V26
Software User Guide

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APPLICABILITY TABLE

PRODUCTS

- SE868-V3
- SE873
- SE873Q5
- SE876Q5-A

SOFTWARE

- V26-1.0.0-STD-5.7.11P4 and subsequent versions

CONTENTS

TABLES

1. INTRODUCTION

1.1. Scope

This document describes the basic serial communication interface for any GNSS receiver module within the V26 firmware family.

1.2. Audience

This document is intended for public distribution to potential customers who are evaluating a GNSS module from the V26 firmware family listed in the Applicability Table on page 4. It can also be used by customers who are developing application software for a Host Processor contained within their product that incorporates one of the listed modules.

1.3. Contact Information, Support

For general contact, technical support services, technical questions and report documentation errors contact Telit Technical Support at:

- TS-EMEA@telit.com
- TS-AMERICAS@telit.com
- TS-APAC@telit.com
- TS-SRD@telit.com (for Short Range Devices)

Alternatively, use:

http://www.telit.com/support

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. 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.

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1.5. Related Documents

[1] NMEA-0183 Standard for Interfacing Marine Electronic Devices Version 4.0
[2] Interface Specification IS-GPS-200G, 2012-09-05
[3] Galileo-OS-SIS-ICD, Issue 1.3, December 2016
[4] QUALCOMM NMEA Reference Guide, CS-129435-MA-14
[5] Telit Jupiter SE868-V3 Product User Guide, 1VV0301205
[6] Telit Jupiter SE873 Product User Guide, 1VV0301216
[7] Telit Jupiter SL876Q5-A Product User Guide, 1VV0301333

2. COMMUNICATION INTERFACE

The serial communication interface between the GNSS 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 GNSS receivers [1].

This document does not describe the NMEA 0183 standard, however an overview of NMEA messages format is provided in **Appendix A – Standard NMEA Messages Format.**

This document makes use of Qualcomm specific terminology which may differ from the one used in the NMEA-0183 protocol standard specification.

2.1. Serial Communication

Serial communication with the GNSS receiver is primarily conducted over the serial port. There is no hardware flow control. The default port settings are:

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

Some Firmware versions may have different default values than those given above.

2.2. Proprietary NMEA Message Format

In addition to the use of standard NMEA sentences, the GNSS receiver modules within the V26 firmware family communicates with the host processor using Qualcomm proprietary messages.

These messages start with the “$” character, which is then followed by the proprietary address field string that uses the Manufacturer’s Mnemonic Code registered by Qualcomm with the NMEA, which is “SRF”. Thus the proprietary address field is of the form:

$PSRFxxx

where *xxx* represents a Sentence Identifier in decimal format (typically). This latter may be followed (comma separated) by a Message Sub-Identifier (SID) whose values can be decimal or hexadecimal. In case of hexadecimal subIDs, these must be input without the 0x prefix. The couple Talker ID-Sentence ID (PSRFXXX) is typically referred to as Message Header.

The maximum sentence length for Qualcomm proprietary NMEA messages may be greater than the one defined by the NMEA 0183 standard (82 characters).

Paragraphs 3.2 and4.1 of this document describe Qualcomm Proprietary NMEA Messages that can be used to control the receiver and output extra information beyond the NMEA-0183 standard definition.

In addition to the standard NMEA output messages as well as Qualcomm proprietary messages, V26 firmware supports Telit proprietary messages, that comply with NMEA 0183, to further enhance the control of the GNSS receiver and expose more functionalities.

Please contact Telit Technical Support for further information.

3. NMEA OUTPUT MESSAGES

V26 firmware outputs a set of standard NMEA messages which have formats that are compatible with the NMEA sentences in version 4.00 of the NMEA-0183 Interface Standard. The set of standard NMEA messages are described in section 3.1 below.

Additionally, the Beidou GNSS constellation is incorporated into these standard message formats by introduction of a 'GB' Talker Identifier, and also by including Beidou as "another satellite system" mentioned in the GNS format description in the NMEA Interface Standard.

Satellite IDs used by V26 firmware for the Galileo and Beidou constellations, as well as IDs for QZSS and SBAS satellites, are specified in Appendix B of this guide.

