EC25&EC21 GNSS AT Commands Manual

LTE Module Series

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About the Document

History

Revision	Date	Author	Description
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Contents

Table Index

1 Introduction

Quectel EC25/EC21 module integrates a GNSS engine which supports GPS, BeiDou, Galileo and GLONASS systems. The high performance GNSS engine is suitable for various applications where lowest-cost and accurate positioning is needed, and it supports position tracking without network assistance. EC25/EC21 GNSS can be applied in the following applications: turn-by-turn navigation, asset tracking, buddy tracking, location-aware games, as well as home and fleet management.

1.1. GNSS Turning on/off Procedures

EC25/EC21 GNSS supports location calculation without any assistance from the network. GNSS turning on/off procedures are shown below:

Step 1: Configure GNSS parameters via **AT+QGPSCFG**.

Step 2: Turn on GNSS via **AT+QGPS**.

Step 3: After GNSS is turned on and position is fixed successfully, the positioning information can be obtained by three ways:

1) NMEA sentences are output to "usbnmea" port by default; you can read the port to obtain NMEA sentences.
2) You can use **AT+QGPSLOC** to obtain positioning information directly, such as latitude, longitude, height, GNSS positioning mode, time, number of satellites, and so on.
3) After enabling **<nmeasrc>** via **AT+QGPSCFG="nmeasrc",1**, you can acquire the specified NMEA sentence via **AT+QGPSGNMEA**. If **<nmeasrc>** is disabled, this command cannot be used.

Step 4: GNSS can be turned off by two ways:

1) If the parameter **<fixcount>** of **AT+QGPS** is set to 0 in Step 2, GNSS will get position continuously, and it can be turned off via **AT+QGPSEND**.
2) If **<fixcount>** reaches the specified value, the GNSS will stop automatically.

1.2. NMEA Sentences Type

The NMEA sentences are compatible with NMEA-0183 protocol, and all of the standard NMEA sentences have four kinds of prefix.

For GPS sentences, the prefix is “GP”, as below:

- GPGGA - Global positioning system fix data, such as time, position, etc.
- GPRMC - Recommended minimum data
- GPGSV - Detailed satellite data
- GPGSA - Overall satellite data
- GPVTG - Vector track and speed over the ground

For GLONASS sentences, the prefixes are "GL" and "GN", as below:

- GLGSV - Detailed satellite data
- GNGSA - Overall satellite data
- GNGNS - Positioning system

For Galileo sentences, the prefixes are "GA" and "GN", as below:

- GAGSV - Detailed satellite data
- GNGSA - Overall satellite data
- GNGNS - Positioning system

For BeiDou sentences, the prefix is "PQ", as below:

- PQGSV - Detailed satellite data
- PQGSA - Overall satellite data

2 Description of GNSS AT Commands

2.1. AT+QGPSCFG GNSS Configurations

The command is used to query and configure various GNSS settings, including NMEA sentences output port, output type of NMEA sentences, and more.

AT+QGPSCFG GNSS Configurations	
Test Command **AT+QGPSCFG=?**	Response **+QGPSCFG: "outport",("none","usbnmea")** **+QGPSCFG: "nmeasrc",(0,1)** **+QGPSCFG: "gpsnmeatype",(0-31)** **+QGPSCFG: "glonassnmeatype",(0-7)** **+QGPSCFG: "galileonmeatype",(0,1)** **+QGPSCFG: "beidounmeatype",(0-3)** **+QGPSCFG: "gsvextnmeatype",(0,1)** **+QGPSCFG: "gnssconfig",(0-6)** **+QGPSCFG: "autogps",(0,1)** **OK**
Reference	

2.1.1. AT+QGPSCFG="outport"[,<outport>] Configure NMEA Sentences Output Port

AT+QGPSCFG="outport"[,<outport>] Configure NMEA Sentences Output Port	
Write Command **AT+QGPSCFG="outport"[,<outport>]**	Response When there are two parameters: **OK** When the second parameter is omitted, query the current setting: **+QGPSCFG: "outport",<outport>**

	OK If error is related to ME functionality: **+CME ERROR: <errcode>**
Reference	

Parameter

<outport>	Configure the output port of NMEA sentences, and the configuration parameter will be automatically saved to NVRAM. "none" Close NMEA sentence output "usbnmea" Output via USB NMEA port
<errcode>	Integer type, indicates the error code of the operation. If it is not 0, it is the type of error (Please refer to ***Chapter 5*** for details).

