SL869 SW User Guide

APPLICABILITY TABLE

PRODUCT
SL869
SL869T
SL869DR

SW Version
3.1.5.1
3.1.12.5
3.1.15.1
3.1.12.T1
3.1.15.T1
3.3.5.D1

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Contents

1. Introduction

1.1. Scope

This document describes the serial communications interface between the SL869 GPS/GLONASS receiver module firmware and Host Processor software.

1.2. Audience

This document is intended for public distribution to potential customers who are evaluating the SL869 GPS/GLONASS module. It can also be used by customers who are developing application software for the Host Processor in a device that incorporates the SL869.

1.3. Contact Information, Support

For general contact, technical support, to report documentation errors and to order manuals, contact Telit Technical Support Center (TTSC) at:

> TS-EMEA@telit.com
> TS-NORTHAMERICA@telit.com
> TS-LATINAMERICA@telit.com
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Alternatively, use:

http://www.telit.com/en/products/technical-support-center/contact.php

For detailed information about where you can buy the Telit modules or for recommendations on accessories and components visit:

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Our aim is to make this guide as helpful as possible. Keep us informed of your comments and suggestions for improvements.

Telit appreciates feedback from the users of our information.

1.4.   Document Organization

This document contains the following chapters:

Chapter 1: "Introduction" provides a scope for this document, target audience, contact and support information, and text conventions.

Chapter 2: "Communication Interface" gives an overview of the serial communications interface and describes general characteristics of input commands and output messages.

Chapter 3: "Commands Description" describes in detail each of the input commands for the SL869.

Chapter 4: "Messages Description" describes in detail each of the output messages produced by the SL869.

Chapter 5: "Document History" provides of the changes made to this User Guide.

1.5.   Text Conventions

Danger – This information MUST be followed or catastrophic equipment failure or bodily injury may occur.

Caution or Warning – Alerts the user to important points about integrating the module, if these points are not followed, the module and end user equipment may fail or malfunction.

Tip or Information – Provides advice and suggestions that may be useful when integrating the module.

All dates are in ISO 8601 format, i.e. YYYY-MM-DD.

1.6.   Related Documents

- SL869 Product Description, 80405ST10105A
- SL869 Hardware User Guide, 1VV00301001

2.   Communication Interface

The serial communication interface between the SL869 receiver module and the Host processor is based on the NMEA-0183 protocol standard specified by the National Marine Electronics Association (NMEA). This is an ASCII-based standard that is widely used in the GPS industry for serial communication with GPS receivers.

2.1.   UART

Serial communication with the SL869 is primarily conducted over the UART port, which is assigned to Pins 20 (Tx) and 21 (Rx). There is no hardware flow control. The default port settings are:

- 9600 Baud
- Eight data bits
- No parity bits
- One stop bit

Note that manual user interaction with the SL869 can be achieved using a PC terminal emulator.

2.2.   USB

Alternatively, serial communication can be conducted over the SL869 USB port, which is assigned to Pins 5 (USB D-) and 6 (USB D+). The USB port is enabled and the UART port is disabled when the USB Detect input signal (Pin 7) is asserted high.

NOTE:
The USB interface is not supported by the SL869-DR.

2.3.   NMEA Characteristics

This subsection highlights characteristics of the NMEA-0183 protocol as they pertain to the SL869 interface.

Start And Termination
An NMEA data packet is transmitted as an ASCII string beginning with a "$" character, but it is terminated with <carriage return> <line feed> character sequence. The hexadecimal representation of this sequence is 0x0D 0x0A.

Proprietary Packets
Proprietary data packets are allowed by the NMEA protocol standard. They begin with "$P" followed by a Manufacturer's Mnemonic Code that is assigned by the NMEA. The SL869

module is based on the STA8088 device from ST Microelectronics, who has been assigned the code "STM." Therefore, proprietary packets used by the SL869 begin with the character sequence "$PSTM."

Checksums
The NMEA standard specifies a two-character checksum field that follows a '*" delimiting character placed at the end of the ASCII data string. The checksum is calculated as the 8-bit exclusive-OR (XOR) of all characters in the string, excluding the "$" and "*' delimiters.

The SL869 includes checksums on all output NMEA messages. With one exception, checksums are not required on the input commands presented in this document. However, in software versions 3.1.12.x and higher, if the checksum is present it is verified by the SL869. In software version 3.1.5.1, it is ignored.

