-Volatile Memory (NVM). The TCXO offset is the difference between the assigned frequency and the actual tracking frequency. This allows the receiver to track L-band signals more quickly in future restarts by centering the search for the signal around the known TCXO offset. The offset data is stored in NVM with type LBAND_TCXO_OFFSET. The receiver updates the offset in NVM whenever the L-band signal is tracking and the offset measures 50 Hz away from the currently stored value.

See also the ASSIGNLBAND command, starting on *Page 2*, for the new OMNISTARNARROW mode in *Table 2 L-band Mode* on *Page 3*. Compared to the OMNISTAR mode, this mode uses a narrower search window, and the L-band TCXO offset information, to look for the L-band signal. The L-band TCXO offset information is only used in OMNISTARNARROW mode.

The *tracking* field, *Field #6*, of the LBANDSTAT log, now has the IDLE possible value, see *Page 5*. See also the LBANDSTAT log starting on *Page 4*.

ASSIGNLBAND Command to set L-band satellite communication parameters

You must use this command to ensure that the receiver searches for a specified L-band satellite at a specified frequency with a specified baud rate. The factory parameter default is ASSIGNLBAND IDLE.

Abbreviated ASCII Syntax:

Message ID: 729

ASSIGNLBAND mode freq baud

Factory Default:

assignlband idle

ASCII Example 1:

assignlband cdgps 1547547 4800

ASCII Example 2:

assignlband idle

ASCII Example 3:

assignlband omnistarnarrow 1535137500 1200

Field	Field Type	ASCII Value	Binary Value	Description	Binary Format	Binary Bytes	Binary Offset
1	ASSIGNLBAND header	-	-	This field contains the command name or the message header depending on whether the command is abbreviated ASCII, ASCII or binary, respectively.	-	H	0
2	mode	See <i>Table 2 L-band Mode on Page 3</i>		Set the mode and enter specific frequency and baud rate values	Enum	4	H
3	freq	1525000 to 1560000 or 1525000000 to 1560000000		L-band service beam frequency of satellite (Hz or kHz). See also <i>Beam Frequencies on Page 4</i> (default = 1536782 if the mode is OMNISTAR)	Ulong	4	H+4
4	baud	300, 600, 1200, 2400 or 4800		Data rate for communication with L-band satellite (default = 1200)	Ulong	4	H+8

Table 2 L-band Mode

Binary	ASCII	Description
0		
1	OMNISTAR	When you select OmniSTAR, enter a dedicated frequency and baud rate.
2	CDGPS	When you select CDGPS, enter a dedicated frequency and baud rate.
3	IDLE	When you select IDLE, the receiver is configured to stop tracking any L-band satellites. The 'freq' and 'baud' fields are optional so that you may select IDLE without specifying the other fields.
4	OMNISTARAUTO	<p>When you select OMNISTARAUTO, the receiver automatically selects the best OmniSTAR beam to track based on the receiver's position. This requires the receiver to have a downloaded satellite list from an OmniSTAR satellite. Therefore, a manual assignment is necessary the first time an OmniSTAR satellite is assigned on a new receiver. After collection, the satellite list is stored in NVM for subsequent auto assignments. Lists are considered valid for 6 months and are constantly updated while an OmniSTAR signal is tracking. If the receiver has a valid satellite list, it is reported in a status bit in the LBANDSTAT log, see <i>Page 4</i>.¹</p> <p>This OmniSTAR mode does not use the TCXO offset information (see also OMNISTARNARROW in the row below).</p>
5	OMNISTARNARROW	<p>When you select OMNISTARNARROW, enter a dedicated frequency and baud rate.</p> <p>For re-acquisitions of the L-band signal, the receiver uses a 1500 Hz search window and the stored TCXO offset information.</p> <p>To remove the TCXO offset information from NVM, use the FRESET LBAND_TCXO_OFFSET command. A standard FRESET command does not do this, see <i>Page 10</i>.</p>

¹ The receiver always tracks an available local beam over a global beam. The receiver constantly monitors the satellite list to ensure it is tracking the best one and automatically switches beams if it is not. You can view the satellite list by logging the OMNIVIS log. Refer to the *OEMV Family Firmware Reference Manual*.