2.1.2. AT+QGPSCFG="nmeasrc"[,<nmeasrc>] Enable/Disable Acquisition of NMEA Sentences via AT+QGPSGNMEA

The command enables/disables acquisition of NMEA sentences via **AT+QGPSGNMEA.**

AT+QGPSCFG="nmeasrc"[,<nmeasrc>] Enable/Disable Acquisition of NMEA Sentences via AT+QGPSGNMEA	
Write Command **AT+QGPSCFG="nmeasrc"[,<nmeasrc>]**	Response When there are two parameters: **OK** When the second parameter is omitted, query the current setting: **+QGPSCFG: "nmeasrc",<nmeasrc>** **OK** If error is related to ME functionality: **+CME ERROR: <errcode>**
Reference	

Parameter

<nmeasrc>	After being enabled, original NMEA sentences can be acquired via **AT+QGPSGNMEA**, and the configuration parameter will be automatically saved to NVRAM. Meanwhile, sentences are output via the same NMEA ports

	as before. 0 Disable 1 Enable
<errcode>	Integer type, indicates the error code of the operation. If it is not 0, it is the type of error (Please refer to ***Chapter 5*** for details).

2.1.3. AT+QGPSCFG="gpsnmeatype"[,<gpsnmeatype>] Configure Output Type of GPS NMEA Sentences

AT+QGPSCFG="gpsnmeatype"[,<gpsnmeatype>] Configure Output Type of GPS NMEA Sentences	
Write Command **AT+QGPSCFG="gpsnmeatype"[,<gpsnmeatype>]**	Response When there are two parameters: **OK** When the second parameter is omitted, query the current setting: **+QGPSCFG: "gpsnmeatype",<gpsnmeatype>** **OK** If error is related to ME functionality: **+CME ERROR: <errcode>**
Reference	

Parameter

<gpsnmeatype>	Output type of GPS NMEA sentences by ORed, and the configuration parameter will be automatically saved to NVRAM. The default value is 31 which means all the five types of sentences will be output. 0 Disable 1 GGA 2 RMC 4 GSV 8 GSA 16 VTG
<errcode>	Integer type, indicates the error code of the operation. If it is not 0, it is the type of error (Please refer to ***Chapter 5*** for details).

2.1.4. AT+QGPSCFG="glonassnmeatype"[,<glonassnmeatype>] Configure Output Type of GLONASS NMEA Sentences

AT+QGPSCFG="glonassnmeatype"[,<glonassnmeatype>] Configure Output Type of GLONASS NMEA Sentences	
Write Command **AT+QGPSCFG="glonassnmeatype"[,<glonassnmeatype>]**	Response When there are two parameters: **OK** When the second parameter is omitted, query the current setting: **+QGPSCFG: "glonassnmeatype",<glonassnmeatype>** **OK** If error is related to ME functionality: **+CME ERROR: <errcode>**
Reference	

Parameter

<glonassnmeatype>	Configure output type of GLONASS NMEA sentences by ORed, and the configuration parameter will be automatically saved to NVRAM. The default value is 0. 0 Disable 1 GSV 2 GSA 4 GNS
<errcode>	Integer type, indicates the error code of the operation. If it is not 0, it is the type of error (Please refer to ***Chapter 5*** for details).

2.1.5. AT+QGPSCFG="galileonmeatype"[,<galileonmeatype>] Configure Output Type of Galileo NMEA Sentences

AT+QGPSCFG="galileonmeatype"[,<galileonmeatype>] Configure Output Type of Galileo NMEA Sentences	
Write Command **AT+QGPSCFG="galileonmeatype"[,<galileonmeatype>]**	Response When there are two parameters: **OK**

	When the second parameter is omitted, query the current setting: **+QGPSCFG: "galileonmeatype",<galileonmeatype>** **OK** If error is related to ME functionality: **+CME ERROR: <errcode>**
Reference	

Parameter

<galileonmeatype>	Configure output type of Galileo NMEA sentences by ORed, and the configuration parameter will be automatically saved to NVRAM. The default value is 0. 0 Disable 1 GSV
<errcode>	Integer type, indicates the error code of the operation. If it is not 0, it is the type of error (Please refer to ***Chapter 5*** for details).