Note that satellite IDs for GPS, GLONASS and WAAS SBAS satellites are as specified in the NMEA Interface Standard.

3.1. Standard NMEA Output Messages

3.1.1. GNS – GNSS Fix Data

This message provides fix data for GPS, GLONASS, BEIDOU and GALILEO satellite systems, and a combination of these.

An example of this message is:

*$GNGNS,112136.000,3913.6579,N,00904.1275,E,AANN,10,1.0,26.3,47.8,,0000*5B<CR><LF>*

Field	Example	Description
Talker ID	GN	Navigation System GP = GPS GL = GLONASS GB = BEIDOU (BDS) GA = GALILEO GN = Global Navigation/Multi-constellation
Sentence ID	GNS	GNSS Fix Data
UTC of Position	112136.000	hhmmss.sss (hours,minutes,seconds)
Latitude	3913.6579	ddmm.mmmm (degrees and minutes)
N/S Indicator	N	N = North, S = South
Longitude	00904.1275	dddmm.mmmm (degrees and minutes)
E/W Indicator	E	E = East, W = West
Mode Indicator	AANN	Fixed length field of four characters. The first character indicates the use of GPS satellites, the second character indicates the use of GLONASS satellites, the third character indicates the use of Galileo satellites, and the fourth character indicates the use of Beidou satellites Characters are: A = Autonomous D = Differential

		E = Estimated N = No fix
Satellites Used	10	Number of satellites used in the fix. Range is 0 to 99.
HDOP	1.0	Horizontal Dilution of Precision
MSL Altitude	26.3	Antenna altitude above/below Mean Sea Level (MSL) geoid surface (Meters)
Geoid Separation	47.8	Geoid-to-ellipsoid separation. Ellipsoid altitude: Geoid MSL altitude – Geoid Separation
Age of Differential Data	-	Age of DGPS data in seconds since last update – Null field when DGPS is not used
Diff. Ref. Station ID	0000	ID of the Differential Reference Station – NULL field when DGPS is not used

Table 1 GNS – GNSS Fix Data Message Structure

3.1.2. GGA – Global Positioning System Fix Data

This message provides time, position and fix related data for a GNSS receiver.

An example of this message is:

*$GPGGA,002153.000,3342.6618,N,11751.3858,W,1,10,1.2,27.0,M,-34.2,M,,0000*5E <CR><LF>*

Field	Example	Description
Talker ID	GP	Navigation System GP = GPS GL = GLONASS GB = BEIDOU (BDS) GA = GALILEO GN = Global Navigation/Multi-constellation
Sentence ID	GGA	Global Positioning System Fix Data
UTC Time	002153.000	hhmmss.sss (hours,minutes,seconds)
Latitude	3342.6618	ddmm.mmmm (degrees and minutes)
N/S Indicator	N	N = North, S = South
Longitude	11751.3858	dddmm.mmmm (degrees and minutes)
E/W Indicator	W	E = East, W = West
Position Fix Indicator	1	0 = Fix not available or invalid 1 = GPS Standard Positioning Service (SPS) Mode, fix valid

		3 to 5 = Not supported 6 = Dead Reckoning Mode, fix valid
Satellites Used	10	Number of satellites in use in fix. Range is 0 to12.
HDOP	1.2	Horizontal Dilution of Precision
MSL Altitude	27.0	Antenna altitude above/below Mean Sea Level (MSL) geoid surface
Units	M	M = Meters
Geoid Separation	-34.2	Geoid-to-ellipsoid separation Ellipsoid altitude: Geoid MSL altitude – Geoid Separation
Units	M	M = Metrers
Age of Differential Data	-	Age of DGPS data in seconds since last update – Null field when DGPS is not used
Diff. Ref. Station ID	0000	ID of the Differential Reference Station – NULL field when DGPS is not used

Table 2 GGA – Global Positioning System Fix Data Message Structure

A valid status is derived from all the parameters set in the software. This includes the minimum number of satellites required, any DOP mask setting and the presence of DGPS corrections. If a required factor is not met, the solution is marked as invalid.

3.1.3. GLL – Geographical Position-Latitude/Longitude

This message provides latitude, longitude, time and status of Navigation Solution.

