AirPrime XS1110

AT Command Reference Guide

41113737
Rev 5.0

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Due to the nature of wireless communications, transmission and reception of data can never be guaranteed. Data may be delayed, corrupted (i.e., have errors) or be totally lost. Although significant delays or losses of data are rare when wireless devices such as the Sierra Wireless product are used in a normal manner with a well-constructed network, the Sierra Wireless product should not be used in situations where failure to transmit or receive data could result in damage of any kind to the user or any other party, including but not limited to personal injury, death, or loss of property. Sierra Wireless accepts no responsibility for damages of any kind resulting from delays or errors in data transmitted or received using the Sierra Wireless product, or for failure of the Sierra Wireless product to transmit or receive such data.

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Revision History

Revision number	Release date	Changes
1.0	March 09, 2020	Creation

2.0	April 09, 2020	• Added Boot-up message
		• Changed example for Response formats
		• Updated AT+GNSSLOWP
		  • Changed Usage details
		  • Changed Parameters
		  • Changed Examples
		• Updated AT+GNSSUTC
		  • Changed <date> and <time> format
		• Changed descriptions for Table 2-4
		• Updated AT+GNSSTHRES
		  • Changed <height> parameters
		  • Changed example for Read setting for all threshold
		• Updated AT+GNSSLLE
		  • Revised Write and Read responses
		  • Added new parameter: <lle_select>
		  • Changed example for Write and Read configurations

Revision number	Release date	Changes

3.0	June 2020	• Updated AT+GNSSLOWP
		  • Changed note
		  • Changed Write AT command
		• Updated <period> parameter under AT+GNSSSLP
		• Updated <mode> parameter under AT+GNSSUMODE
		• Updated Table 2-3 and Table 2-4
		• Added Normal Mode and Low Power Tracking
		• Updated AT+GNSSPVTL Example
		• Added PVT Log Table

3.1	July 2020	Minor edits for Normal Mode and Low Power Tracking
4.0	November 2020	• Updated AT+GNSSCONFIG • Revised description
5.0	February 2021	• Updated AT+GNSSLOWP • Updated Figure 2-2

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1: About This Guide

Introduction

This document describes proprietary AT commands available for Sierra Wireless' AirPrime® XS1110 modules. These commands are intended for use by OEMs.

Note: For questions or concerns relating to command implementation, please contact your Sierra Wireless account representative.

Command timing

Interval timing

Some commands require time to process before additional commands are entered.

When building automated test scripts, ensure that sufficient delays are embedded, where necessary, to avoid these errors.

Boot-up message

When the XS1110 module initializes, the following message is shown:
+SWIXS1110,READY*20<CR><LF>

Escape sequence

The AT sequence "+++" can be used to exit the +GNSSLLE injection data mode.

Result codes

The result code OK is typically returned when the command has been executed. An ERROR code may be returned if parameters are out of range. It is also returned if the command is not recognized or is not permitted in the current state or condition of the module.

Response formats

Response formats shown in this document are intended to accurately describe the command query and it requires "\r\n" at the end.

A module response usually places "*<CRC>\r\n" at the end.

For example:

AT+GNSSLOWP=1<CR><LF>

+GNSSLOWP,1,OK*38<CR><LF>

References

For additional product-specific documentation, refer to source.sierrawireless.com.

Abbreviations and Terms Used

This document makes use of abbreviations and terms that are in common use in data communications and GNSS technology.

For details, see Abbreviations

Document structure

This document describes the proprietary commands found in the chapters listed below.

General AT Commands — Commonly used functions

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2: General Commands

Introduction

This chapter describes general AT commands.

Command summary

The following table lists the commands described in this chapter.

Table 2-1: General Commands (Summary)

Command	Description	Page
AT+GNSSSTOP	Stop positioning and enter standby states	12
AT+GNSSSTART	Execute GNSS startup process	12
AT+GNSSSATE	Configure and query GNSS search mode	13
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AT+GNSSPPS	Configure and query output time in one pulse per second (1PPS) function	25

Command reference

Table 2-2: General Commands (Detail)

Command	Description
AT+GNSSSTOP	**Stop positioning and enter standby states** **Usage:** • Execute: **AT+GNSSSTOP** Response: +GNSSSTOP,OK or +GNSSSTOP,<error code> Purpose: Configure module into standby mode. **Examples:** • Stop positioning: AT+GNSSSTOP<CR><LF> +GNSSSTOP,OK*39<CR><LF>
AT+GNSSSTART	**Execute GNSS startup process** **Usage:** • Write: **AT+GNSSSTART=<mode>** Response: AT+GNSSSTART=<mode>,OK or +GNSSSTART,<error code> Purpose: Configure module to restart by specified mode. **Parameters:** <mode> (Restart mode) • 0—Cold Start • 1—Warm Start • 2—Hot Start **Examples:** • Cold Start: AT+GNSSSTART=0<CR><LF> +GNSSSTART,0,OK*7D<CR><LF> • Hot Start: AT+GNSSSTART=2<CR><LF> +GNSSSTART,2,OK*7F<CR><LF>

Table 2-2: General Commands (Detail) (Continued)

Command	Description
AT+GNSSSATE	**Configure and query GNSS search mode** *Note: Confirm which search modes are supported by your firmware.* **Usage:** • Write: **AT+GNSSSATE=<GP>,<GL>,<GA>,<Reserved>,<BD>,<QZ>,<SBAS>** Response: +GNSSSATE,<GP>,<GL>,<GA>,<Reserved>,<BD>,<QZ>,<SBAS>,OK or +GNSSSATE,<error code> Purpose: Configure module to use specified satellite. • Read: **AT+GNSSSATE?** Response: +GNSSSATE,<GP>,<GL>,<GA>,<Reserved>,<BD>,<QZ>,<SBAS>,OK or +GNSSSATE,<error code> Purpose: Acquire current satellite system used for positioning. **Parameters:** <GP> (GPS configuration). Note that the GPS is mandatory, it is always enabled. • 1—Enable <GL> (GLONASS configuration) • 0—Disable • 1—Enable <GA> (Galileo configuration) • 0—Disable • 1—Enable <Reserved> (Reserved field) <BD> (BeiDou configuration) • 0—Disable • 1—Enable <QZ> (QZSS configuration) • 0—Disable • 1—Enable <SBAS> (SBAS configuration) • 0—Disable • 1—Enable Note: Refer to Table 2-4 for details on satellite settings **Examples:** • Change search mode to GPS+GLONASS+QZSS: AT+GNSSSATE=1,1,0,0,0,1,0<CR><LF> +GNSSSATE,1,1,0,0,0,1,0,OK*3F<CR><LF> • Read search mode: AT+GNSSSATE?<CR><LF> +GNSSSATE,1,1,0,0,0,1,0,OK*3F<CR><LF>

Table 2-2: General Commands (Detail) (Continued)

Command	Description
AT+GNSSLOWP	**Configure and acquire GNSS low power tracking** *Note: When low power tracking is enabled, the +GNSSLOWP,ENTRY,OK*5D message appears after the system sleeps. The +GNSSLOWP,WAKEUP,OK*14 message appears after the system wakes up.* **Usage:** • Write (<status> = 0,1): **AT+GNSSLOWP=<status>** Response: +GNSSLOWP,<status>,OK or +GNSSLOWP,<error code> Purpose: Enable or disable low power tracking. • Write (<status> = 2): **AT+GNSSLOWP=<status>,<Min_Sat_Num>,<EPH_Time>, <Act_Time>,<Slp_Time>,OK** Response: +GNSSLOWP,<status>,<Min_Sat_Num>,<EPH_Time>, <Act_Time>,<Slp_Time>,OK or +GNSSLOWP,<error code> Purpose: Enable low power tracking with customized configuration. • Read: **AT+GNSSLOWP?** Response: +GNSSLOWP,<status>,OK or +GNSSLOWP,<status>,<Min_Sat_Num>,<EPH_Time>, <Act_Time>,<Slp_Time>,OK or +GNSSLOWP,<error code> Purpose: Get the status of low power tracking. **Parameters:** <status> (Low power tracking status) • 0—Disable (Default) • 1—Enable default configuration • 2—Enable customized configuration <Min_Sat_Num> (Minimum satellites number) • Range: 4-8 • Default: 6 <EPH_Time> (Query ephemeris time) • Unit: seconds • Range: 0-900 • Default: 750 <Act_Time> (Active time) • Unit: seconds • Range: 3-2592000 • Default: 30 <Slp_Time> (Sleep time) • Unit: seconds • Range: 1-2592000 • Default: 15