Packet Length
The NMEA standard specifies a maximum number of characters for each data packet, but the SL869 does not strictly adhere to this limit.

2.4. Commands

Commands are sent from the Host Processor to the SL869 and have the basic structure illustrated below:

```
command-ID[,parameter1,parameter2,…,parameterN]<cr><lf>
```

Parameters, if present, are delimited by "," characters as per the NMEA protocol. All SL869 commands are proprietary and therefore all command-ID's begin with the "$PSTM" character sequence.

In most cases, the SL869 will echo the command back out to the Host Processor after the command has been executed. Commands that are not echoed are indicated in the detailed commands descriptions later in this Guide.

NOTE:

An easy way to send commands to the SL869 manually is to write the command to a text file and use the "send text file" function of the terminal emulator. When doing so, make sure that the <cr><lf> characters are transmitted at the end of the command.

2.5.   Messages

Messages are sent from the SL869 to the Host Processor and have the basic structure illustrated below:

`message-ID,<data1,data2,…,dataN>*<checksum><cr><lf>`

Individual data fields are delimited by "," characters. The checksum is provided for purposes of bit error detection by the Host if desired.

The SL869 outputs certain standard messages as defined in the NMEA-0183 protocol standard. The message-ID for standard messages begins with an NMEA talker ID: "$GP" indicating GPS, "$GL" indicating GLONASS, and "$GN" indicating global navigation.

The SL869 also outputs proprietary messages. As with commands, proprietary message-IDs begin with "$PSTM." Note that some proprietary messages are responses to input commands.

3. Commands Description

The table below summarizes the set of commands for the SL869:

Command ID	Description
$PSTMINITGPS	Initialize GPS position and time
$PSTMINITTIME [1]	Initialize GPS time
$PSTMCLREPHS	Clear all ephemeris data
$PSTMDUMPEPHEMS	Dump ephemeris data
$PSTMEPH	Load ephemeris data
$PSTMNMEAONOFF	Toggle the NMEA output ON and OFF
$PSTMCOLD	Perform a COLD start
$PSTMWARM	Perform a WARM start
$PSTMHOT	Perform a HOT start
$PSTMSRR	Perform a system reset
$PSTMGPSRESET	Reset the GPS engine
$PSTMGETSWVER	Get the GNSS Library version
$PSTMSBASONOFF	Toggle the SBAS feature ON and OFF
$PSTMSBASSAT	Select the SBAS satellite PRN code
$PSTMSETCONSTMASK	Set the GNSS constellation mask

Note 1: This command is not available in software version 3.1.5.1

Unless otherwise noted in the following subsections, commands are echoed by the SL869 after the command is executed.

3.1. $PSTMINITGPS

This command is used to initialize GPS position and time. It is typically only used for test purposes or for aiding satellite acquisitions in very harsh RF signal environments.

Synopsis:

$PSTMINITGPS,<Lat>,<LatRef>,<Lon>,<LonRef>,<Alt>,<Day>, <Month>,<Year>,<Hour>,<Minute>,<Second><cr><lf>

Parameter	Format	Description
Lat	DDMM.MMM	Latitude (DegreesMinutes.FractionalMinute)
LatRef	'N' or 'S'	Latitude direction (North or South)
Lon	DDDMM.MMM	Longitude (DegreesMinutes.FractionalMinute)
LonRef	'E' or 'W'	Longitude direction (East or West)
Alt	dddd – Decimal, 4 digits	WGS-84 altitude in meters (-1500 to 100000)
Day	dd – Decimal, 2 digits	Day of month (01 to 31)
Month	mm – Decimal, 2 digits	Month (01 to 12)
Year	yyyy – Decimal, 4 digits	Year (1994 - …)
Hour	HH – Decimal, 2 digits	Hour (00 to 23)
Minute	MM – Decimal, 2 digits	Minute (00 to 59)
Second	SS – Decimal, 2 digits	Second (00 to 59)

The time and position data will be ignored by the SL869 if it already has an estimate of time and position, respectively. If the data is accepted, it will be reflected in the output messages, for example $GPGGA, and the SL869 will respond with the message:

$PSTMINITGPSOK*40<cr><lf>

The $PSTMINITGPS command is ignored by the SL869 if any of the input parameters are out of range or if the command is otherwise formatted incorrectly, and the SL869 will respond with the message:

$PSTMINITGPSERROR*1c<cr><lf>

Example:

Initialize position to 48^0 11.365' N latitude, 11^0 64.123' E longitude and 530 meters altitude, and set current time to 9:44:12 UTC on Feb 23rd, 2009.