Beam Frequencies

You can switch between OmniSTAR VBS and CDGPS by using the following commands:

Use CDGPS

```
assignlband cdgps <freq> 4800
psrdiffsource cdgps
```

Use OmniSTAR VBS

```
assignlband omnistar <freq> 1200
psrdiffsource omnistar
```

Where <freq> is determined for CDGPS or OmniSTAR as follows:

1. CDGPS beam frequency chart:

- East 1547646 or 1547646000
- East-Central 1557897 or 1557897000
- West-Central 1557571 or 1557571000
- West 1547547 or 1547547000

2. The OmniSTAR beam frequency chart can be found at <http://www.omnistar.com/chart.html>.

For example:

Eastern US (Coverage is Northern Canada to southern Mexico) 1530359 or 1530359000

LBANDSTAT Log to output L-band status information

This log outputs status information for a standard L-band, OmniSTAR XP (Extra Precision) or OmniSTAR HP (High Performance) service.

Message ID: 731

Log Type: Asynch

Recommended Input:

```
log lbandstata ontime 1
```

ASCII Example:

```
#LBANDSTATA,COM1,0,73.5,FINESTEERING,1314,494510.000,00000000,c797,1846;
1551488896,43.19,62.3,0.00,0082,0000,7235,11,0,0000,0001,7762,04000000,0
*93f7d2af
```

Field #	Field Type	Data Description	Format	Binary Bytes	Binary Offset
1	LBANDSTAT header	Log header		H	0
2	freq	Measured frequency of L-band signal (Hz)	Ulong	4	H
3	C/No	Carrier to noise density ratio (dB-Hz)	Float	4	H+4
4	locktime	Number of seconds of continuous tracking (no cycle slipping)	Float	4	H+8
5	Reserved		Float	4	H+12
6	tracking	Tracking status of L-band signal (see <i>Table 3 L-band Signal Tracking Status</i> on Page 6)	Hex	2	H+16
7	VBS status	Status word for OmniSTAR VBS (see <i>Table 4 OmniSTAR VBS Status Word</i> on Page 7)	Hex	2	H+18
8	#bytes	Number of bytes fed to the standard process	Ulong	4	H+20
9	#good dgps	Number of standard updates	Ulong	4	H+24
10	#bad data	Number of missing standard updates	Ulong	4	H+28
11	Reserved (the <i>hp status 1</i> field is obsolete and has been replaced by the longer OmniSTAR HP Status field. The shorter legacy status here is maintained for backward compatibility)		Hex	2	H+32
12	hp status 2	Additional status pertaining to the HP or XP process (see <i>Table 5 OmniSTAR HP/XP Additional Status Word</i> on Page 8)	Hex	2	H+34
13	#bytes hp	Number of bytes fed to the HP or XP process	Ulong	4	H+36
14	hp status	Status from the HP or XP process (see <i>Table 6 HP/XP Status Word</i> on Page 9)	Hex	4	H+40
15	Reserved		Hex	4	H+44
16	xxxx	32-bit CRC (ASCII and Binary only)	Hex	4	H+48
17	[CR][LF]	Sentence terminator (ASCII only)	-	-	-

Table 3 L-band Signal Tracking Status

Nibble #	Bit #	Mask	Description	Range Value
N0	0	0x0001	Tracking State	0 = Searching, 1 = Pull-in, 2 = Tracking, 3 = Idle
	1	0x0002		
	2	0x0004	Reserved	
	3	0x0008		
N1	4	0x0010		Reserved
	5	0x0020		
	6	0x0040	Bit Timing Lock	0 = Not Locked, 1 = Locked
	7	0x0080	Phase Locked	0 = Not Locked, 1 = Locked
N2	8	0x0100	DC Offset Unlocked	0 = Good, 1 = Warning
	9	0x0200	AGC Unlocked	0 = Good, 1 = Warning
	10	0x0400	Reserved	
	11	0x0800		
N3	12	0x1000		Reserved
	13	0x2000		
	14	0x4000		
	15	0x8000	Error	0 = Good, 1 = Error

Table 4 OmniSTAR VBS Status Word

Nibble #	Bit #	Mask	Description	Bit = 0	Bit = 1
N0	0	0x0001	Subscription Expired ²	False	True
	1	0x0002	Out of Region	False	True
	2	0x0004	Wet Error	False	True
	3	0x0008	Link Error	False	True
N1	4	0x0010	No Remote Sites	False	True
	5	0x0020	No Almanac	False	True
	6	0x0040	No Position	False	True
	7	0x0080	No Time	False	True
N2	8	0x0100	Reserved		
	9	0x0200			
	10	0x0400			
	11	0x0800			
N3	12	0x1000			
	13	0x2000			
	14	0x4000			
	15	0x8000		Updating Data	False

² Contact OmniSTAR for subscription support. All other status values are updated by collecting OmniSTAR data for 20-35 minutes.