Table 2-2: General Commands (Detail) (Continued)

Command	Description
	Note: For details on sleep states, see Figure 2-4 **Example:** • Disable low power tracking: AT+GNSSLOWP=0<CR><LF> +GNSSLOWP,0,OK*39<CR><LF> • Enable low power tracking with customized configuration: AT+GNSSLOWP=2,4,300,20,15<CR><LF> +GNSSLOWP,2,4,300,20,15,OK*3A<CR><LF> • Acquire low power tracking status: AT+GNSSLOWP?<CR><LF> +GNSSLOWP,2,4,300,20,15,OK*3A<CR><LF>
AT+GNSSSLP	**Transfer receiver into sleep states** *Note: When sleep 0 mode is enabled, wake up will get the +GNSSSLP,WAKEUP,OK*5F message.* **Usage:** • Write: **AT+GNSSSLP=<mode>,<period>** Response: +GNSSSLP,<mode>,<period>,OK or +GNSSSLP,<error code> Purpose: Configure module into sleep mode with specified period. **Parameters:** <mode> (Sleep mode) • 0—Sleep 0 mode (Default) • 1—Sleep 1 mode <period> (Sleep time) (unit: second) • 0—Manual wake up • 1-604800s—Sleep period *Note: For details on sleep states, see Table 2-3.* **Examples:** • Set module to sleep 1 mode. AT+GNSSSLP=1,0<CR><LF> +GNSSSLP,1,0,OK<CR><LF> • Set module to sleep 0 mode and to sleep 5 seconds: AT+GNSSSLP=0,5<CR><LF> +GNSSSLP,0,5,OK*6B<CR><LF> +GNSSSLP,WAKEUP,OK*5F<CR><LF>

Table 2-2: General Commands (Detail) (Continued)

Command	Description
AT+GNSSUMODE	**Configure and query navigation algorithm to fit different scenarios** **Usage:** • Write: **AT+GNSSUMODE=<mode>** Response: +GNSSUMODE,<mode>,OK or +GNSSUMODE,<error code> Purpose: Set the specific navigation mode. • Read: **AT+GNSSUMODE?** Response: +GNSSUMODE,<mode>,OK or +GNSSUMODE,<error code> Purpose: Read the navigation mode configuration. **Parameters:** <mode> (Navigation mode) • 0—Fitness mode (default) is used for low velocity (speed < 25 km/hr) activities such as running or walking. • 1—Swimming mode is used for swimming activities. • 2—Driving mode is used for high velocity (speed > 25 km/hr) activities such as driving or riding motorcycles. **Examples:** • Set module to fitness mode: AT+GNSSUMODE=0<CR><LF> +GNSSUMODE,0,OK*6B<CR><LF> • Read configuration mode: AT+GNSSUMODE?<CR><LF> +GNSSUMODE,0,OK*6B<CR><LF>

Table 2-2: General Commands (Detail) (Continued)

Command	Description
AT+GNSSUTC	**Acquire current UTC Time** *Note: You must receive the full ephemeris before you can get the valid data.* **Usage:** • Read: **AT+GNSSUTC?** Response: +GNSSUTC,<year>,<month>,<day>,<hour>,<min>,<sec>.<usec>,OK or +GNSSUTC,<error code> Purpose: Get UTC time from module. **Parameters:** <year> (UTC Year) • Range: 1980-2099 <month> (UTC Month) • Range: 1-12 <day> (UTC Day) • Range: 1-31 <hour> (UTC Hour) • Range: 0-23 <min> (UTC Minute) • Range: 0-59 <sec> (UTC Second) • Range: 0-59 <usec> (UTC Microsecond) • Range: 0-999999 *Note: The starting UTC time is from 1980.1.6 0:0:0.00.* *UTC format: yyyy,mm,dd,hh,mm.ffffff (Year,Month,Day,Hour,Minute,Second.Microsecond)* **Examples:** • Acquire GNSS UTC Time: AT+GNSSUTC?<CR><LF> +GNSSUTC,2013,07,02,03,38,07.221606,OK*46<CR><LF>

Table 2-2: General Commands (Detail) (Continued)

Command	Description
AT+GNSSUTCCOR	**Acquire the UTC time correction information** *Note: You must receive the full ephemeris before you can get the valid data.* **Usage:** • Read: **AT+GNSSUTCCOR?** Response: +GNSSUTCCOR,<Valid>,<A0>,<A1>,<dtLS>,<Tot>,<WNt>, <WNlsf>,<Dn>,<DTlsf>,OK or +GNSSUTCCOR,<error code> Purpose: Get UTC time correction data from module. **Parameters:** <Valid> (Correction data) • 0—UTC correction data are not available • 1—UTC correction data are available <A0> (UTC parameter A0) • Unit: (seconds)/(2^-30) <A1> (UTC parameter A1) • Unit: (seconds/second)/(2^-50) <dtLS> (UTC time difference due to leap seconds before event.) • Unit: seconds <Tot> (UTC reference time of week) • Unit: seconds <WNt> (UTC reference week number.) • Unit: weeks <WNlsf> (UTC week number when next leap second event occurs.) • Unit: weeks <Dn> (UTC day of week when next leap second event occurs.) • Unit: days <DTlsf> (UTC time difference due to leap seconds after event.) • Unit: seconds **Examples:** • Read available UTC correction data: AT+GNSSUTCCOR?<CR><LF> +GNSSUTCCOR,1,0,0,18,319488,21,137,7,18,OK*2E<CR><LF> • Read not available UTC correction data: AT+GNSSUTCCOR?<CR><LF> +GNSSUTCCOR,-5<CR><LF>

Table 2-2: General Commands (Detail) (Continued)

Command	Description
AT+GNSSGPST	**Acquire current GPS Time** **Usage:** • Read: **AT+GNSSGPST?** Response: +GNSSGPST,<date>,<time>,OK or +GNSSGPST,<error code> Purpose: Get GPS time from module. **Parameters:** <date> (GPS Date) • Format: "yyyymmdd" (YearMonthDay) <time> (GPS Time) • Format: "hhmmss" (HourMinuteSecond) **Examples:** • Acquire GNSS GPS Time: AT+GNSSGPST?<CR><LF> +GNSSGPST,20190806,032526,OK<CR><LF>

Table 2-2: General Commands (Detail) (Continued)

Command	Description
AT+GNSSPOS	**Set position information into receiver** **Usage:** • Write: **AT+GNSSPOS=<lat>,<lon>,<alt>** Response: +GNSSPOS,<lat>,<lon>,<alt>,OK or +GNSSPOS,<error code> Purpose: Configure the position data into the module. • Read: **AT+GNSSPOS?** Response: +GNSSPOS,<lat>,<lon>,<alt>,OK or +GNSSPOS,<error code> Purpose: Get the position data from module. **Parameters:** <lat> (Latitude) (unit: degree) • Maximum decimal precision—6 • North: positive (+) • South: negative (-) • Range: -90.0 - 90.0 <lon> (Longitude) (unit: degree) • Maximum decimal precision—6 • East: positive (+) • West: negative (-) • Range: -180.0 - 180.0 <alt> (Altitude) (unit: meter) • Maximum decimal precision—3 • Range: -500.0 - 20000.0 **Example:** • Write position (latitude: 23.09615, longitude: 120.2837, altitude: 17.2) to module. AT+GNSSPOS=23.09615,120.2837,17.2<CR><LF> +GNSSPOS,23.096150,120.283700,17.200,OK*6C<CR><LF> • Read the position of module. AT+GNSSPOS?<CR><LF> +GNSSPOS,25.033328,121.750005,-21.479,OK*40<CR><LF>
AT+GNSSCONFIG	**Recover configuration and change it to factory default** **Usage:** • Execute: **AT+GNSSCONFIG** Response: +GNSSCONFIG,OK or + GNSSCONFIG,<error code> Purpose: Reset all user configuration to factory default. **Example:** • Reset all configuration: AT+GNSSCONFIG<CR><LF> +GNSSCONFIG,OK*2B<CR><LF>