$PSTMINITGPS,4811.365,N,01164.123,E,0530,23,02,2009,09,44,12

3.2. $PSTMINITTIME

This command may be used to initialize GPS time in the receiver. It is typically only used for test purposes or for aiding satellite acquisitions in very harsh RF signal environments.

Note that this command is available only in software versions 3.1.12.x and higher.

 Synopsis:

`$PSTMINITTIME,<Day>,<Month>,<Year>,<Hour>,<Minute>,<Second><cr><lf>`

Parameter	Format	Description
Day	dd – Decimal, 2 digits	Day of month (01 to 31)
Month	mm – Decimal, 2 digits	Month (01 to 12)
Year	yyyy – Decimal, 4 digits	Year (1994 - …)
Hour	HH – Decimal, 2 digits	Hour (00 to 23)
Minute	MM – Decimal, 2 digits	Minute (00 to 59)
Second	SS – Decimal, 2 digits	Second (00 to 59)

The input time will be ignored by the SL869 if it already has an estimate of time. If the data is accepted, it will be reflected in the output messages, for example $GPGGA. The SL869 will also respond with the message:

`$PSTMINITTIMEOK*11<cr><lf>`

The $PSTMINITTIME command is ignored by the SL869 if any of the input parameters are out of range or if the command is otherwise formatted incorrectly, and the SL869 will respond with the message:

`$PSTMINITTIMEERROR*4d<cr><lf>`

Example:

Initialize current time to 9:44:12 UTC on Feb 23rd, 2009.

`$PSTMINITTIME,23,02,2009,09,44,12`

3.3. $PSTMCLREPHS

This command allows the user to clear all ephemeris data from backup SRAM and erase all ephemeris stored in NVM backup memory. It is typically used to force the SL869 to collect the most recent satellite ephemeris data, or to prepare the SL869 to be loaded with ephemeris data over the serial port. There are no parameters, and there is no response message to this command.

Synopsis:

$PSTMCLREPHS<cr><lf>

As a result of clearing ephemeris data, the SL869 drops out of navigation. It will produce position fixes after it has re-collected ephemeris from a sufficient number of satellites.

3.4. $PSTMDUMPEPHEMS

This command is used to request that the SL869 output all ephemeris data stored in backup memory. There are no parameters.

Synopsis:

$PSTMDUMPEPHEMS<cr><lf>

The SL869 responds with a series of $PSTMEPHEM messages, each containing the ephemeris data for one satellite. Each of these messages has the same format as the $PSTMEPHEM command described in the next section. Checksums are included in $PSTMEPHEM when it is a message, but they are not required when $PSTMEPHEM is used as a command.

The SL869 echoes the command once all of the response messages have been output.

NOTE:

The $PSTMEPHEM response messages do not block regularly scheduled periodic output messages, and therefore they are not guaranteed to be output all in sequence. The $PSTMNMEAONOFF command can be used to temporarily disable periodic output so that the response messages can be captured as one sequence and then be re-used as a source of $PSTMEPHEM load ephemeris commands.

3.5. $PSTMEPHEM

This command allows the user to load ephemeris data for a satellite into backup memory. It has the same ID and data structure as when it is output as a message. Note that this command also requires a checksum.

Synopsis:

`$PSTMEPHEM,<SatId>,<Size>,<Byte1>……<ByteN>*<checksum><cr><lf>`

Parameter	Format	Description
SatId	ii – Decimal, 2 digits	Satellite ID (GPS PRN number, range 1 to 32, or GLONASS frequency number , range 65 to 92)
Size	nn - Decimal, 2 digits	Number of ephemeris data bytes in the command
Byte1… ByteN	bb – Hexadecimal, 2 digits	N ephemeris data bytes
checksum	cc – Hexadecimal, 2 digits	NMEA checksum

Note also that the ephemeris data bytes are input as a single parameter and are not delimited by commas.