An example of this message is:

*$GPGLL,3723.2475,N,12158.3416,W,161229.487,A,A*41<CR><LF>*

Field	Example	Description
Talker ID	GP	Navigation System GP = GPS GL = GLONASS GB = BEIDOU (BDS) GA = GALILEO GN = Global Navigation/Multi-constellation
Sentence ID	GLL	Geographical Position-Latitude/Longitude

Latitude	3723.2475	ddmm.mmmm (degrees and minutes)
N/S Indicator	N	N = North, S = South
Longitude	12158.3416	dddmm.mmmm (degrees and minutes)
E/W Indicator	W	E = East, W = West
UTC Time	161229.487	hhmmss.sss (hours,minutes,seconds)
Status	A	A = Data valid V = Data not valid
Mode	A	A = Autonomous D = DGPS E = DR N = Output Data Not Valid

Table 3 GLL – Geographical Position-Latitude/Longitude Message Structure

3.1.4. GSA – GNSS DOP and Active Satellites

This message provides GNSS receiver operating mode, satellites used in the navigation solution and DOP values.

An example of this message is:

*$GPGSA,A,3,07,02,26,27,09,04,15,,,,,,1.8,1.0,1.5*33<CR><LF>*

Field	**Example**	**Description**
Talker ID	GP	Navigation System GP = GPS GL = GLONASS GB = BEIDOU (BDS) GA = GALILEO GN = Global Navigation/Multi-constellation
Sentence ID	GSA	GNSS DOP and Active Satellites
Mode 1	A	M = Manual, forced to operate in 2D or 3D mode A = Automatic, allowed to automatically switch 2D/3D
Mode 2	3	1 = Fix not available 2 = 2D (<4SV s used) 3 = 3D (>3 SV s used)
Satellite Used [1]	07	Satellite ID used in the solution – Range varies by constellation (see Appendix B – Satellite ID Mapping)
Satellite Used [2]	02	Satellite ID used in the solution – Range varies by constellation (see Appendix B – Satellite ID Mapping)

Satellite Used [3]	26	Satellite ID used in the solution – Range varies by constellation (see Appendix B – Satellite ID Mapping)
Satellite Used [4]	27	Satellite ID used in the solution – Range varies by constellation (see Appendix B – Satellite ID Mapping)
Satellite Used [5]	09	Satellite ID used in the solution – Range varies by constellation (see Appendix B – Satellite ID Mapping)
Satellite Used [6]	04	Satellite ID used in the solution – Range varies by constellation (see Appendix B – Satellite ID Mapping)
Satellite Used [7]	15	Satellite ID used in the solution – Range varies by constellation (see Appendix B – Satellite ID Mapping)
Satellite Used [8]	-	Satellite ID used in the solution – Range varies by constellation (see Appendix B – Satellite ID Mapping)
Satellite Used [9]	-	Satellite ID used in the solution – Range varies by constellation (see Appendix B – Satellite ID Mapping)
Satellite Used [10]	-	Satellite ID used in the solution – Range varies by constellation (see Appendix B – Satellite ID Mapping)
Satellite Used [11]	-	Satellite ID used in the solution – Range varies by constellation (see Appendix B – Satellite ID Mapping)
Satellite Used [12]	-	Satellite ID used in the solution – Range varies by constellation (see Appendix B – Satellite ID Mapping)
PDOP	1.8	Position Dilution of Precision
HDOP	1.0	Horizontal Dilution of Precision
VDOP	1.5	Vertical Dilution of Precision

Table 4 GSA – GNSS DOP and Active Satellites Message Structure

Maximum DOP value reported is 50. When 50 is reported, the actual DOP may be much larger.

This is an example of only GLONASS satellites:

*$GLGSA,A,3,73,66,88,83,81,68, , , , , ,1.8,1.0,1.5*2E<CR><LF>*

This is an example of a solution using a mix of GPS and GLONASS satellites:

*$GNGSA,A,3,07,66,26,83,09,68, , , , , ,1.8,1.0,1.5*22<CR><LF>*

3.1.5. GSV – GNSS Satellites in View

This message provides Number of Space Vehicle (SV) satellites in view, satellite ID numbers, elevation, azimuth and Signal to Noise (SNR) values.