Table 2-2: General Commands (Detail) (Continued)

Command	Description
AT+GNSSNMEA	**Configure and acquire general NMEA sentence output types** **Usage:** • Write (<action> = 3): **AT+GNSSNMEA=<action>,<NMEA_type>,<state>** Response: +GNSSNMEA,<action>,<NMEA_type>,<state>,OK or +GNSSNMEA,<error code> Purpose: Configure specified NMEA type output or not. • Write (<action> = 2): **AT+GNSSNMEA=<action>,<NMEA_type>** Response: +GNSSNMEA,<action>,<NMEA_type>,OK or +GNSSNMEA,<error code> Purpose: Configure specified NMEA type outputting state to default. • Read: **AT+GNSSNMEA?** Response: +GNSSNMEA,<GGA>,<GLL>,<GSA>,<GSV>,<GNS>, <RMC>,<VTG>,<ZDA>,<SIX_DEC>,OK or +GNSSNMEA,<error code Purpose: Get the state of all NMEA type. **Parameters:** <action> • 2—Set the specified NMEA type to default configuration. • 3—Set the specified NMEA type outputting state. <NMEA_type> (Type of general NMEA) • 0—Erase all (Only available in <mode=2>) • 1—GGA • 2—GLL • 3—GSA • 4—GSV • 5—GNS • 6—RMC • 7—VTG • 8—ZDA • 9—Six Decimals <state> (Enable/disable regular output) • In <mode=1~8>: • 0—Disable • 1—Enable • In <mode=9>: • 0—four decimals • 1—six decimals <GGA> (Global positioning system fix data) • 0—Disable • 1—Enable (Default) <GLL> (Geographic position-Latitude/Longitude) • 0—Disable (Default) • 1—Enable (Continued on next page)

Table 2-2: General Commands (Detail) (Continued)

Command	Description
	<GSA> (GNSS DOP and active satellites) • 0—Disable • 1—Enable (Default) <GSV> (GNSS satellites in view) • 0—Disable • 1—Enable (Default) <GNS> (GNSS fix data) • 0—Disable (Default) • 1—Enable <RMC> (Recommended minimum specific GNSS data) • 0—Disable • 1—Enable (Default) <VTG> (Course over ground and ground speed) • 0—Disable • 1—Enable (Default) <ZDA> (Time and data) • 0—Disable • 1—Enable (Default) <SIX_DEC> • 0—Four decimals (Default) • 1—Six decimals **Example:** • Enable GNSS NMEA Output GSV on): AT+GNSSNMEA=3,4,1<CR><LF> +GNSSNMEA,3,4,1,OK*3C<CR><LF> • Disable GNSS NMEA Output GLL: AT+GNSSNMEA=3,2,0<CR><LF> +GNSSNMEA,3,2,0,OK*3B<CR><LF> • Set GNSS NMEA Output GGA to default: AT+GNSSNMEA,2,1<CR><LF> +GNSSNMEA,2,1,OK*25<CR><LF> • Acquire GNSS NMEA Output (with GGA, GSA, GSV, RMC and six decimals on): AT+GNSSNMEA?<CR><LF> +GNSSNMEA,1,0,1,1,0,1,0,0,1,OK*3B<CR><LF>

Table 2-2: General Commands (Detail) (Continued)

Command	Description
AT+GNSSGEOFEN	**Configure and acquire geo-fencing settings** **Usage:** • Write (<action> = 0,1): **AT+GNSSGEOFEN=<action>** Response: +GNSSOFEN,<action>,OK or +GNSSOFEN,<error code> Purpose: After setting enable / disable, $PSWIGEOFEN sentence will be set or not set as an output. • Write (<action> = 2): **AT+GNSSGEOFEN=<action>,<ID>** Response: +GNSSGEOFEN,<action>,<ID>,OK or +GNSSGEOFEN,<error code> Purpose: Erase the configuration of the specified ID region. • Write (<action> = 3): **AT+GNSSGEOFEN=< action >,<ID>,<lat>,<lon>,<radius>** Response: +GNSSGEOFEN,<action>,<ID>,<lat>,<lon>,<radius>,OK or +GNSSGEOFEN,<error code> Purpose: Set the configuration of the specified ID region • Read: **AT+GNSSGEOFEN?** Response: +GNSSGEOFEN,<sentence_status>,<region_1_data>,<region_2_data>,<region_3_data>,OK or +GNSSGEOFEN,<error code> Purpose: Get whole region setting value. **Parameters:** <mode> • 0—Disable $PSWIGEOFEN sentence. • 1—Enable $PSWIGEOFEN sentence. • 2—Erase the specified region configuration. • 3—Set the specified region configuration. <ID> (Region ID) • Range: 0-3 • 0—Only available for erasing commands. <lat> (Latitude) (unit: degree) • North: positive (+) • South: negative (-) • Range: -90-90 • 0—Default value <lon> (Longitude) (unit: degree) • East: positive (+) • West: negative (-) • Range: -180-180 • 0—Default value <radius> (The radius of GEO-Fencing) (unit: meter) • Range: 1-65535 • 1—Default value (Continued on next page)

Table 2-2: General Commands (Detail) (Continued)

Command	Description
	<sentence_status> (Show the $PSWIGEOFEN sentence is enabled or disabled) • 0—Disable • 1—Enable <region_data> (The data of each specified region) • Formats: <id>,<latitude>,<longitude>,<radius>,<status> • <status>: The status that shows the module is in the specified region or not • 0—Outside • 1—Inside • 3—No position information **Example:** • Write for enabling $PSWIGEOFEN output: AT+GNSSGEOFEN=1<CR><LF> +GNSSGEOFEN,1,OK*3C<CR><LF> • Write for erasing settings for all regions. AT+GNSSGEOFEN=2,0<CR><LF> +GNSSGEOFEN,2,0,OK*23<CR><LF> • Write for setting 1st region. (latitude: 60.472, longitude: 96.2527, radius: 100) AT+GNSSGEOFEN=3,1,60.472,95.2527,100<CR><LF> +GNSSGEOFEN,3,1,60.472,95.2527,100,OK*08<CR><LF> • Read the geo-fencing status of the module.(The module has exceeded the position of all regions) AT+GNSSGEOFEN?<CR><LF> +GNSSGEOFEN,0, 1,60.472000,95.252701,100,0, 2,60.472000,95.252701,100,0, 3,60.472000,95.252701,100,0,OK*28<CR><LF>

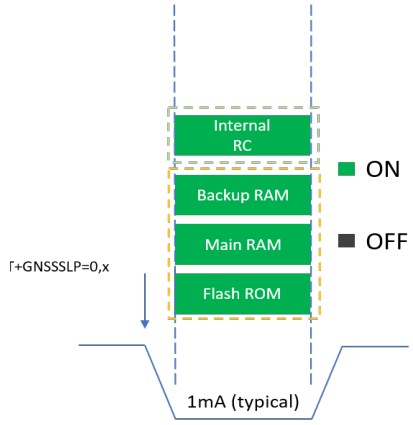
Table 2-2: General Commands (Detail) (Continued)

Command	Description
AT+GNSSPPS	**Configure and query output time in one pulse per second (1PPS) function** **Usage:** • Write: (<mode> = 0) **AT+GNSSPPS=<mode>** Response: +GNSSPPS,0,OK or +GNSSPPS,<error code> Purpose: Disable 1 PPS output. • Write: (<mode> = 1,2,3) **AT+GNSSPPS=<mode>,<pulse_width>** Response: +GNSSPPS,<mode>,<pulse_width>,OK or +GNSSPPS,<error code> Purpose: Set the 1PPS mode output. • Read: **AT+GNSSPPS?** Response: +GNSSPPS,<mode=1, 2, 3>,<pulse_width>,OK or +GNSSPPS,<mode=0>,OK or +GNSSPPS,<error code> Purpose: Get the 1PPS output mode. **Parameters:** <mode> (1PPS mode) • 0—Disable • 1—PPS output mode 1 (Only outputs PPS when time is adjusted) • 2—PPS output mode 2 (Always outputs PPS) • 3—PPS output mode 3 (Only outputs PPS when position is fixed and also the default mode) Note: For details on the 1PPS output types, see Figure 2-4 on page 29. <pulse_width> (1PPS pulse width) (unit: millisecond) • Default: 125 ms. • Only supports 125, 250, 500 ms **Example:** • Disable PPS output: AT+GNSSPPS=0<CR><LF> +GNSSPPS,0,OK*6E<CR><LF> • Enable PPS output mode 3 and pulse width is 125 ms: AT+GNSSPPS=3,125<CR><LF> +GNSSPPS,3,125,OK*72<CR><LF>