Example:

```
$PSTMEPHEM,3,64,8f06786978691313132001009ba4ff009af9e5178c12aa
faba006e00fc3700001f7eea25cab5b60780b00da183d906cb6048efd545e6
e12ff7002d0012c0c003*58
```

The command is not echoed in software version 3.1.5.1 and older, but the SL869 responds with a message having the following format:

`$PSTMEPHEM,<SatId>,<N>, <status><cr><lf>`

where `SatId` and `N` are the echoed parameters from the load command. The status is "OK" if the ephemeris message was accepted.

In newer software versions the command is echoed, but there is no response message.

NOTE:

This command has the same format as the $PSTMEPHEM message that is output in response to the $PSTMDUMPEPHEMS command described in the previous section.

3.6. $PSTMNMEAONOFF

This command can be used to switch the periodic NMEA output on and off. It does not affect command responses.   The parameter is optional. If the parameter is not provided, the NMEA output is toggled on or off. There is no response message to this command.

Synopsis:

`$PSTMNMEAONOFF[,<OnOff]<cr><lf>`

Parameter	Format	Description
OnOff	One digit decimal	0 – NMEA output will be disabled 1 – NMEA output will be enabled

This command is only echoed when the NMEA output is being switched on, and not when it is being switched off.

3.7. $PSTMCOLD

This command causes the SL869 to perform a cold start.   There is no response message to this command.

Synopsis:

`$PSTMCOLD,[<Mask>]<cr><lf>`

Parameter	Format	Description
Mask	Integer	Optional configuration parameter used to specify data to be invalidated for the cold start: 0x01 – clear almanac 0x02 – clear ephemeris 0x04 – clear position 0x08 – clear time

If the mask parameter is not provided, the default cold start configuration, bitmap 0xE (clear ephemeris, position and time), is used. This is equivalent to an input parameter of 14 and is the most common definition of a cold start used in the industry.

In response to this message the SL869 will perform a GNSS engine reset. It will not however perform a system reboot. Note that if the firmware is version 3.1.12.5, it is possible for there to be a delay of up to 20 seconds before the reset is performed.

Example:

Cold start with all data cleared:

`$PSTMCOLD,15`

3.8. $PSTMWARM

This command causes the SL869 to perform a warm start. A warm start is defined as one in which position and time is known from a previous operation but ephemeris is invalid. There are no parameters, and there is no response message to this command.

Synopsis:

`$PSTMWARM<cr><lf>`

In response to this message the SL869 will perform a GNSS engine reset. It will not perform a system reboot. Note that if the firmware is version 3.1.12.5, it is possible for there to be a delay of up to 20 seconds before the reset is performed.

3.9. $PSTMHOT

This command causes the SL869 to perform a hot start. A hot start is defined as one in which position and time is known and ephemeris is valid from previous operation. There are no parameters, and there is no response message to this command.

Synopsis:

`$PSTMHOT<cr><lf>`

In response to this message the SL869 will perform a GNSS engine reset. It will not perform a system reboot. Note that if the firmware is version 3.1.12.5, it is possible for there to be a delay of up to 20 seconds before the reset is performed.

3.10. $PSTMSRR

This command allows the user to execute a system reset and reboot the GNSS firmware on the SL869. There are no parameters, and there is no response message to this command. Note that if the firmware is version 3.1.12.5, it is possible for there to be a delay of up to 20 seconds before the system reset is performed.

Synopsis:

`$PSTMSRR<cr><lf>`

NOTE:
The SL869 does not echo the $PSTMSRR command.

	CAUTION: **The $PSTMSRR command is not supported if the USB port is being used, i.e. if the USB Detect input signal is connected.**

3.11. $PSTMGPSRESET

This command is used to reset the GNSS receiver engine. It does not reboot the GNSS firmware.   There are no parameters for this command, and there is no response message to this command. Note that if the firmware is version 3.1.12.5, it is possible for there to be a delay of up to 20 seconds before the receiver engine reset is performed.

Synopsis:

$PSTMGPSRESET<cr><lf>

3.12. $PSTMGETSWVER

This command allows the user to get the versions of the libraries embedded within the firmware application. It also allows the user to get the Telit firmware application version string, which is also output in a GPTXT message when the SL869 starts up.