2.1.6. AT+QGPSCFG="beidounmeatype"[,<beidounmeatype>] Configure Output Type of BeiDou NMEA Sentences

AT+QGPSCFG="beidounmeatype"[,<beidounmeatype>] Configure Output Type of BeiDou NMEA Sentences	
Write Command **AT+QGPSCFG="beidounmeatype"[,<beidounmeatype>]**	Response When there are two parameters: **OK** When the second parameter is omitted, query the current setting: **+QGPSCFG: "beidounmeatype",<beidounmeatype>** **OK** If error is related to ME functionality: **+CME ERROR: <errcode>**
Reference	

Parameter

<beidounmeatype>	Configure output type of BeiDou NMEA sentences via ORed, and the configuration parameter will be automatically saved to NVRAM. The default value is 0. 0 Disable 1 GSA 2 GSV
<errcode>	Integer type, indicates the error code of the operation. If it is not 0, it is the type of error (Please refer to ***Chapter 5*** for details).

2.1.7. AT+QGPSCFG="gsvextnmeatype"[,<gsvextnmeatype>] Enable/Disable Output of GSVEXT NMEA Sentences

AT+QGPSCFG="gsvextnmeatype"[,<gsvextnmeatype>] Enable/Disable Output of GSVEXT NMEA Sentences	
Write Command **AT+QGPSCFG="gsvextnmeatype"[,<gsvextnmeatype>]**	Response When there are two parameters: **OK** When the second parameter is omitted, query the current setting: **+QGPSCFG: "gsvextnmeatype",<gsvextnmeatype>** **OK** If error is related to ME functionality: **+CME ERROR: <errcode>**
Reference	

Parameter

<gsvextnmeatype>	Enable/disable output of extended GSV information. Elevation/Azimuth/SNR (C/No) will be displayed as decimals when extended information is enabled, otherwise they will be displayed as integers. The configuration parameter will be automatically saved to NVRAM. The default value is 0. 0 Disable 1 Enable
<errcode>	Integer type, indicates the error code of the operation. If it is not 0, it is the type of error (Please refer to ***Chapter 5*** for details).

2.1.8. AT+QGPSCFG="gnssconfig"[,<gnssconfig>] Configure Supported GNSS Constellation

AT+QGPSCFG="gnssconfig"[,<gnssconfig>] Configure Supported GNSS Constellation	
Write Command **AT+QGPSCFG="gnssconfig"[,<gnssconfig>]**	Response When there are two parameters: **OK** When the second parameter is omitted, query the current setting: **+QGPSCFG: "gnssconfig",<gnssconfig>** **OK** If error is related to ME functionality: **+CME ERROR: <errcode>**
Reference	

Parameter

<gnssconfig>	Supported GNSS constellation. GPS is always on. 0 GLONASS off/ BeiDou off/ Galileo off 1 GLONASS on/ BeiDou on/ Galileo on 2 GLONASS on/ BeiDou on/ Galileo off 3 GLONASS on/ BeiDou off/ Galileo on 4 GLONASS on/ BeiDou off/ Galileo off 5 GLONASS off/ BeiDou on/ Galileo on 6 GLONASS off/ BeiDou off/ Galileo on
<errcode>	Integer type, indicates the error code of the operation. If it is not 0, it is the type of error (Please refer to ***Chapter 5*** for details).

2.1.9. AT+QGPSCFG="autogps"[,<autogps>] Enable/Disable GNSS to Run Automatically

AT+QGPSCFG="autogps"[,<autogps>] Enable/Disable GNSS to Run Automatically	
Write Command **AT+QGPSCFG="autogps"[,<autogps**	Response When there are two parameters:

>]	**OK** When the second parameter is omitted, query the current setting: **+QGPSCFG: "autogps",<autogps>** **OK** If error is related to ME functionality: **+CME ERROR: <errcode>**
Reference	

Parameter

<autogps>	Enable/disable GNSS to run automatically after the module is powered on. Configuration parameter will be automatically saved to NVRAM. The default value is 0. 0 Disable GNSS to run automatically 1 Enable GNSS to run automatically
<errcode>	Integer type, indicates the error code of the operation. If it is not 0, it is the type of error (Please refer to ***Chapter 5*** for details).