Table 2-3: Sleep States

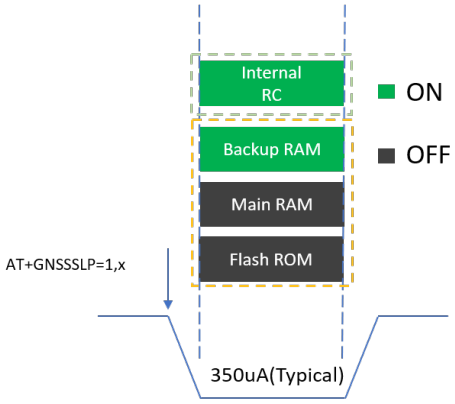
Sleep State	Main RAM status[a]	Backup RAM status[b]	Module activity upon waking up
Sleep 0[c]	Retained	Retained	Re-start with previous setting (hot start).
Sleep 1[d]	Off	Retained	Reboot

a. The main RAM contains the firmware (GNSS kernel firmware and GNSS systems) and all data during GNSS reception.
b. The backup RAM stores the ephemeris, almanac, position, and TCXO offset information needed for a hot start.
c. When the module enters a Sleep 0 state, the backup RAM and the main RAM are still powered. Thus, when the module wakes up, it continues to execute the previous program. Since data for the backup RAM is retained, the module can execute a hot start. When the module wakes up, it responds with +GNSSLP,WAKEUP,OK. There are three ways to wake up the module from a Sleep 0 state: module timeout, using the wakeup pin, interrupting via interface. Sending any data on the UART/I2C can wake up the module from a Sleep 0 state. It is recommended to send a dummy data before sending an actual command to prevent losing transmission data when the module wakes up.



Sleep 0 State

d. When the module enters a Sleep 1 state, the backup RAM is turned on while the main RAM power is turned off. Thus, when the module wakes up, hot start can run as soon as the firmware is downloaded from the flash to the RAM. This happens because data is retained in the backup RAM. There are three ways to wake up the module from a Sleep 1 state: module timeout, using the wakeup pin, interrupting via interface. Any data on the UART/I2C can wake the module from the Sleep 1 state. It is recommended to send a dummy data before sending an actual command to prevent losing transmission data when the module wakes up.



Sleep 1 State

Sleep 1 has a lower consumption than Sleep 0 but the TTFF time for Sleep 1 is slower. For details, see the AirPrime XS1110 Product Technical Specification.

Table 2-4: Satellite System Settings

The following table indicates which satellite systems are supported by the GNSS kernel.

Model	GNSS Kernel Version	Support Satellite System	
		Default	Optional
XS1110	SWI5605_XS_FDLS	GPS+Glonass+SBAS+QZSS	
	SWI5605_XS_FDLG[a]	GPS+Galileo+QZSS	GPS+Glonass+QZSS
	SWI5605_XS_FDLB	GPS+Beidou+QZSS	GPS+Glonass+QZSS
XP2210	SWI5608_XP_158F	GPS+Glonass+QZSS	

a. Two different sets of satellite systems cannot be enabled at the same time. For example, GPS+Glonass+QZSS and GPS+Galileo+QZSS cannot be active at the same time. Only one of them must be enabled.

Normal Mode

In Normal mode, the XS1110 module keeps on operating normally and updates the latest navigation message anytime to get an accurate positional information.

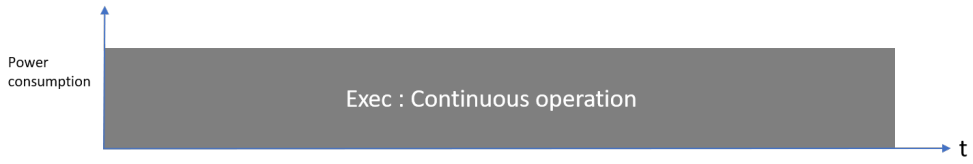


Figure 2-1: Power Consumption in Normal Mode

Low Power Tracking

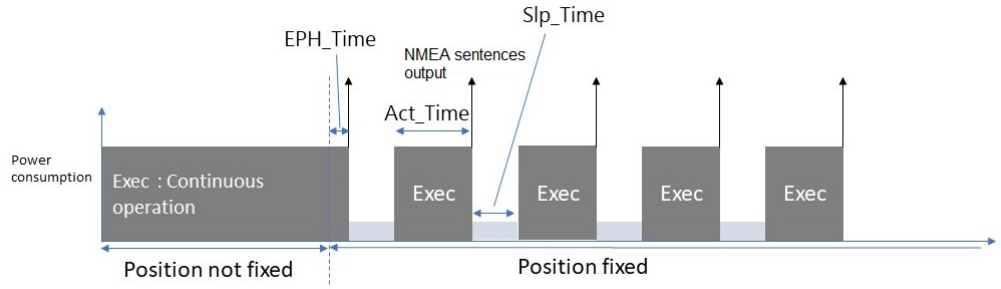


Figure 2-2: Power Consumption in Low Power Tracking

When low power tracking of XS1110 is enabled, in the beginning, it keeps receiving a GNSS navigation message. This GNSS navigation message is continually received for about 12 minutes and 30 seconds (EPH_Time) and includes the ephemeris, almanac, and satellite health in open sky.

After that, the module runs to cycle between Sleep (15 seconds) and Exec (30 seconds) as shown in Figure 2-2.

Before the XS1110 module enters into a sleep state, it outputs "GNSSLOWP,ENTRY,OK" messages in NMEA sentences to indicate that sleep mode will be executed. Once the XS1110 wakes up, it outputs "GNSSLOWP, WAKEUP, OK" to indicate that the module has woken up and will start updating the navigation message.

The module executes hot start internally after waking up every time, then it acquires satellite information for about 30 seconds (Act_Time) to update the TOW (time of the week).The module will check all of the satellite ephemeris status and ensure that all updated data is the latest. Once update is complete, the modules enter into the sleep cycle. If it doesn't, it will keep acquiring satellites in an exec status until all the navigation messages are completely updated as this is helpful for ensuring positional accuracy.

The module will hot start after waking up from an intermittent behavior and, within 30 seconds (Act_Time), track satellites to update the TOW (time of the week). Then the module will check all of the satellite ephemeris to ensure data update is complete. If there are no issues, the module gets into the next sleep cycle. Otherwise, the module will switch into continuous operation and keep tracking until data update is complete.