An example of GPS-only messages are:

*$GPGSV,2,1,07,07,79,048,42,02,51,062,43,26,36,256,42,27,27,138,42*71<CR><LF>*

*$GPGSV,2,2,07,09,23,313,42,04,19,159,41,15,12,041,42*41<CR><LF>*

Examples of GLONASS-only satellites in view reporting messages are:

*$GLGSV,2,1,07,73,14,302,39,66,33,037,39,80,13,251,38,83,16,313,38*64<CR><LF>*

*$GLGSV,2,2,07,81,36,083,36,68,29,185,31,82,53,003,43*53<CR><LF>*

Field	Example	Description
Talker ID	GP	Navigation System GP = GPS GL = GLONASS GB = BEIDOU (BDS) GA = GALILEO
Sentence ID	GSV	GNSS Satellites in View
Number of Messages	2	Total number of GSV messages to be sent in this group
Message Number	1	Message number in this group of GSV messages
Satellite in View	07	Total number of satellites in view
Satellite ID1	07	Range varies by constellation (see Appendix B – Satellite ID Mapping)
Elevation1	79	Elevation angle in degrees, 0-90
Azimuth1	048	Azimuth angle in degrees, True, 000-359 clockwise from true North
SNR1	42	SNR (C/No), 00-99 dB-Hz, null while not tracking
Satellite ID2	02	Range varies by constellation (see Appendix B – Satellite ID Mapping)
Elevation2	51	Elevation angle in degrees, 0-90
Azimuth2	062	Azimuth angle in degrees, True, 000-359 clockwise from true North
SNR2	43	SNR (C/No), 00-99 dB-Hz, null while not tracking
Satellite ID3	26	Range varies by constellation (see Appendix B – Satellite ID Mapping)
Elevation3	36	Elevation angle in degrees, 0-90
Azimuth3	256	Azimuth angle in degrees, True, 000-359 clockwise from true North
SNR3	42	SNR (C/No), 00-99 dB-Hz, null while not tracking

Satellite ID4	27	Range varies by constellation (see Appendix B – Satellite ID Mapping)
Elevation4	27	Elevation angle in degrees, 0-90
Azimuth4	138	Azimuth angle in degrees, True, 000-359 clockwise from true North
SNR4	42	SNR (C/No), 00-99 dB-Hz, null while not tracking

Table 5 GSV – GNSS Satellites in View Message Structure

Depending on the number of satellites tracked, multiple messages of GSV data may be required. In some software versions, the maximum number of satellites reported as visible is limited to 12, but the actual number may be larger.

3.1.6. RLM – Return Link Message

This message is used to transfer a Return Link Message received by a Return Link Service (RLS) compatible GNSS Receiver from a Cospas-Sarsat recognized Return Link Service Provider (RLSP) to an RLS compliant Cospar-Sarsat 406 MHz Beacon.

The RLM sentence supports communications to an emitting beacon once a distress alert has been detected, located and confirmed. The communications may include acknowledgement of the alert to the emitting beacon as well as optional text messages, and may also include remote beacon configuration and testing.

An example of this message is:

*$GARLM,0A0A0A0A0A0A0A0,120051.00,1,8AA0*04<CR><LF>*

Field	Example	Description
Talker ID	GA	Navigation System GA = GALILEO
Sentence ID	RLM	Return Link Message
Beacon ID	0A0A0A0A0A0A0A0	hhhhhhhhhhhhhhh Identifies the beacon intended to receive this message. This is a fixed length 15 hexadecimal character data field
Time of reception	120051.00	hhmmss.ss Indicates the RLM timestamp (i.e. the time of reception of the last 20 bit packet of the RLM) in UTC. The field does not support decimal seconds. Any decimal point or decimal seconds should be ignored. A = Data valid V = Data not valid

Message code	1	h The Message code field identifies the Type of RLM Message Service: 0 = Reserved for future RLM services 1 = Acknowledgement Service RLM 2 = Command Service RLM 3 = Message Service RLM 4 – E = Reserved for future RLM services F = Test Service RLM (currently used only by the Galileo Program)
Message body	8AA0	h - - h The Message body is a variable length field encapsulating the data parameters provided by the RLSP into hexadecimal format. Galileo OS SIS ICD defines a Short Message containing 16 bits (4 hex characters) and a Long Message containing 96 bits (24 hex characters). Other GNSS, such as GLONASS may define a different length message.

