



# SIM7000 Series\_GNSS \_Application Note

LPWA Module

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# About Document

## Version History

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V1.00	2017.11.19	Ping.Zhang	First Release
V1.01	2020.07.28	Wenjie.Lai	All

## Scope

This document applies to the following products

Name	Type	Size(mm)	Comments
SIM7000E/C/A/G	Cat-M1(/NB1/EGPRS )	24*24	
SIM7000E-N SIM7000C-N	NB1	24*24	

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# 1 Introduction

## 1.1 Purpose of the document

Based on module AT command manual, this document will introduce GNSS application process.

Developers could understand and develop application quickly and efficiently based on this document.

## 1.2 Related documents

[1] SIM7000 Series\_AT Command Manual

## 1.3 Conventions and abbreviations

In this document, the GSM engines are referred to as following term:

- ME (Mobile Equipment);
- MS (Mobile Station);
- TA (Terminal Adapter);
- DCE (Data Communication Equipment) or facsimile DCE (FAX modem, FAX board);

In application, controlling device controls the GSM engine by sending AT Command via its serial interface. The controlling device at the other end of the serial line is referred to as following term:

- TE (Terminal Equipment);
- DTE (Data Terminal Equipment) or plainly "the application" which is running on an embedded system;

## 2 GNSS Function

### 2.1 GNSS

The full name of GNSS is the Global Navigation Satellite System, which refers to all satellite navigation systems, including global, regional and enhanced, such as GPS in the United States, Glonass in Russia, Galileo in Europe, and China. Beidou satellite navigation system, and related augmentation systems, such as WAAS (Wide Area Augmentation System) in the United States, EGNOS (European Geostationary Navigation Overlay System) in Europe, and MSAS (Multifunctional Transportation Satellite Augmentation System) in Japan, etc. Other satellite navigation systems to be built and later. The international GNSS system is a complex system with multiple systems, multiple layers and multiple modes.

### 2.2 XTRA

XTRA (eXTended Receiver Assistance) is a GPS enhancement function provided by Qualcomm, similar to the AGPS function, Before GPS finds satellites, use the network to download ephemeris data, and then use the data to quickly find available satellites, thereby increasing the speed of searching for stars.

XTRA function settings:

- For the setting of XTRA and AGPS, NV4627, 4628 and 4631 correspond to the function switch of XTRA, the setting of download interval and the switch when downloading.
- XTRA can predict ephemeris and almanac within 7 days. The information predicted by XTRA is very accurate within 24 hours, but its effectiveness decreases over time.
- Users can update or download the latest XTRA data through the Internet. Qualcomm provides a free download from the server.
- The XTRA file size is very small (about tens of KB, which saves more data than AGPS) and the performance (TTFF, etc.) is close to AGPS, but better than standalone.

## 3 AT Commands for GNSS

Command	Description
<b>AT+CGNSPWR</b>	GNSS Power Control
<b>AT+CGNSINF</b>	GNSS Navigation Information Parsed From NMEA Sentences
<b>AT+CGNSURC</b>	GNSS Navigation URC Report
<b>AT+CGNSPORT</b>	GNSS NMEA Out Port Set
<b>AT+CGNSCOLD</b>	GNSS Cold Start
<b>AT+CGNSWARM</b>	GNSS Warm Start
<b>AT+CGNSHOT</b>	GNSS Hot Start
<b>AT+CGNSMOD</b>	GNSS Work Mode Set
<b>AT+CGNSCFG</b>	GNSS NMEA Out Configure
<b>AT+CGNSTST</b>	GNSS NMEA Data Out Put To AT Port
<b>AT+CGNSXTRA</b>	GNSS XTRA Function Open
<b>AT+CGNSCPY</b>	GNSS XTRA File Copy
<b>AT+CGNSRTMS</b>	GNSS NMEA out frequency configure
<b>AT+CGNSHOR</b>	Configure Positioning Desired Accuracy
<b>AT+CGNSUTIPR</b>	Configure Baud Rate When NMEA Output From UART3
<b>AT+CGNSNMEA</b>	Configure NMEA output sentences
<b>AT+CGTP</b>	IZAT GNSS Configure

For detail information, please refer to "SIM7000 Series\_AT Command Manual".

## 4 GNSS Examples

In default mode only power on(AT+CGNSPWR) GNSS through USB's AT Port, USB's NMEA port will output NMEA data.