NOTE

The command is only valid in Stand-alone Solution.

2.2. AT+QGPSDEL Delete Assistance Data

Delete assistance data to operate cold start, hot start and warm start of GNSS. The command can only be executed when GNSS is turned off. After deleting the assistance data via this command, cold start of GNSS can be enforced via **AT+QGPS**. Hot/warm start can also be performed if the corresponding conditions are satisfied.

AT+QGPSDEL Delete Assistance Data	
Test Command **AT+QGPSDEL=?**	Response **+QGPSDEL: (0-3)** **OK**
Write Command **AT+QGPSDEL=<deletetype>**	Response **OK**

	If error is related to ME functionality: **+CME ERROR: <errcode>**
Reference	

Parameter

<deletetype>	Delete data types of GNSS 0 Delete all assistance data. Enforce cold start after starting GNSS. 1 Do not delete any data. Perform hot start if the conditions are permitted after starting GNSS. 2 Delete some related data. Perform warm start if the conditions are permitted after starting GNSS.
<errcode>	Integer type, indicates the error code of the operation. If it is not 0, it is the type of error (Please refer to the ***Chapter 5*** for details).

2.3. AT+QGPS Turn on GNSS

The command is used to turn on GNSS function. Currently **<gnssmode>** only supports turning on GNSS in Stand-alone Solution. When **<fixcount>** is 0, GNSS will fix position continuously, and it can be turned off via **AT+QGPSEND**. When **<fixcount>** is non-zero and reaches the specified value, GNSS will be turned off automatically.

AT+QGPS Turn on GNSS	
Test Command **AT+QGPS=?**	Response **+QGPS: (1-4),(1-255),(0-1000),(0-1000),(1-65535)** **OK**
Read Current GNSS State **AT+QGPS?**	Response **+QGPS: <gnssstate>** **OK**
Write Command **AT+QGPS=<gnssmode>[,<fixmaxtime>[,<fixmaxdist>[,<fixcount>[,<fixrate>]]]]**	Response **OK** If error is related to ME functionality: **+CME ERROR: <errcode>**
Reference	

Parameter

<gnssstate>	GNSS state 0 GNSS off 1 GNSS on
<gnssmode>	GNSS working mode 1 Stand-alone 2 MS-based 3 MS-assisted 4 Speed-optimal
<fixmaxtime>	The maximum positioning time (unit: s), which indicates the response time of GNSS receiver while measuring the GNSS pseudo range, and the upper time limit of GNSS satellite searching. It also includes the time for demodulating the ephemeris data and calculating the position. 1-30-255 Maximum positioning time
<fixmaxdist>	Accuracy threshold of positioning, unit: m. 1-50-1000
<fixcount>	Number of attempts for positioning 0–1000 0 indicates continuous positioning. Non-zero values indicate the actual number of attempts for positioning.
<fixrate>	The interval time between the first and second time positioning, unit: s. 1–65535
<errcode>	Integer type, indicates the error code of the operation. If it is not 0, it is the type of error (Please refer to ***Chapter 5*** for details).

2.4. AT+QGPSEND Turn off GNSS

When GNSS is turned on and **<fixcount>** is 0, GNSS fixes position continuously. In this case, GNSS can be turned off compulsorily via **AT+QGPSEND**. When **<fixcount>** is non-zero, GNSS will be turned off automatically when the parameter reaches the specified value, and thus the command can be ignored.

AT+QGPSEND Turn off GNSS	
Test Command **AT+QGPSEND=?**	Response **OK**
Read Command **AT+QGPSEND?**	Response **OK**
Execution Command **AT+QGPSEND**	Response **OK** If error is related to ME functionality:

	+CME ERROR: <errcode>
Reference	

Parameter

<errcode>	Integer type, indicates the error code of the operation. If it is not 0, it is the type of error (Please refer to ***Chapter 5*** for details).