Table 6 RLM – Return Link Message Message Structure

The content and structure of **Beacon ID**, **Message code** and **Message body** fields are defined by [3].

3.1.7. RMC – Recommended Minimum Specific GNSS Data

This message provides time, date, position, course and speed data provided by a GNSS navigation receiver.

An example of this message is:

*$GPRMC,161229.487,A,3723.2475,N,12158.3416,W,0.13,309.62,120598,,,A*10<CR><LF>*

Field	Example	Description
Talker ID	GP	Navigation System GP = GPS GL = GLONASS GB = BEIDOU (BDS) GA = GALILEO GN = Global Navigation/Multi-constellation
Sentence ID	RMC	Recommended Minimum Specific GNSS Data
UTC Time	161229.487	hhmmss.sss (hours,minutes,seconds)
Status	A	A = Data valid

		V = Data not valid
Latitude	3723.2475	ddmm.mmmm (degrees and minutes)
N/S Indicator	N	N = North, S = South
Longitude	12158.3416	dddmm.mmmm (degrees and minutes)
E/W Indicator	W	E = East, W = West
Speed Over Groud	0.13	Knots
Course Over Ground	309.62	True, degrees
Date	120598	ddmmyy (day, month, year)
Magnetic Variation	-	Magnetic, degrees – Not Supported
East/West Indicator	-	E = East, W = West – Not Supported
Mode	A	A = Autonomous D = DGPS E = DR N = Output Data Not Valid

Table 7 RMC – Recommended Minimum Specific GNSS Data Message Structure

A valid status is derived from all the parameters set in the software. This includes the minimum number of satellites required, any DOP mask setting and the presence of DGPS corrections. If a required factor is not met, the solution is marked as invalid.

3.1.8. VTG – Course over Ground and Ground Speed

This message provides the actual course and speed relative to the ground.

An example of this message is:

*$GPVTG,309.62,T,,M,0.13,N,0.2,K,A*23<CR><LF>*

Field	Example	Description
Talker ID	GP	Navigation System GP = GPS GL = GLONASS GB = BEIDOU (BDS) GA = GALILEO GN = Global Navigation/Multi-constellation

Sentence ID	VTG	Course over Ground and Ground Speed
Course Over Ground	309.62	Measured heading, degrees
Reference	T	True
Course Over Ground	-	Measured heading, degrees – Not Supported
Reference	M	Magnetic
Speed Over Groud	0.13	Measured horizontal speed
Units	N	Knots
Speed Over Groud	0.2	Measured horizontal speed
Units	K	Km/h
Mode	A	A = Autonomous D = DGPS E = DR N = Output Data Not Valid

Table 8 VTG – Course over Ground and Ground Speed Message Structure

3.1.9. ZDA – UTC Date/Time and Local Time Zone Offset

This message provides UTC, day, month, year and local time zone.

ZDA is included only with systems that support a time-mark output pulse identified as 1PPS. This outputs the time associated with the current 1PPS pulse. Each message is outputted within a few hundred m/s after the 1PPS pulse is outputted, and provides the time of the pulse that just occurred.

This message reports the UTC time and date represented by the immediately preceding 1 PPS pulse. The message is typically only supported in receivers where the position report is not aligned with the GPS second (SiRFstarII and SiRFstarIII receivers), although it can be provided in other receivers under certain circumstances.

An example of this message is:

*$GPZDA,181813,14,10,2003,,*4F<CR><LF>*

Field	Example	Description
Talker ID	GP	Navigation System GP = GPS GL = GLONASS GB = BEIDOU (BDS) GA = GALILEO GN = Global Navigation/Multi-constellation
Sentence ID	ZDA	UTC Date/Time and Local Time Zone Offset

UTC Time	181813	hhmmss (hours,minutes,seconds) Either using valid IONO/UTC or estimated from default leap seconds
Day	14	01 to 31
Month	10	01 to 12
Year	2003	-
Local Zone Hour	-	Offset from UTC – Not Supported
Local Zone Minutes	-	Offset from UTC – Not Supported

Table 9 ZDA – UTC Date/Time and Local Time Zone Offset Message Structure

3.2. Proprietary NMEA Output Messages

3.2.1. PSRF150 – OkToSend

PSRF150 is the first message sent when power is restored. It is the last message sent before going into low-power mode.