### 4.1 Get GNSS information through UART

```

AT+CGNSPWR=1 //Turn on GNSS power(UART port)
OK
AT+CGNSINF //Read GNSS navigation information
+CGNSINF:
1,1,20171103022632.000,31.222067,121.354368
,34.700,0.00,0.0,1,,1.1,1.4,0.9,,21,6,,45,,
OK

```

### 4.2 Get NMEA data through AT port

```

AT+CGNSPWR=1 //Turn on GNSS power(UART or USB AT port)
OK
AT+CGNSTST=1,1 //Output 1 package GNSS NMEA data to AT port
OK
$GNGGA,,,,,0,,,,,,*78
$GNRMC,V,,,,,,,N*4D
$GLGSV,2,1,07,66,30,216,,86,07,130,,65,82,336,
,88,54,350,*64
$GLGSV,2,2,07,87,58,098,,81,08,323,,72,33,028,
*5D //NMEA data
$GPGSV,2,1,08,06,54,050,42,09,32,056,42,13,05
,189,40,17,25,147,45*7A
$GPGSV,2,2,08,19,46,147,44,02,53,333,,12,24,2
67,,25,10,302,*7F
$BDGSV,2,1,06,06,58,192,,08,69,052,,09,32,202,
,10,03,212,*67

```

```
$BDGSV,2,2,06,12,48,320,,13,61,337,*62
$GNVTG,,T,,M,,N,,K,N*32
$GPGSA,A,1,,,,,,,,,,,,,*1E
$GLGSA,A,1,,,,,,,,,,,,,*02
$BDGSA,A,1,,,,,,,,,,,,,*0F
```

### 4.3 Configure GNSS through UART and output NMEA data to USB's NMEA port

In this way, NMEA data will out to USB's NMEA port, please open NMEA port to receive NMEA data.

```
AT+CGNSCFG=1 //Configure GNSS out to USB NMEA port before
                GNSS power on
OK
AT+CGNSPWR=1 //Turn on GNSS power(UART port)
OK
$GLGSV,2,1,07,66,33,217,20,86,05,132,34,65,79
,347,23,87,56,105,27*6A
$GLGSV,2,2,07,72,30,028,18,88,56,351,,81,11,3
24,*5F
$GPGSV,7,1,25,02,55,336,32,05,45,257,34,06,53
,054,42,07,00,099,40*7A
$GPGSV,7,2,25,09,30,053,40,12,23,264,25,13,07
,189,36,17,22,147,46*70
$GPGSV,7,3,25,19,45,149,44,20,00,244,,23,05,0
37,,25,10,299,*7B
$GPGSV,7,4,25,33,,,35,34,,,34,35,,,46,36,,,35*7C
$GPGSV,7,5,25,38,,,34,39,,,35,40,,,35,41,,,34*7C
$GPGSV,7,6,25,42,,,42,46,,,35,48,,,35,49,,,35*7A
$GPGSV,7,7,25,50,,,35*7D //NMEA data output from USB's NMEA port
$BDGSV,3,1,11,01,46,146,45,08,69,056,38,17,,,2
9,02,36,237,*58
$BDGSV,3,2,11,03,51,199,,04,33,122,,06,59,194,
,09,33,203,*64
$BDGSV,3,3,11,10,02,212,,12,50,319,,13,62,337,
*56
$GNGGA,023851.00,3113.330830,N,12121.2648
88,E,1,08,0.9,33.8,M,9.0,M,,*7D
$GNVTG,0.0,T,4.6,M,0.0,N,0.0,K,A*3F
$GNRMC,023851.00,A,3113.330830,N,12121.26
```

```
4888,E,0.0,0.0,031117,4.6,W,A*31
$GPGSA,A,2,02,05,06,09,12,13,17,19,,,,,1.2,0.9,
0.8*36
$GLGSA,A,2,86,87,,,,,,,,,1.2,0.9,0.8*2C
$BDGSA,A,2,01,,,,,,,,,1.2,0.9,0.8*21
```

## 4.4 Configure GNSS output NMEA data to UART3 port

In this way, NMEA data will out to UART3 port, please open UART3 port to receive NMEA data.

```
AT+CGNSCFG=2 //Configure GNSS out to UART3 NMEA port
before GNSS power on
OK
AT+CGNSPWR=1 //Turn on GNSS power(UART port)
OK
$GLGSV,2,1,07,66,33,217,20,86,05,132,34,65,79
,347,23,87,56,105,27*6A
$GLGSV,2,2,07,72,30,028,18,88,56,351,,81,11,3
24,*5F
$GPGSV,7,1,25,02,55,336,32,05,45,257,34,06,53
,054,42,07,00,099,40*7A
$GPGSV,7,2,25,09,30,053,40,12,23,264,25,13,07
,189,36,17,22,147,46*70
$GPGSV,7,3,25,19,45,149,44,20,00,244,,23,05,0
37,,25,10,299,*7B
$GPGSV,7,4,25,33,,,35,34,,,34,35,,,46,36,,,35*7C
$GPGSV,7,5,25,38,,,34,39,,,35,40,,,35,41,,,34*7C
$GPGSV,7,6,25,42,,,42,46,,,35,48,,,35,49,,,35*7A
$GPGSV,7,7,25,50,,,35*7D //NMEA data output from UART3 port
$BDGSV,3,1,11,01,46,146,45,08,69,056,38,17,,,2
9,02,36,237,*58
$BDGSV,3,2,11,03,51,199,,04,33,122,,06,59,194,
,09,33,203,*64
$BDGSV,3,3,11,10,02,212,,12,50,319,,13,62,337,
*56
$GNGGA,023851.00,3113.330830,N,12121.2648
88,E,1,08,0.9,33.8,M,9.0,M,,*7D
$GNVTG,0.0,T,4.6,M,0.0,N,0.0,K,A*3F
$GNRMC,023851.00,A,3113.330830,N,12121.26
4888,E,0.0,0.0,031117,4.6,W,A*31
$GPGSA,A,2,02,05,06,09,12,13,17,19,,,,,1.2,0.9,
0.8*36
```

```
$GLGSA,A,2,86,87,,,,,,,,,1.2,0.9,0.8*2C  
$BDGSA,A,2,01,,,,,,,,,1.2,0.9,0.8*21
```