2.5. AT+QGPSLOC Acquire Positioning Information

Before executing the command, GNSS must be turned on via **AT+QGPS**. If it fails in position fix, **+CME ERROR: <errcode>** will be returned to indicate the corresponding situation.

AT+QGPSLOC Acquire Positioning Information	
Test Command **AT+QGPSLOC=?**	Response **+QGPSLOC:** **<UTC>,<latitude>,<longitude>,<hdop>,<altitude>,<fix>,<cog>,<spkm>,<spkn>,<date>,<nsat>** **OK**
Read Command **AT+QGPSLOC=<mode>**	Response **+QGPSLOC:** **<UTC>,<latitude>,<longitude>,<hdop>,<altitude>,<fix>,<cog>,<spkm>,<spkn>,<date>,<nsat>** **OK** If error is related to ME functionality: **+CME ERROR: <errcode>**
Reference	

Parameter

<mode>	Latitude and longitude display format 0: <latitude>,<longitude> format: ddmm.mmmm N/S,dddmm.mmmm E/W 1: <latitude>,<longitude> format: ddmm.mmmmmm N/S,dddmm.mmmmmm E/W 2: <latitude>,<longitude> format: (-)dd.ddddd,(-)ddd.ddddd
<UTC>	UTC time Format: hhmmss.sss (Quoted from GPGGA sentence).

<latitude>	Latitude Format: ddmm.mmmm N/S (Quoted from GPGGA sentence). dd 00-89 (degree) mm.mmmm 00.0000-59.9999 (minute) N/S North latitude/South latitude
<longitude>	Longitude Format: dddmm.mmmm E/W (Quoted from GPGGA sentence). ddd 000-179 (degree) mm.mmmm 00.0000-59.9999 (minute) E/W East longitude/West longitude
<hdop>	Horizontal precision: 0.5-99.9 (Quoted from GPGGA sentence).
<altitude>	The altitude of the antenna away from the sea level (unit: m), accurate to one decimal place (Quoted from GPGGA sentence)
<fix>	GNSS positioning mode (Quoted from GNGSA/GPGSA sentence). 2 2D positioning 3 3D positioning
<cog>	Course Over Ground based on true north. Format: ddd.mm (Quoted from GPVTG sentence). ddd 000-359 (degree) mm 00-59 (minute)
<spkm>	Speed over ground. Format: xxxx.x; unit: Km/h; accurate to one decimal place (Quoted from GPVTG sentence).
<spkn>	Speed over ground. Format: xxxx.x; unit: knots; accurate to one decimal place (Quoted from GPVTG sentence).
<date>	UTC time when fixing position. Format: ddmmyy (Quoted from GPRMC sentence).
<nsat>	Number of satellites, from 00 (The first 0 should be retained) to 12 (Quoted from GPGGA sentence).
<errcode>	Integer type, indicates the error code of the operation. If it is not 0, it is the type of error (Please refer to ***Chapter 5*** for details).

2.6. AT+QGPSGNMEA Acquire NMEA Sentences

Before using this command, GNSS must be turned on via **AT+QGPS**, and **<nmeasrc>** has to enabled via **AT+QGPSCFG="nmeasrc",1**.

If parameters **<gpsnmeatype>**, **<glonassnmeatype>**, **<galileonmeatype>** and **<beidounmeatype>** are all 0, the command can be used to acquire NMEA sentences. If the GNSS has already acquired sentences via this command after its activation, you can disable sentences output via **AT+QGPSCFG="gpsnmeatype"/"glonassnmeatype"/"galileonmeatype"/"beidounmeatype",0**.

Then the sentences obtained via **AT+QGPSGNMEA** are the last sentences.