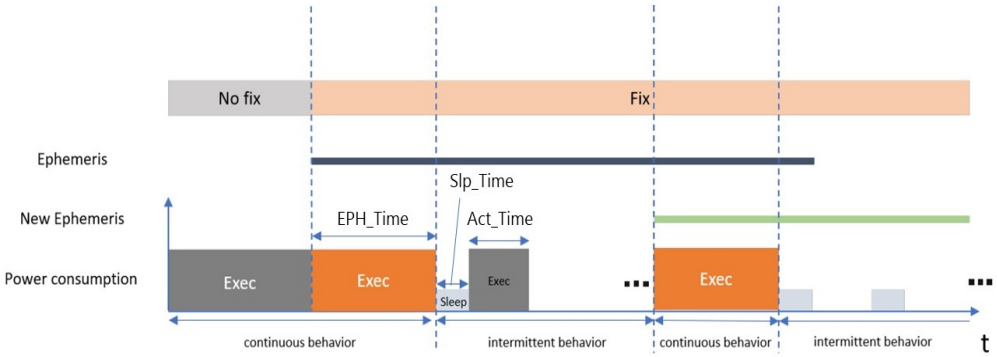


Figure 2-3: Low Power Tracking Behavior

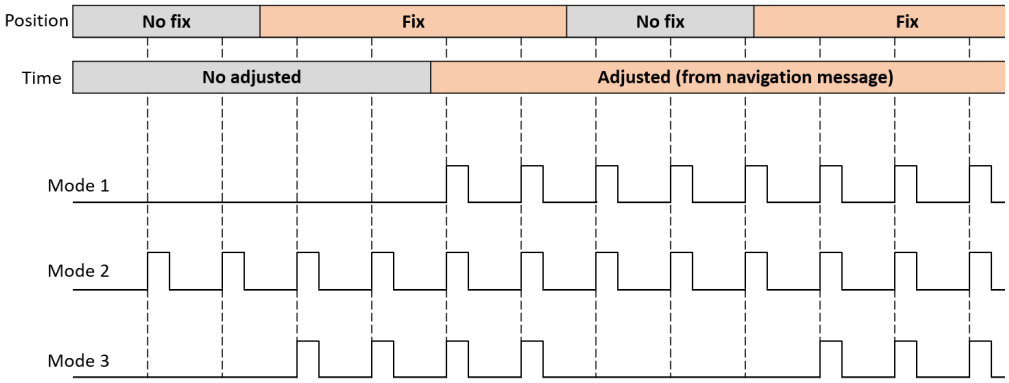


Figure 2-4: 1PPS Output Types

3: Other Commands

Introduction

This chapter describes other types of AT commands.

Command summary

The following table lists the commands described in this chapter.

Table 3-1: Other Commands (Summary)

Command	Description	Page
AT+GNSSTHRES	Configure and query the GNSS threshold	31
AT+GNSSRAW	Acquire specific data from the GNSS receiver	32
AT+GNSSEPE	Configure and query the horizontal and vertical estimated position error (EPE) based on HDOP and VDOP	33
AT+GNSSVELWARN	Configure and query GNSS speed warning feature	34
AT+GNSSPVTL	Configure and query the log and configuration of PVT log in flash	35

Command reference

Table 3-2: Other Commands (Detail)

Command	Description
AT+GNSSTHRES	**Configure and query the GNSS threshold** **Usage:** • Write (<action> = 2): **AT+GNSSTHRES=<action>,<ID>** Response: +GNSSTHRES,< action >,<ID>,OK or +GNSSTHRES,<error code> Purpose: Set the default threshold value for positioning. • Write (<action> = 3): **AT+GNSSTHRES=<action>,<threshold_mode>,<value>** Response: +GNSSTHRES,<action>,<threshold_mode>,<value>,OK or +GNSSTHRES,<error code> Purpose: Set the threshold for positioning. • Read: **AT+GNSSTHRES?** Response: +GNSSTHRES,<CNR>,<elevation>,<reserved><horizontal>,<HDOP>, <static_states>,<height>,OK or +GNSSTHRES,<error code> Purpose: Get all threshold values. **Parameters:** <action> (Status of configuring threshold) • 2—Erase • 3—Set <threshold_mode> (The mode of threshold) • 0—All threshold • 1—CNR • 2—Elevation • 3—Used satellite • 4—Horizontal accuracy • 5—HDOP • 6—Static states • 7—Height <CNR> (Minimal C/N Ratio) (unit: dB-Hz) • Minimum satellite CNR value to be used for positioning • Default: 0 dB-Hz • Valid value: 0-50 <elevation> (The minimal elevation) (unit: degree) • Minimum satellite elevation value to be used for positioning • Default: 5 degrees • Valid value: 0-90 (Continued on next page)

Table 3-2: Other Commands (Detail) (Continued)

Command	Description
	<horizontal> (The maximum value of horizontal accuracy) (unit: meter) • 0—Default • Valid value: 0-300 <HDOP> (The maximum value of horizontal dilution of precision) (no unit) • -1.0—Default • Valid value: -1.0-3.0 <static_states> (The maximum velocity) (unit: meter per second) • 0—Default • Valid value: 0.0-3.0 <height> (Height limitation) (unit: kilometer) • 15—Default • Valid value: 0-50 **Examples:** • Write the following to set the CNR threshold to 5dB-Hz: AT+GNSSTHRES=3,1,5<CR><LF> +GNSSTHRES,3,1,5,OK*62<CR><LF> • Write the following to set all threshold to default: AT+GNSSTHRES=2,0<CR><LF> +GNSSTHRES,2,0,OK*7B<CR><LF> • Read setting for all threshold: AT+GNSSTHRES?<CR><LF> +GNSSTHRES,0,5,0,0.0,-1.0,0.0,15,OK*66<CR><LF>
AT+GNSSRAW	**Acquire specific data from the GNSS receiver** **Usage:** • Write: **AT+GNSSRAW=<status>** Response: +GNSSRAW,<status>,OK or +GNSSRAW,<error code> Purpose: Configure the output mode for $PSWIRAW. • Read: **AT+GNSSRAW?** Response: +GNSSRAW,<status>,OK or +GNSSRAW,<error code> Purpose: Get the output mode status for $PSWIRAW. **Parameters:** <status> $PSWIRAW outputting mode • 0—Disable • 1—Enable Note: See $PSWIRAW Details on page 48 for the format of PSWIRAW **Examples:** • Disable $PSIRAW output: AT+GNSSRAW=0<CR><LF> +GNSSRAW,0,OK*79<CR><LF> • Read the status of $PSWIRAW outputting: AT+GNSSRAW?<CR><LF> +GNSSRAW,0,OK*79<CR><LF>

Table 3-2: Other Commands (Detail) (Continued)

Command	Description
AT+GNSSEPE	**Configure and query the horizontal and vertical estimated position error (EPE) based on HDOP and VDOP** **Usage:** • Write: **AT+GNSSEPE=<status>** Response: +GNSSEPE,<status>,OK or +GNSSEPE,<error code> Purpose: Configure the output mode for $PSWIEPE. • Read: **AT+GNSSEPE?** Response: +GNSSEPE,<status>,<3D>,<2D>,<lat>,<lon>,<height>,OK or +GNSSEPE,<error code> Purpose: Get the output mode status for $PSWIEPE. **Parameters:** <status> $PSWIEPE outputting mode • 0—Disable • 1—Enable Note: See $PSWIEPE Details on page 49 for the format of $PSWIEPE. <3D> 3D EPE • Unit: meter <2D> 2D EPE • Unit: meter <lat> Latitude EPE • Unit: meter <lon> Longitude EPE • Unit: meter <height> Altitude EPE • Unit: meter **Examples:** • Enable $PSWIEPE output: AT+GNSSEPE=1<CR><LF> +GNSSEPE,1,OK*6C<CR><LF> • Read the status of $PSWIEPE outputting: AT+GNSSEPE?<CR><LF> +GNSSEPE,1,20.8,14.6,9.9,10.7,14.9,OK*6D<CR><LF>

Table 3-2: Other Commands (Detail) (Continued)

Command	Description
AT+GNSSVELWARN	**Configure and query GNSS speed warning feature** **Usage:** • Write (<action> = 0, 1): or **AT+GNSSVELWARN=<action>** Response: +GNSSVELWARN,<action>,OK or +GNSSVELWARN,<error code> Purpose: After enabling or disabling, the $PSWIVELW sentence becomes set to output or not. or After erasing the velocity threshold, the value becomes 0. • Write (<action> = 3): or **AT+GNSSVELWARN=<action>,<velocity>** Response: +GNSSVELWARN,<action>,<velocity>,OK or + GNSSVELWARN,<error code> Purpose: Set the velocity threshold. • Read: **AT+GNSSVELWARN?** Response: +GNSSVELWARN,<action>,<velocity>,<GPS_velocity>,<status>,OK or +GNSSVELWARN,<error code> Purpose: Get speed warning configuration. **Parameters:** <action> • 0—Disable $PSWIVELW sentence • 1—Enable $PSWIVELW sentence • 2—Erase velocity threshold • 3—Set velocity threshold Note: See $PSWIVELW Details on page 47 for the format of $PSWIVELW. <velocity> (Threshold of velocity) • Unit: m/s (meter/second) • Default setting: 5 m/s • Range: 0-100 <GPS_velocity> (Current velocity) • Unit: m/s (meter/second) <status> (Overspeed status) • 0—Underspeed criteria • 1—Overspeed criteria **Examples:** • Write configuration for enabling $PSWIVELW output: AT+GNSSVELWARN=1<CR><LF> +GNSSVELWARN,1,OK*69<CR><LF> • Write configuration for setting velocity to 10 m/s: AT+GNSSVELWARN=3,10<CR><LF> +GNSSVELWARN,3,10,OK*46<CR><LF> • Read the speed warning status of the module (The module is not overspeeding and does not output $PSWIVELW): AT+GNSSVELWARN?<CR><LF> +GNSSVELWARN,0,10,0.0,0,OK*5B<CR><LF>