An example of this message is:

1. OkToSend

*$PSRF150,1*3E<CR><LF>*

2. Not OkToSend

*$PSRF150,0*3F<CR><LF>*

Field	Example	Description
Message Header	PSRF150	OkToSend
OkToSend	1	0 = CPU is about to go Off and stay in Hibernate. Not Ok to Send 1 = CPU has just come On in Full Power Mode. Indicates Receiver is On 2 = Receiver initialization is complete in Full Power Mode. Ok to Send 4 = Low Power Mode enabled,. CPU is about to go Off. Not Ok to Send 5 = Low Power Mode enabled. Indicates Receiver is On 6 = Low Power Mode enabled. Receiver initialization is completed. Ok to Send

Table 10 PSRF150 – OkToSend Message Structure

$PSRF150,2 and $PSRF150,6 comes out only when receiver goes through a restart and/or comes out of hibernate state. It is not sent out when receiver comes out of standby.

3.2.2. PSRF195 – Response to Poll SW Version String

PSRF195 is the response to the Poll SW Version message, PSRF125.

An example of this message is:

*$PSRF195,5xp__5.7.10-P2.1.GCC+5xpt_5.7.10-P2.1.KCC*0A<CR><LF>*

Field	Example	Description
Message Header	PSRF195	-
SID	53	Message SID for Response to Poll SW Version String
Version String	5xp__5.7.10-P2.1.GCC+5xpt_5.7.10-P2.1.KCC	Version string, ASCII

Table 11 PSRF195 – Response to Poll SW Version String Message Structure

An additional PSFR195 message may be output if a custom version string has been set for the specific FW binary release.

3.2.3. PSRFPWRUP – Power Up

PSRFPWRUP message is automatically sent by the receiver during a power up cycle.

An example of this message is:

*$PSRFPWRUP*47<CR><LF>*

Field	Example	Description
Message Header	PSRFPWRUP	-

Table 12 PSRFPWRUP – Power Up Message Structure

3.2.4. PSRFGNSSTART – GNSS Start

PSRFGNSSTART message is automatically sent by the receiver, after the PSRFPWRUP message, at the GNSS receiver’s start/restart.

PSRFGNSSTART message is for Telit purposes only.

3.2.5. PSRFGNSSTOP – GNSS Stop

PSRFGNSSTOP message is automatically sent by the receiver, before the PSRFPWRDOWN message, at the GNSS receiver’s stop.

PSRFGNSSTOP message is for Telit purposes only.

3.2.6. PSRFPWRDOWN – Power Down

PSRFPWRDOWN message is automatically sent by the receiver during a power down cycle.

An example of this message is:

*$PSRFPWRDOWN*50<CR><LF>*

Field	Example	Description
Message Header	PSRFPWRDOWN	-

Table 13 PSRFPWRDOWN – Power Down Message Structure

4. NMEA INPUT MESSAGES

4.1. Proprietary NMEA Input Messages

4.1.1. PSRF100 – Set Serial Port

PSRF100 message is used to change communication protocol and parameters such as baud rate, data and stop bits and parity.

When a valid message is received, the parameters are stored in the battery-backed SRAM. After a reset, the receiver resumes using the saved parameters.

An example of this message is:

*$PSRF100,0,9600,8,1,0*0C<CR><LF>*

Field	Example	Description
Message Header	PSRF100	-
Protocol	0	0 = SiRF binary 1 = NMEA
Baud Rate	9600	Supported data rates 4800 9600 19200 38400 57600 115200 230400 460800 921600 1228800
Data Bits	8	8 only
Stop Bits	1	1 only
Parity	0	0 = None only

Table 14 PSRF100 – Set Serial Port Message Structure

SiRF Binary Protocol is a proprietary communication protocol that offers a more extensive command message set to control the receiver and output extra information. Please contact Telit Technical Support for further information 1.3.

4.1.2. PSRF101 – Navigation Initialization

PSRF101 message is used to restart the receiver specifying the type of restart.