AT+QGPSGNMEA Acquire NMEA Sentences	
Test Command **AT+QGPSGNMEA=?**	Response **+QGPSGNMEA:** **(“GGA”,“RMC”,“GSV”,“GSA”,“VTG”,“GNS”)** **OK**
Read Command **AT+QGPSGNMEA?**	Response **OK**
Query GGA Information **AT+QGPSGNMEA=“GGA”**	Response **+QGPSGNMEA: GGA sentence** **OK** If error is related to ME functionality: **+CME ERROR: <errcode>**
Query RMC Information **AT+QGPSGNMEA=“RMC”**	Response **+QGPSGNMEA: RMC sentence** **OK** If error is related to ME functionality: **+CME ERROR: <errcode>**
Query GSV Information **AT+QGPSGNMEA=“GSV”**	Response **+QGPSGNMEA: GSV sentence** **OK** If error is related to ME functionality: **+CME ERROR: <errcode>**
Query GSA Information **AT+QGPSGNMEA=“GSA”**	Response **+QGPSGNMEA: GSA sentence** **OK** If error is related to ME functionality: **+CME ERROR: <errcode>**
Query VTG Information **AT+QGPSGNMEA=“VTG”**	Response **+QGPSGNMEA: VTG sentence** **OK**

	If error is related to ME functionality: **+CME ERROR: <errcode>**
Query GNS Information **AT+QGPSGNMEA="GNS"**	Response **+QGPSGNMEA: GNS sentence** **OK** If error is related to ME functionality: **+CME ERROR: <errcode>**
Reference	

Parameter

<errcode>	Integer type, indicates the error code of the operation. If it is not 0, it is the type of error (Please refer to ***Chapter 5*** for details).

3 Examples

3.1. Turn on and off the GNSS

Default arguments are used in this example to turn on GNSS. After turning on GNSS, NMEA sentences will be output from "usbnmea" port by default; and GNSS can be turned off via **AT+QGPSEND**.

```
AT+QGPS=1                       //Turn on GNSS.
OK

//After turning on GNSS, NMEA sentences will be output from "usbnmea" port by default.

AT+QGPSLOC?                     //Obtain positioning information.
+QGPSLOC: 061951.0,3150.7223N,11711.9293E,0.7,62.2,2,0.0,0.0,0.0,110513,09

OK
AT+QGPSEND                      //Turn off GNSS.
OK
```

3.2. Application of GNSS <nmeasrc>

When GNSS is turned on and **<nmeasrc>** is enabled, NMEA sentences can be acquired directly via **AT+QGPSGNMEA**.

```
AT+QGPSCFG="nmeasrc",1          //Enable <nmeasrc> functionality.
OK
AT+QGPSGNMEA="GGA"              //Obtain GGA sentence.
+QGPSGNMEA: $GPGGA,103647.0,3150.721154,N,11711.925873,E,1,02,4.7,59.8,M,-2.0,M,,*77

OK
AT+QGPSCFG="nmeasrc",0          //Disable <nmeasrc> functionality.
OK
AT+QGPSGNMEA="GGA"              //Disable <nmeasrc> functionality, and thus GGA sentence
                                  cannot be obtained.
+CME ERROR: 507
```

4 Appendix A References

Table 1: Related Documents

SN	Document name	Remark
[1]	Quectel_EC25&EC21_AT_Commands_Manual	EC25&EC21 AT Commands Manual

Table 2: Terms and Abbreviations

Abbreviation	Description
BeiDou	BeiDou Navigation Satellite System
Galileo	Galileo Satellite Navigation System
GGA	Global Positioning System Fix Data
GLONASS	Global Navigation Satellite System Provided by Russia
GNS	Global Network Service
GNSS	Global Navigation Satellite System
GPS	Global Positioning System Provided by USA
GSA	GPS DOP and Active Satellites
GSV	Satellites in View
ME	Mobile Equipment
NMEA	National Marine Electronics Association
NVRAM	Non-Volatile Random Access Memory
RMC	Recommended Minimum Navigation Information
SNR	Signal Noise Ratio
UTC	Universal Time Code
VTG	Track Made Good and Ground Speed

5 Appendix B Summary of Error Codes

The **<errcode>** indicates an error related to GNSS operation. The details about **<errcode>** are described in the following table.

Table 3: Summary of Error Codes

<errcode>	Meaning
501	Invalid parameter(s)
502	Operation not supported
503	GNSS subsystem busy
504	Session is ongoing
505	Session not active
506	Operation timeout
507	Function not enabled
508	Time information error
512	Validity time is out of range
513	Internal resource error
514	GNSS locked
515	End by E911
516	Not fixed now
549	Unknown error