Table 3-2: Other Commands (Detail) (Continued)

Command	Description
AT+GNSSPVTL	**Configure and query the log and configuration of PVT log in flash** Steps: **1.** Enable PVT log function. **2.** Disable PVT log function. **3.** Get PVT log function. **Usage:** • Write (<action> = 0, 1, 2): or **AT+GNSSPVTL=<action>** Response: +GNSSPVTL,<action>,OK or +GNSSPVTL,<error code> Purpose: Disable / Enable / Erase PVT log. • Write (<action> = 3): or **AT+GNSSPVTL=<action>,<override_mode>,<cycle>** Response: +GNSSPVTL,<action>,<override_mode>,<cycle>,OK or + GNSSPVTL,<error code> Purpose: Configure the record mode for recording PVT log. or Disable recording the PVT log. • Execute: **AT+GNSSPVTL** Response: +GNSSPVTL,<log size>,OK +GNSSPVTL,<sector>,<log_data>,<log_data>,<log_data>, <log_data>,<log_data>,OK or +GNSSPVTL,<error code> Purpose: Get PVT log data Requirement: Disable recording the PVT log. • Read: **AT+GNSSPVTL?** Response: +GNSSPVTL,<action>,<log_size>,<override_mode>,<cycle>,OK or +GNSSPVTL,<error code> Purpose: Get PVT log mode configuration. (Continued on next page)

Table 3-2: Other Commands (Detail) (Continued)

Command	Description
	Parameters: <action> (PVT log mode) • 0—Disable (Default) • 1—Enable • 2—Erase • 3—Set recording mode <override_mode> (PVT log override mode) • 0—Stop recording data (Default) • 1—Override data from the beginning • 2—Only override the last record and keep the other data <cycle> (PVT log recording cycle) (unit: second) • Range:1-3600. • Default: 15 second <sector> (Calculate PVT log sentences) • Maximum value: 48 <log size> (PVT log size) • Unit: byte <log_data> (The binary data of PVT Log) *Note: Enter the execute disable comment (=0) before reading or executing the erase and write parameters.* **Examples:** • Enable PVT log: AT+GNSSPVTL=1<CR><LF> +GNSSPVTL,1,OK*22<CR><LF> • Set override mode to stop recording data and cycle to 5 seconds: AT+GNSSPVTL=3,0,5<CR><LF> +GNSSPVTL,3,0,5,OK*25<CR><LF> • Get PVT Log data: +GNSSPVTL,01,90000064DC040080271B00040080007A0A54235C, 41010064A80100804718000400000420C54235C, 370000645C03008027190004000000240E54235C, B841BF6368050080471A00040000008210 54235C, OK*62<CR><LF>

4: AGNSS Commands

Introduction

This chapter describes AGNSS related AT commands.

Command Summary

The following table lists the commands described in this chapter.

Table 4-1: AGNSS Commands (Summary)

Command	Description	Page
AT+GNSSLLE	Configure connecting AGNSS function and acquire the status	38
AT+GNSSSGE	Enable / disable autonomous AGNSS function and acquire the status	40

Command References

Table 4-2: AGNSS Commands (Detail)

Command	Description
AT+GNSSLLE	**Configure connecting AGNSS function and acquire the status** **Usage:** • Write (<action> = 0, 1, 2): **AT+GNSSLLE=<action>** Response: +GNSSLLE,<action>,OK or +GNSSLLE,<error code> Purpose: Set the LLE function to enabling, disabling, or erasing. *Note: The module returns either of the following error codes:* *-5—This indicates that the LLE is enabled / disabled and the module does not have LLE data.* *-1—This indicates that the module does not have an LLE data.* • Write (<action> = 3): **AT+GNSSLLE=<action>,<packet_num>** Response: +GNSSLLE,<packet_num>,CONNECT +GNSSLLE,<packet_num>,<packet_size>,OK or +GNSSLLE,<error code> Purpose: Set the LLE data into flash. • Write (<action> = 4): **AT+GNSSLLE=<action>** Response: +GNSSLLE,<action>,OK or +GNSSLLE,<error code> Purpose: Check the integrity of the injected LLE data. • Read: **AT+GNSSLLE?** Response: +GNSSLLE,<lle_select>,<lle_satellite_GPS>,<age_GPS>,<start_time_GPS>, <lle_satellite_QZSS>,<age_QZSS>,<start_time_QZSS>, <lle_satellite_GLN>,<age_GLN>,<start_time_GLN>, <lle_satellite_GAL>,<age_GAL>,<start_time_GAL>, <lle_satellite_BDS>,<age_BDS>,<start_time_BDS>,OK or +GNSSLLE,<error code> Purpose: Get the valid date of the LLE. (Continued on the next page)

Table 4-2: AGNSS Commands (Detail) (Continued)

Command	Description

	Parameters:
	<action>
	• 0—Disable LLE function.
	• 1—Enable LLE function.
	• 2—Erase LLE data in flash.
	• 3—Set LLE data saved into flash.
	• 4—Check the integrity of the injected LLE data in flash.
	<packet_num> (Packet number)
	<lle_satellite_xxx>
	• xxx:
	  • 0—GPS
	  • 1—QZSS
	  • 2—GLN
	  • 3—GAL
	  • 4—BDS
	<age_xxx> (Life of the saved LLE data of the xxx satellite system)
	• Availability: 3 days, 7 days, or 14 days
	• xxx:
	  • GLN—GLONASS
	  • GAL—Galileo
	  • BDS—BeiDou
	<start_time_xxx> (start time of the LLE data of the xxx satellite system)
	• Format: YYYYMMDD (YearMonthDay)
	<packet_size> (Single packet size)
	<lle_select>
	• 0— LLE function is disable
	• 1— LLE function is enable
	
	Example:
	• Enable LLE function:
	AT+GNSSLLE=1<CR><LF>
	+GNSSLLE,1,OK*69<CR><LF>
	• Write configuration for setting LLE data to flash.
	AT+GNSSLLE=3,0<CR><LF>
	+GNSSLLE,0,CONNECT*22<CR><LF>
	.(Inject LLE data)
	.
	.
	+++ (exit data mode)
	
	+GNSSLLE,0,1024,OK*5A<CR><LF>
	• Read the configuration of LLE.
	AT+GNSSLLE?<CR><LF>
	+GNSSLLE,0,0,3,20200325,1,0,00000,2,0,00000,3,0,00000,4,0,00000,OK*57
	<CR><LF>

Table 4-2: AGNSS Commands (Detail) (Continued)

Command	Description
AT+GNSSSGE	**Enable / disable autonomous AGNSS function and acquire the status** **Usage:** • Write: **AT+GNSSSGE=<action>** Response: +GNSSSGE,<action>,OK or +GNSSSGE,<error code> Purpose: Configure SGE function. • Read: **AT+GNSSSGE?** Response: +GNSSSGE,<action>,<satellite A>,<satellite B>,OK or +GNSSSGE,<error code> Purpose: Acquire the status when the satellite already have AGNSS data, waiting for ephemeris. **Parameters:** <action> (Status of auto-GPS) • 0—Disable (Default) • 1—Enable • 2—Erase <satellite A> (Satellite have already generated AGNSS data) • Value: AAAAAAAA • Bit 0: SV1 • Bit 2: SV2 • Bit 31: SV32 <satellite B> (Satellite waiting for the ephemeris to generate AGNSS data) • Value: BBBBBBBB • Bit 0: SV1 • Bit 1: SV2 • Bit 31: SV32 *Note: The SGE function is only needed to capture the 12.5-minute ephemeris data from the satellite. It automatically calculates and predicts using GNSS without a 24-hour or 72-hour waiting period.* **Example:** • Enable auto AGNSS: AT+GNSSSGE=1<CR><LF> +GNSSSGE,1,OK*6E<CR><LF> • Acquire auto AGNSS state: AT+GNSSSGE? <CR><LF> + GNSSSGE,1,00000000,677381157,OK*1F<CR><LF>

5: System Commands

Introduction

This chapter describes system AT commands.