Optionally, this command may also initialize position (in X, Y, Z ECEF coordinates), clock drift, GPS Time Of Week and GPS Week Number. Correct initialization parameters enable the receiver to quickly acquire signals.

An example of this message is:

*$PSRF101,-2686700,-4304200,3851624,96000,497260,921,12,3*1C<CR><LF>*

Field	Example	Description
Message Header	PSRF101	-
ECEFX	-2686700	X-Coordinate position, meters
ECEFY	-4304200	Y-Coordinate position, meters
ECEFZ	3851624	Z-Coordinate position, meters
ClkDrift	96000	Clock drift of the receiver, Hz (Use 0 for last saved value. If unavailable, use a default value of 96250)
Time Of Week	497260	GPS Time of Week, seconds
Week Number	921	GPS Week Number
Channel Count	12	Range 1 to 12
ResetCfg	3	Reset Mode - See Table 16

Table 15 PSRF101 – Navigation Initialization Message Structure

Value	Description
1	Hot Start. Initialization data is used. Ephemeris data in SRAM is used.
2	Warm Start (No Init). No initialization data is used. Ephemeris data is cleared and warm start performed using remaining data in RAM.
3	Warm Start (with Init). Initialization data is used. Ephemeris data is cleared and warm start performed using remaining data in RAM.
4	Cold Start. No initialization data is used. Position, time and ephemeris are cleared, and a cold start is performed.
8	Factory Start. No initialization data is used. Internal RAM is cleared and a factory reset is performed.

Table 16 Reset Modes Values

4.1.3. PSRF103 – Query/Rate Control

PSRF103 message is used to query and control the output rate of the of standard NMEA messages and the proprietary PSRFEPE message.

NMEA messages can be polled once, or setup for periodic output. Checksums may also be enabled or disabled depending on the needs of the receiving program. NMEA message settings are saved in battery-backed memory for each entry when the message is accepted.

An example of this message is:

*$PSRF103,0,1,0,1*25<CR><LF>*

Field	Example	Description
Message Header	PSRF103	-
Msg	0	Message to be controlled – See Table 18
Mode	1	0 = Set rate 1 = Query one time
Rate	0	Output Rate 0 = Off 1 to 255 = Seconds between messages Message rates are increased five times for 5 Hz Navigation, 10 times for 10 Hz Navigation, etc.(1)
ChecksumEnable	1	Enable/Disable Checksum Not Supported – Checksums are always enabled

Table 17 PSRF103 – Query/Rate Control Message Structure

(1)10 Hz Navigation mode supported from 5.7.8-P1-based SW versions.

Field	Description
1	GLL
2	GSA
3	GSV
4	RMC
5	VTG
6	UNUSED
7	EPE
8	ZDA

9	GNS
0	GGA

Table 18 Query/Rate Control Messages

4.1.4. PSRF104 – LLA Navigation Initialization

PSRF104 message is used to restart the receiver specifying the type of restart.

Optionally, this command may also initialize position (in latitude, longitue and altitude), clock drift, GPS Time Of Week and GPS Week Number. Correct initialization parameters enable the receiver to quickly acquire signals.

An example of this message is:

*$PSRF104,37.3875111,-121.97232,0,96000,237759,1946,12,1*07<CR><LF>*

Field	Example	Description
Message Header	PSRF104	-
Latitude	37.3875111	Range -90 to 90 (degrees) – North (+)
Longitude	-121.97232	Range -180 to 180 (degrees) – East (+)
Altitude	0	WGS84 Ellipsoid Altitude (meters)
ClkDrift	96000	Clock drift of the receiver, Hz**(1)**
Time Of Week	237759	GPS Time of Week, seconds
Week Number	1946	GPS Week Number
Channel Count	12	Range 1 to 12
ResetCfg	1	Reset Mode - See Table 20

Table 19 PSRF101 – Navigation Initialization Message Structure

(1) Use a clock drift value if known, use 0 otherwise. The receiver uses the last saved value in this latter case.

Value	Description
1	Hot Start. Initialization data is used. Ephemeris data in SRAM is used.

2	Warm Start (No Init). No initialization data is used. Ephemeris data is cleared and warm start performed using remaining data in RAM.
3	Warm Start (with Init). Initialization data is used. Ephemeris data is cleared and warm start performed using remaining data in RAM.
4	Cold Start. No initialization data is used. Position, time and ephemeris are cleared, and a cold start is performed.
8	Factory Start. No initialization data is used. Internal RAM is cleared and a factory reset is performed.