Table 5 OmniSTAR HP/XP Additional Status Word

Nibble #	Bit #	Mask	Description	Bit = 0	Bit = 1
N0	0	0x0001	Solution not fully converged	False	True
	1	0x0002	OmniSTAR satellite list available	False	True
	2	0x0004	Reserved		
	3	0x0008			
N1	4	0x0010	HP not authorized ³	Authorized	Unauthorized
	5	0x0020	XP not authorized ³	Authorized	Unauthorized
	6	0x0040	Reserved		
	7	0x0080			
N2	8	0x0100	Reserved		
	9	0x0200			
	10	0x0400			
	11	0x0800			
N3	12	0x1000			
	13	0x2000			
	14	0x4000			
	15	0x8000			

³ This authorization is related to the receiver model and not the OmniSTAR subscription. To view OmniSTAR subscription information use the LBANDINFO log, refer to the *OEMV Family Firmware Reference Manual*.

Table 6 HP/XP Status Word

Nibble #	Bit #	Mask	Description	Bit = 0	Bit = 1
N0	0	0x00000001	Subscription Expired ⁴	False	True
	1	0x00000002	Out of Region	False	True
	2	0x00000004	Wet Error	False	True
	3	0x00000008	Link Error	False	True
N1	4	0x00000010	No Measurements	False	True
	5	0x00000020	No Ephemeris	False	True
	6	0x00000040	No Initial Position	False	True
	7	0x00000080	No Time Set	False	True
N2	8	0x00000100	Velocity Error	False	True
	9	0x00000200	No base stations	False	True
	10	0x00000400	No Mapping Message	False	True
	11	Reserved			
N3-N5	12-23				
N6	24-25				
	26	0x04000000	Static Initialization Mode	False	True
	27	Reserved			
N7	28-30				
	31	0x80000000	Updating Data	False	True

⁴ Contact OmniSTAR for subscription support. All other status values are updated by collecting OmniSTAR data for 20-35 minutes.

FRESET Command to clear selected data from NVM and reset

This command clears data stored in NVM. Such data includes the almanac, ephemeris, and any user-specific configurations. The commands, ephemeris, almanac, and L-band related data, excluding the subscription information, can be cleared by using the STANDARD target. The model can only be cleared by using the MODEL target. The receiver is forced to hardware reset. In addition, values entered using the CLOCKCALIBRATE, or the ASSIGNLBAND OMNISTARNARROW, command can only be cleared by using their respective targets. See also *Table 7 FRESET Target on Page 11*.

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- FRESET STANDARD (which is also the default) causes any commands, ephemeris, GPS almanac and SBAS almanac data (COMMAND, GPSALMANAC, GPSEPHM and SBASALMANAC in *Table 7 on Page 11*) previously saved to NVM to be erased.
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Abbreviated ASCII Syntax:

Message ID: 20

FRESET [target]

Input Example:

freset command

Field	Field Type	ASCII Value	Binary Value	Description	Binary Format	Binary Bytes	Binary Offset
1	FRESET header	-	-	This field contains the command name or the message header depending on whether the command is abbreviated ASCII, ASCII or binary, respectively.	-	H	0
2	target	See <i>Table 7 FRESET Target on Page 11</i>		Data to be reset by the receiver	Enum	4	H

Table 7 FRESET Target

Binary	ASCII	Description
0	STANDARD	Resets commands, ephemeris, and almanac (default). Also resets L-band related data except for subscription information.
1	COMMAND	Resets the stored commands (saved configuration)
2	GPSALMANAC	Resets the stored GPS almanac
3	GPSEPHEM	Resets the stored GPS ephemeris
4	GLOEPHEM	Resets the stored GLONASS ephemeris
5	MODEL	Resets the currently selected model
11	CLKCALIBRATION	Resets the parameters entered using the CLOCKCALIBRATE command
20	SBASALMANAC	Resets the stored SBAS almanac
21	LAST_POSITION	Resets the position using the last stored position
31	GLOALMANAC	Resets the stored GLONASS almanac
38	LBAND_TCXO_OFFSET	Removes the TCXO offset information from NVM (entered using the ASSIGNLBAND command)

Final Points

If you require any further information regarding the topics covered within this application, please contact:

NovAtel Customer Service

1120 – 68 Ave. N.E.

Calgary, Alberta, Canada, T2E 8S5

Phone: +1-800-NOVATEL (in Canada or the U.S.) or +1-403-295-4500

Fax: +1-403-295-4501

E-mail: support@novatel.com

Website: www.novatel.com