Command summary

The following table lists the commands described in this chapter.

Table 5-1: System Commands (Summary)

Command	Description	Page
AT+GNSSFER	Erase the currently saved firmware	42
AT+GNSSFSN	Acquire the serial number of the GNSS module	42
AT+GNSSVERS	Acquire the SWIR-defined firmware version	42
AT+GNSSRTC	Get CPU time and the elapsed time since system startup	43
AT+GNSSBRATE	Set the baud rate of communication interface	43
AT+GNSSRTCXO	Acquire TCXO offset value	44
AT+GNSSREBOOT	Reboot module	44
AT+GNSSSTACK	Get a size of unused stack	44

Command reference

Table 5-2: System Commands (Detail)

Command	Description
AT+GNSSFER	**Erase the currently saved firmware** **Usage:** • Exec: **AT+GNSSFER** Response: +GNSSFER,OK or +GNSSFER,<error code> **Example:** • Erase the current firmware: AT+GNSSFER<CR><LF> +GNSSFER,OK*59<CR><LF>
AT+GNSSFSN	**Acquire the serial number of the GNSS module** **Usage:** • Read: **AT+GNSSFSN?** Response: +GNSSFSN,<fsn>,OK or +GNSSFSN<error code> **Parameters:** <fsn> (Serial number) **Example:** • Read the serial number of the module: AT+GNSSFSN?<CR><LF> +GNSSFSN,03891419444620,OK*59<CR><LF>
AT+GNSSVERS	**Acquire the SWIR-defined firmware version** **Usage:** • Read: **AT+GNSSVERS?** Response: +GNSSVERS,<ver>,OK or +GNSSVERS,<error code> **Parameters:** <ver> (Firmware version) **Example:** • Read the SWIR-defined firmware version: AT+GNSSVERS?<CR><LF> +GNSSVERS,SWI5605XS_RC16.1_FDLS.19017,OK*5B<CR><LF>

Table 5-2: System Commands (Detail) (Continued)

Command	Description
AT+GNSSRTC	**Get CPU time and the elapsed time since system startup** **Usage:** • Read: **AT+GNSSRTC?** Response: +GNSSRTC,<rtc_time>,OK or +GNSSRTC,<error code> **Parameters:** <rtc_time> (RTC Time) • Unit: microsecond • Format: hex **Example:** • Read the elapsed time since system startup: AT+GNSSRTC?<CR><LF> +GNSSRTC,0,OK*78 <CR><LF>
AT+GNSSBRATE	**Set the baud rate of communication interface** *Note: The module will reboot after the baud rate is set.* **Usage:** • Write: **AT+GNSSBRATE=<baud_rate>** Response: +GNSSBRATE,<baud_rate>,OK or +GNSSBRATE,<error code> Purpose: Configure the module's baud rate. • Read: **AT+GNSSBRATE?** Response: +GNSSBRATE,<baud_rate>,OK or +GNSSBRATE,<error code> Purpose: Get the module's baud rate. **Parameters:** <baud_rate> (Baud Rate) • 0—115200 (Default) • 1—460800 **Example:** • Changed baud rate to 115200: AT+GNSSBRATE=0<CR><LF> +GNSSBRATE,0,OK*7D<CR><LF> • Changed baud rate to 460800: AT+GNSSBRATE=1<CR><LF> +GNSSBRATE,1,OK*7C<CR><LF>

Table 5-2: System Commands (Detail) (Continued)

Command	Description
AT+GNSSTCXO	**Acquire TCXO offset value** **Usage:** • Read: **AT+GNSSTCXO?** Response: +GNSSTCXO,<TCXO>,OK or +GNSSTCXO,<error code> Purpose: Get TCXO offset. **Parameters:** <TCXO> (TCXO offset) • Unit is in Hz. **Example:** • Read the TCXO value: AT+GNSSTCXO?<CR><LF> +GNSSTCXO,-292,OK*19<CR><LF>
AT+GNSSREBOOT	**Reboot module** **Usage:** • Exec: **AT+GNSSREBOOT** Response: +GNSSREBOOT,OK or + GNSSREBOOT,<error code> Purpose: Reboot module. **Example:** • Reboot module: AT+GNSSREBOOT<CR><LF> +GNSSREBOOT,OK*19<CR><LF> *Note: This AT command erases all of the RAM data.*
AT+GNSSSTACK	**Get a size of unused stack** **Usage:** • Read: **AT+GNSSSTACK?** Response: +GNSSSTACK,<size>,OK or +GNSSSTACK,<error code> Purpose: Get a size of unused stack. **Parameters:** <size> (Unused stack size) • Unit: byte **Example:** • Get a size of unused stack: AT+GNSSSTACK?<CR><LF> +GNSSSTACK,256,OK*19<CR><LF>

6: Customized NMEA Sentences

Introduction

This chapter describes the normal output sentences developed by Sierra Wireless. These sentences will output with NMEA when the user enables it by command.

Command summary

The following table lists the commands described in this chapter.

Table 6-1: Other Commands (Summary)

Command	Description	Page
$PSWIGEOFEN	$PSWIGEOFEN Details	46
$PSWIRAW	$PSWIRAW Details	48
$PSWIVELW	$PSWIVELW Details	47
$PSWIEPE	$PSWIEPE Details	49

Command reference

$PSWIGEOFEN Details

A geo-fence is a virtual perimeter for a real-world geographic area. It could be dynamically generated, as in a radius around a point location, or a predefined set of boundaries, such as school zones or neighborhood boundaries.

The following table shows the $PSWIGEOFEN sentence format:

$PSWIGEOFEN,20190904,083257.000000,1,1,2,0,3,0*3E

Table 6-2: $PSWIGEOFEN Data Format

Name	Example	Description
Message ID	$PSWIGEOFEN	$PSWIGEOFEN header
UTC Date	20190904	Coordinated Universal Date Format: yyyymmdd
UTC Time	083257.000000	Coordinated Universal Time Format: hhmmss.ssssss
Sector number	1	
Status of first sector	1	0—Outside 1—Inside 3—No position information
Sector number	2	
Status of second sector	0	0—Outside 1—Inside 3—No position information
Sector number	3	
Status of third sector	0	0—Outside 1—Inside 3—No position information
Checksum	*3E	
Termination	<CR><LF>	End of message termination

$PSWIVELW Details

Speed warn allows users to set the maximum velocity that will be seen as safe. If the speed is over this value, speed warn will be activated.

The following table explains the $PSWIVELW sentence format:

$PSWIVELW,20190905,055601.00,1*27

Table 6-3: $PSWIVELW Data Format

Name	Example	Description
Message ID	$PSWIVELW	$PSWIVELW header
UTC Date	20190904	Coordinated Universal Date Format: yyyymmdd
UTC Time	095849.00	Coordinated Universal Time Format: hhmmss.ss
Status	1	The status of overspeed
Checksum	56	
Termination	<CR><LF>	End of message termination

$PSWIRAW Details

Raw measurement brings more information for analysis, for the production line, and for application. The information should output as a NMEA sentence. The output frequency is same as NMEA sentences.