Synopsis:

$PSTMGETSWVER,<Id><cr><lf>

Parameter	Format	Description
Id	Integer	Identifier representing the specified library or libraries for which the version number is being requested 0 – GNSS Library 1 – OS20 Library 2 – SDK Application 4 – WAAS (SBAS) Library 6 – Binary Image 255 – Telit Version

The SL869 responds with the following message format for all valid input parameter values except for 255:

$PSTMVER,<Lib>_<Ver>_<Type>*<checksum><cr><lf>

Parameter	Format	Description
Lib	Fixed Text	Text string indicating the requested library: - GNSSLIB - OS20LIB - GPSAPP - WAASLIB - BINIMG
Ver	x.x.x.x	Library version, for example 7.3.1.43
Type	ARM	Indicates ARM compiler type

If the input parameter value is 255, the SL869 responds with a message of the form:

$GPTXT,<Telit version string>*<checksum><cr><lf>

3.13. $PSTMSBASONOFF

This command can be used to toggle the SBAS differential GPS feature on and off. By default the SBAS feature is off (disabled) whenever the SL869 is reset. When SBAS is on (enabled), the SL869 searches for SBAS satellites. If the SL869 successfully acquires a satellite, it obtains and uses differential GPS corrections transmitted by the satellite. The SBAS PRN appears in the GPGSV messages as specified in the NMEA standard.

Synopsis:

$PSTMSBASONOFF<cr><lf>

3.14. $PSTMSBASSAT

This command is used to select the SBAS PRN code to be used for differential operation. By default the SBAS PRN is automatically selected by the SL869. If an SBAS PRN is selected but cannot be acquired, the SL869 searches for other SBAS satellites.   The SL869 reverts back to automatic SBAS selection when it is reset or is power cycled.

Synopsis:

$PSTMSBASSAT,<Prn><cr><lf>

Parameter	Format	Description
Prn	Decimal, three digits	SBAS Satellite PRN code, ranging from 120 to 138

Example:

Set the SBAS PRN code to 138:

$PSTMSBASSAT,138

3.15. $PSTMSETCONSTMASK

This command can be used to select the GNSS constellations to be used by the SL869 for positioning. The constellations are specified using a bit mask. If a constellation is disabled, the associated GSV messages (satellite visibility) for that constellation are no longer output. The GSA message for the disabled constellation however continues to be output, but with an empty satellite ID list.

Synopsis:

`$PSTMSETCONSTMASK,<Mask><cr><lf>`

Parameter	Format	Description
Mask	Bitmap	Each bit enables/disables a specific constellation independent from the other bits: 0x01 – enable GPS constellation 0x02 – enable GLONASS constellation 0x04 – enable QZSS constellation

If the command is successful, the SL869 responds with the following message and echoes the specified mask:

`$PSTMSETCONSTMASKOK,<Mask>*<checksum><cr><lf>`

In software versions 3.1.5.1 and older, the SL869 GNSS navigation process will restart if the command is successful. For later software versions the navigation process continues without a restart.

The new constellation mask remains in effect until a system reset is performed on the module.

If the input parameter for the command is missing or is not a valid value, the SL869 responds with the following message:

`$PSTMSETCONSTMASKERROR*51<cr><lf>`

Examples:

Enable use of the GPS constellation only:

`$PSTMSETCONSTMASK,1`

Enable use the GLONASS constellation only:

`$PSTMSETCONSTMASK,2`

Use all constellations:

`$PSTMSETCONSTMASK,7`

4.   Messages Description

The table below summarizes the messages that are output periodically by the SL869:

Message ID	Description
$GPGGA	NMEA: Global Position System fix data
$GNGSA	NMEA: GNSS Dilution of Precision (DOP) and active satellites
$--GSV	NMEA: GNSS satellites in view. "GP" talker ID reports GPS, "GL" talker ID reports GLONASS satellites.
$GPRMC	NMEA: Recommended minimum specific GNSS data

All messages in the above table are output once per second. There are multiple GSA and GSV messages output each second.

In addition to periodic messages, the SL869 outputs a single $GPTXT message at start-up.

4.1.   GPGGA

This message contains time, position, and fix status data.