Table 20 Reset Modes Values

4.1.5. PSRF125 – Poll SW Version String

PSRF125 message is used to poll the software version string.

The GNSS receiver responds with a PSRF195 message. If a customer version string is defined, this request generates two PSRF195, one with the SW Version String, and one with the customer-specific version string.

An example of this message is:

*$PSRF125*21<CR><LF>*

Field	Example	Description
Message Header	PSRF125	-

Table 21 PSRF125 – Poll SW Version String Message Structure

5. APPENDIX A – STANDARD NMEA MESSAGES FORMAT

Serial communication between the Host Processor and the GNSS module is accomplished using messages following the NMEA 0183 standard. Standard NMEA messages output by the receiver are called "Sentences" and always start with an ASCII '$' character (Hex value 0x24). All NMEA sentences also end or terminate with a two character Carriage Return <CR> (ASCII hex value 0x0D) Line Feed <LF> (ASCII hex value 0xA) sequence.

After the starting '$' character a NMEA sentence contains a two character Talker Identifier which may have the values GP for GPS, GL for GLONASS, GB for BEIDOU (COMPASS), GA for Galileo, or GN for Global Navigation that can be a combination of the individual navigation system (GPS, GL, etc.). The Talker Identifier indicates the GNSS system source of the information contained in the sentence. Following the Talker Identifier is a three character Sentence Identifier. The Sentence Identifier indicates the type of the sentence. Each type is described in its own section in this document.

Following the Sentence Identifier is a sequence of Data Fields that are separated, or delimited, by commas. The number and meaning of the data fields, which are sometimes referred to as the Payload of the sentence, is determined by the sentence type. A particular data field might be omitted from a sentence and then that field is called a NULL field. A NULL field is still separated from the other fields by commas.

After the last data field appears, the '*' character (ASCII hex value 0x2A) denotes the end of the data fields. Immediately following the '*' character is a two character hexadecimal checksum used to detect errors in the sentence that might have been introduced during serial transmission. The NMEA sentence checksum is computed by performing an 8-bit Exclusive OR (XOR) sum on all the characters in the sentence that appear after the '$' character and before the '*' character.

After the checksum appears the terminating <CR><LF> sequence.

The maximum length of a NMEA standard sentence is 82 characters, consisting of a maximum of 79 characters in the string between the starting '$' character and the terminating <CR><LF>.

6. APPENDIX B – SATELLITE ID MAPPING

SATELLITE ID MAPPING

Value	Constellation	Description
1 to 32	GPS	Satellite PRN code
33 to 51	SBAS	PRN - 87
52 to 56	QZSS SAIF	PRN - 131
57 to 61	QZSS IMES	PRN - 136
65 to 96	GLONASS	Slot # + 64
121 to 147	BDS IGSO/MEO (PRNs 11 to 37)	PRN + 110
148 to 152	BDS GEO (PRNs 1 to 5)	PRN + 147
153 to 157	BDS IGSO/MEO (PRNs 6 to 10)	PRN + 147
205 to 254	GALILEO	PRN + 204

Table 22 Satellite ID Mapping

7. GLOSSARY AND ACRONYMS

ASCII	American Standard Code for Information Interchange
BE	Broadcast Ephemeris
CGEE	Client Generated Extended Ephemeris
DGPS	Differential Global Positioning System
DOP	Diluition of Precision
NMEA	National Marine Electronics Assosiation
OSP	One Socket Protocol
PRN	Pseudo-Random Noise
SGEE	Server Generated Extended Ephemeris
SRAM	Static Random Access Memory
UTC	Co-ordinated Universal Time

8. DOCUMENT HISTORY

Revision	Date	Changes
0	2018-04-12	First Issue
1	2019-05-27	Section 1.5 – Added Galileo-OS-SIS-ICD Section 3.1 – Added RLM NMEA message description Section 3.2 – Removed PSRFEPE message description Appendix A – Corrected NMEA Talker ID used for Beidou

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Link to **www.telit.com** and contact our technical support team for any questions related to technical issues.

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