The following table explains the $PSWIRAW sentence format:

$PSWIRAW,20190904,095849.00,1,015,37.13,21442795.307,695888.540,-1813.7,18,-12247689.878,9952300.944,21086004.996,-64,8946,5.429,2*56

Table 6-4: $PSWIRAW Data Format

Name	Example	Units	Description
Message ID	$PSWIRAW		$PSWIRAW header
UTC Date	20190904		Coordinated Universal Date Format: yyyymmdd
UTC Time	095849.00		Coordinated Universal Time Format: hhmmss.ss
System ID	1		1—GPS 2—GLONASS 3—Galileo 4—BeiDou 5—QZSS
Satellite ID	015		Identifies the number of each satellite
CNR	37.13	dB-Hz	Quality of received signals
Pseudo range	21442795.307	meter	Raw GNSS measurement
Time sync carrier phase	695888.540	cycle	Carrier phase measurement synchronized to the GPS time
Doppler frequency	-1813.7	Hz	Raw GNSS measurement
Cycle slip flag	1		Index for cycle slip in carrier phase measurement
Satellite position (X)	-12247689.878		X coordinate in ECEF system
Satellite position (Y)	9952300.944		Y coordinate in ECEF system
Satellite position (Z)	21086004.996		Z coordinate in ECEF system
Frequency channel	-64		Frequency channel for GLONASS
Age of ephemeris	8946		Age of ephemeris for each satellite systems
Ionosphere correction	5.429	meter	Ionsphere correction
Sync status	2		G+B data sync status
Checksum	56		
Termination	<CR><LF>		End of message termination

$PSWIEPE Details

EPE is the horizontal and vertical estimated position error based on HDOP and VDOP.

The following table explains the $PSWIEPE sentence format:

$PSWIEPE,20190905,060310.00,10.5,7.6,4.6,6.0,7.3*56

Table 6-5: $PSWIEPE Data Format

Name	Example	Units	Description
Message ID	$PSWIEPE		$PSWIEPE header
UTC Date	20190904		Coordinated Universal Date Format: yyyymmdd
UTC Time	060310.00		Coordinated Universal Time Format: hhmmss.ss
3D EPE	10.5	meter	Position 3D uncertainty
2D EPE	7.6	meter	Position 2D uncertainty
Latitude EPE	4.6	meter	Latitude uncertainty
Longitude EPE	6.0	meter	Longitude uncertainty
Height EPE	7.3	meter	Height uncertainty
Checksum	56		
Termination	<CR><LF>		End of message termination

Note: "Uncertainty" is the predicted error between the NMEA position and the actual position. This uncertainty is tuned so that the actual position is inside the circle of uncertainty with around 1-sigma.

A: Error Codes

When communication has failed, the module will show an error code. The following table describes the definition of the error code.

Table A-1: Error Codes

Error Code	Error Name	Description
-1	GRECO_AT_COMMAND_RESPONSE_EXECUTION_FAIL	Function executes with wrong result.
-2	GRECO_AT_COMMAND_RESPONSE_NOT_ATCMD	Unsupportable command.
-3	GRECO_AT_COMMAND_RESPONSE_WRONG_PARAMETER	Unsupportable parameter.
-4	GRECO_AT_COMMAND_RESPONSE_WRONG_TYPE	Unsupportable AT command type.
-5	GRECO_AT_COMMAND_RESPONSE_NO_DATA	Data is not ready, cannot be reached.
-6	GRECO_AT_COMMAND_RESPONSE_WRONG_PARAMETER_LENGTH	Incorrect length of command argument.
-7	GRECO_AT_COMMAND_RESPONSE_BACKUPRAM_FAIL	Backup function is failed.

B: Abbreviations

Table B-1: Acronyms and Definitions

Abbreviation	Meaning	Definition
AGNSS	Assisted Global Navigation Satellite System	While using a GPS / GNSS receiver in an inadequate signaling situation, for example, the module is applied in a building where only a weak signal can be received, it may depend on periodically receiving the orbital information of the target satellite from a calculating source other than the GPS satellite itself. The data received is known as assisted GNSS data.
BeiDou		Satellite navigation system operated by China
EPE	Estimated Position Error	EPE is a statistical level of confidence generated for each position. It is measured by horizontal position error in feet or meters based upon a variety of factors including Dilution of Precision (DOP) and satellite signal quality. However, this is not an error message. It is only a reference to inform users how accurate the position of the GPS is displaying at that time. Furthermore, a wide range of factors can have impacts on this reference, such as multipath, number of satellites, SNR, satellites elevations and period of time GPS unit is switched on prior to recording and how long users stay in one location to record the position.
Geofencing		Geofencing defines a geographic boundary. For example, if this “virtual barrier” is established in the module, the further application is able to use triggers that send a text message, email alert, or app notification when an objective enters/ leaves the specified area.
GLONASS		Satellite positioning system operated by Russia
GNSS	Global Navigation Satellite System	A generic standard term for satellite navigation systems that provide autonomous geo-spatial positioning with global coverage.
GPS	Global Positioning System	Satellite positioning system operated by USA
HDOP	Horizontal Dilution of Precision	This measures the geometric quality of a GPS satellite configuration in the sky. HDOP is a factor that determines the relative accuracy of a horizontal position.
LLE	Long Life Ephemeris	Predicts satellite orbit information (ephemeris), with high accuracy, by offering satellite information from the AGPS server for one day or more

Table B-1: Acronyms and Definitions (Continued)

Abbreviation	Meaning	Definition
NMEA	The National Marine Electronics Association	This is a standard data format supported by all GPS manufacturers. The output definition consists of latitude, longitude, time, etc.
PPS	pulse-per-second	This is an electrical signal that has a width of less than one second, with edges that sharply increases or abruptly decreases and repeats accurately and precisely once per second. In this application, PPS signals are output by GPS receivers.
PVT	Position, Velocity, Time	A GPS receiver is an L-Band radio processor capable of addressing navigation equations that decide the user's position, velocity, and precise time by dealing with the signal broadcasted by GPS satellites.
QZSS	Quasi-Zenith Satellite System	This is a four-satellite regional time transfer system and a satellite-based augmentation system development operated by Japan.
RTC	Real-Time Clock	This is present in almost any electronic device that needs to have an accurate time.
SBAS	Satellite-based Augmentation Systems	The accuracy and reliability of GNSS information are improved by SBAS via correcting signal measurement errors and via providing information about the accuracy, integrity, continuity and availability of its signals. These systems also support wide-area or regional augmentation by applying the additional satellite-broadcast messages. Correction messages are created and sent to one or more satellites for broadcast from the ground stations used measurements to end users as differential signal.
SGE	Self Generated Ephemeris	Predicts satellite orbit information (ephemeris) with high accuracy by accumulating satellite information internally for more than one day.
TCXO	Temperature Compensate X'tal (crystal) Oscillator	A TCXO adjusts the frequency of the oscillator to compensate for the changes that will occur because of temperature changes.
VDOP	Vertical Dilution of Precision	This measures the geometric quality of a GPS satellite configuration in the sky. VDOP is a factor that determines the relative accuracy of a vertical position.

C: PVT Log Table

Table C-1: PVT Log Payload

Bit	Definition		Parameters
0-19	Latitude	Latitude (decimal places of minutes)	
20-25		Latitude (minutes)	
26-32		Latitude (degrees)	
33		Latitude symbol	0: Plus (north latitude) 1: Minus (south latitude)
34-53	Longitude	Longitude (decimal places of minutes)	
54-59		Longitude (minutes)	
60-67		Longitude (degrees)	
68		Longitude symbol	0: Plus (east longitude) 1: Minus (west longitude)
69-72	Altitude	Altitude (decimal places)	
73-89		Altitude (integer)	Unit: [m]
90		Altitude symbol	0: Plus 1: Minus
91-94	Horizontal speed	Horizontal speed (decimal places)	
95-101		Horizontal speed (integer)	Unit: [m/s]
102-105	Vertical speed	Vertical speed (decimal places)	
106-110		Vertical speed (integer)	Unit: [m]
111		Vertical speed symbol	0: Plus 1: Minus
112-120	Bearing	Integer	0 - 359 Unit: Degree
121-124	Time (UTC)	msec	
125-130		Seconds	
131-136		Minutes	
137-141		Hours	

Table C-1: PVT Log Payload (Continued)

Bit	Definition		Parameters
142-148	Date (UTC)	Year	
149-153		Day	
154-157		Month	
158-159	Positioning mode	Mode	0: Not fixed 1: Fixed 2: Assisted GPS 3: Dead Recording

Index (AT Commands)

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