Format:

```
$GPGGA,<Timestamp>,<Lat>,<N/S>,<Long>,<E/W>,<GPSQual>,<Sats>,
<HDOP>,<Alt>,M,<GEOSep>,M,<DGPSAge>,<DGPSRef>
*<checksum><cr><lf>
```

Parameter	Format	Description
Timestamp	hhmmss.sss	UTC time of position fix (HoursMinutesSeconds.Millisecs)
Lat	DDMM.MMMM	Latitude (DegreesMinutes.FractionalMinute)
N/S	'N' or 'S'	Latitude direction (North or South)
Lon	DDDMM.MMMM	Longitude (DegreesMinutes.FractionalMinute)
E/W	'E' or 'W'	Longitude direction (East or West)
GPSQual	Decimal, 1 digit	0 – Invalid 1 – Valid GNSS fix 2 – Valid differential GNSS fix
Sats	ss – Decimal, 2 digits	Number of GNSS satellites in use
HDOP	HH.H	Horizontal Dilution of Precision, maximum of 99.0
Alt	+/-AAA.AA	Height above WGS-84 ellipsoid in meters, maximum of 999.99
GEOSep	+/-aa.a	Difference between mean sea level (MSL) altitude and WGS-84 ellipsoid, in meters. Leading '-' indicates MSL below ellipsoid surface.
DGPSAge		Age of RTCM Type 1 or 9 corrections. Not populated.
DGPSRef		Differential reference station ID. Not populated.

Example:
```
$GPGGA,194829.000,3309.1073,N,09638.0012,W,1,15,0.7,182.64,M,
-24.2,M,,*59
```

4.2.   GNGSA

This message reports Dilution of Precision (DOP) values and the PRN codes of the active satellites used in the position fix.   At least one of these messages is output each second for each enabled GNSS constellation.   In order, the message that lists GPS satellites is output first, followed by the message that lists GLONASS satellites, followed by the message that lists QZSS satellites. All of the messages contain DOP values for the combined GNSS constellation geometry.

The maximum number of satellites reported in a single message is 12. If the number of satellites used from a given constellation exceeds 12, a second message is output listing the additional satellites.

Format:
$GNGSA,<Mode1>,<Mode2>,[<SatPRN1>],...,[<SatPRNn>],<PDOP>, <HDOP>,<VDOP>*<checksum><cr><lf>

Parameter	Format	Description
Mode1	"M" or "A"	M – Manual, forced to operate in 3D mode A – Automatic, allowed to switch between 2D and 3D mode
Mode2	Decimal, 1 digit	1 – No fix available 2 – 2D fix 3 – 3D fix
SatPRN1… SatPRNn	Decimal, 2 digits	List of GPS satellite PRN codes, or list of GLONASS satellite PRN codes, used in the position fix.
PDOP	PP.P	Position Dilution of Precision, maximum of 99.0
HDOP	HH.H	Horizontal Dilution of Precision, maximum of 99.0
VDOP	VV.V	Vertical Dilution of Precision, maximum of 99.0

Example:
GPS and GLONASS enabled:

$GNGSA,A,3,25,11,01,18,12,32,31,22,14,30,,,1.2,0.7,0.9*28
$GNGSA,A,3,65,66,76,75,72,,,,,,,1.2,0.7,0.9*24

4.3. --GSV

This message reports the azimuth, elevation, and signal-to-noise (SNR) values for all satellites in view. Two of these messages are output each second, one having the "GP" talker ID and containing the visible GPS satellites, the other having the "GL" talker ID and containing the visible GLONASS satellites.

Each message is transmitted as multiple sentences, with four satellites maximum per sentence, and each sentence having the format below.

Format:
```
$--GSV,<GSVAmount>,<GSVNumber>,<TotSats>,[<Sat1PRN>,<Sat1Elev>,
<Sat1Azim>,<Sat1C/N0>], ...[<SatNPRN>,<SatNElev>,<SatNAzim>,
<SatNC/N0>]*<checksum><cr><lf>
```

Parameter	Format	Description
GSVAmount	Decimal, 1 digit	Total amount of GSV sentences in this message, maximum of 4
GSVNumber	Decimal, 1 digit	Number of the specific GSV sentence within the message
TotSats	nn – Decimal, 2 digits	Total number of GPS or GLONASS satellites in view
Sat1PRN	ss – Decimal, 2 digits	PRN of first satellite.
Sat1Elev	ee – Decimal, 2 digits	Elevation of first satellite in degrees, 0 to 90
Sat1Azim	aaa – Decimal, 3 digits	Azimuth of first satellite in degrees, 0 to 359
Sat1C/N0	cc – Decimal, 2 digits	Carrier to Noise ration of first satellite in dB-Hz
…		
SatNPRN	ss – Decimal, 2 digits	PRN of Nth satellite (maximum N is 4)
SatNElev	ee – Decimal, 2 digits	Elevation of Nth satellite in degrees, 0 to 90
SatNAzim	aaa – Decimal, 3 digits	Azimuth of Nth satellite in degrees, 0 to 359
SatNC/N0	cc – Decimal, 2 digits	Carrier to Noise ration of Nth satellite in dB-Hz

Example:
```
$GPGSV,3,1,11,01,23,257,26,11,10,239,,14,30,079,23,16,27,175,23*7F
$GPGSV,3,2,11,20,37,311,33,22,14,146,28,23,12,294,31,25,13,040,37*7B
$GPGSV,3,3,11,30,51,156,31,31,60,026,37,32,65,305,24,,,,*48
$GLGSV,2,1,06,66,77,110,32,76,49,021,31,65,22,140,25,67,45,333,25*69
$GLGSV,2,2,06,78,18,227,,77,65,257,17,,,,,,,,*67
```

4.4.   GPRMC

This message contains position, velocity, and time and date information for the current fix.

Format:
$GPRMC,<Timestamp>,<Status>,<Lat>,<N/S>,<Long>,<E/W>,<Speed>,
<Course>,<Date>,<MagVar>,<MagVarDir>,<Mode>*<checksum><cr><lf>

Parameter	Format	Description
Timestamp	hhmmss.sss	UTC time of position fix (HoursMinutesSeconds.Millisecs)
Status	"A" or "V"	A – Data valid V – Navigation warning
Lat	DDMM.MMMM	Latitude (DegreesMinutes.FractionalMinute)
N/S	'N' or 'S'	Latitude direction (North or South)
Lon	DDDMM.MMMM	Longitude (DegreesMinutes.FractionalMinute)
E/W	'E' or 'W'	Longitude direction (East or West)
Speed	sss.s	Speed over ground in knots, maximum 999.9
Course	ccc.c	Course over ground, degrees True, 0 to 359.9
Date	DDMMYY	Day of month (1 to 31), Month (1 to 12), and Year
MagVar		Magnetic variation. Not populated.
MagVarDir		Magnetic variation direction (E or W). Not populated.
Mode	'A', 'D' or 'N'	Position system mode indicator A – Autonomous mode D – Differential mode N – Position data not valid

Example:
$GPRMC,225124.000,A,3309.1077,N,09638.0032,W,0.0,0.0,180113,,,
A*79

4.5.　GPTXT

At start-up the SL869 outputs an NMEA standard text message containing information about the Telit firmware application version.

Format:
$GPTXT,<Telit version string>*<checksum><cr><lf>

Note that this start-up message is output whenever the module performs a GNSS engine reset in response to a command. This message is also output as a response to a request for the Telit firmware version string (see section 3.12 on the $PSTMGETSWVER command).

5.   Document History

Revision	Date	Changes
0	2012-03-19	Draft issue
1	2012-04-11	Corrected PSTMEPHEM command description by adding checksum field.
2	2012-06-15	Preliminary release for 3.1.0.1 firmware. Added SBAS and SW version commands, removed notch filter status output.
3	2012-10-29	Release for version 3.1.3.1 firmware. Added GNSS constellation mask command.
4	2012-12-20	Release for version 3.1.5.1 firmware. Removed GNSS constellation mask command. Updated descriptions of PSTMINITGPS, PSTMCOLD and PSTMGETSWVER commands. Checksums shown on response messages where applicable.
5	2013-02-11	Corrections to GPGGA, GPRMC messages. Updated PSTMNMEAONOFF command. Removed PSTMSRR System Reset command (USB issues).
6	2013-10-1	Release for version 3.1.12 based firmware. Updated to NMEA 3.01. Added PSTMINITTIME command. Added back PSTMSRR command with USB qualifier. Removed PSTM2DFIXONOFF command (not supported).
7	2013-11-20	Added reference to USB in Chapter 2. Added back $PSTMSETCONSTMASK command. Updated text to describe differences since 3.1.5.1. Added section on Start-up ($GPTXT) message.
8	2014-09-30	Updated and corrected description of GNGSA. Added SL869-DR as applicable product. Updated list of SW versions.