## 4.5 Auto report GNSS information every 1s

```
AT+CGNSPWR=1 //Turn on GNSS power  
OK  
AT+CGNSURC=1 //Auto output GNSS information every 1s  
OK  
+UGNSINF:  
1,1,20171103024050.000,31.222176,121.354393  
,31.000,0.00,99.5,1,,0.9,1.3,0.9,,20,8,,48,,  
  
+UGNSINF:  
1,1,20171103024051.000,31.222176,121.354395  
,31.100,0.00,99.5,1,,0.9,1.3,0.9,,20,8,,48,,  
  
+UGNSINF:  
1,1,20171103024052.000,31.222176,121.354396  
,31.100,0.00,99.5,1,,0.9,1.3,0.9,,20,8,,48,,
```

## 4.6 Close USB's NMEA port when start GNSS through USB's AT port

```
AT+CGNSPORT=4 //Turn off GNSS NMEA output to USB's NMEA  
port  
OK  
... //Reboot  
AT+CGNSPWR=1 //Turn on GNSS (USB's AT port)  
OK
```

In this way USB's NMEA port will not output NMEA data, but CGNSINF and CGNSTST can be used.

## 4.7 Configure the GNSS fix mode

```

AT+CGNSMOD=1,0,1,0 //Configure GNSS mod GPS+BD
OK
... //Reboot
AT+CGNSPWR=1 //Turn on GNSS (USB's AT port)
OK

$GNGGA,032201.00,3113.331505,N,12121.2636
72,E,1,11,0.8,42.5,M,9.0,M,,*76
$GNVTG,0.0,T,4.6,M,0.0,N,0.0,K,A*3F
$GNRMC,032201.00,A,3113.331505,N,12121.26
3672,E,0.0,0.0,031117,4.6,W,A*38
$GPGSA,A,2,02,05,06,07,09,12,13,17,19,20,30,,
1.1,0.8,0.8*32
$BDGSA,A,2,,,,,,,,,,,,,1.1,0.8,0.8*22
$GPGSV,6,1,22,02,66,009,36,05,56,288,33,06,45
,085,44,07,07,082,48*78
$GPGSV,6,2,22,09,17,042,39,12,13,246,32,13,26
,187,39,15,01,208,34*74
$GPGSV,6,3,22,17,04,153,46,19,24,156,42,20,12
,258,26,25,08,281,27*7A
$GPGSV,6,4,22,29,,,33,30,07,112,47,33,,,35,38,,,
35*4E
$GPGSV,6,5,22,39,,,35,40,,,35,41,,,35,42,,,34*76 //On NMEA port
$GPGSV,6,6,22,46,,,35,51,,,35*7F
$BDGSV,3,1,12,01,46,147,,02,36,237,,03,50,199,
,04,33,122,*6B
$BDGSV,3,2,12,05,14,255,,06,67,213,,08,73,087,
,09,39,215,*69
$BDGSV,3,3,12,11,12,320,,12,66,302,,13,68,336,
,15,55,331,*64
$GNGGA,032202.00,3113.331494,N,12121.2636
22,E,1,11,0.8,42.0,M,9.0,M,,*7C
$GNVTG,0.0,T,4.6,M,0.0,N,0.0,K,A*3F
$GNRMC,032202.00,A,3113.331494,N,12121.26
3622,E,0.0,0.0,031117,4.6,W,A*37
$GPGSA,A,2,02,05,06,07,09,12,13,17,19,20,30,,
1.1,0.8,0.8*32
$BDGSA,A,2,,,,,,,,,,,,,1.1,0.8,0.8*22

```

## 4.8 XTRA function mode

It provides enhanced standalone performance, and eliminates the need to demodulate the GPS signal for ephemeris, almanac, iono, UTC, or health.

Normally requires -144 dBm or stronger for all SVs in view.

TTF can be reduced by 18 to 30 sec (or more in harsh signal environments)

```

AT+SAPBR=3,1,"APN","CMNET"           //NTP sync time to local
OK
AT+SAPBR=1,1
OK
AT+CNTPCID=1
OK
AT+CNTP="ntp1.aliyun.com",32,1
OK
AT+CNTP
OK

+CNTP: 1,"2018/01/09,10:28:59"
AT+CNACT=1,"CMNET"                   //Download XTRA file
OK

+APP PDP: ACTIVE
AT+HTTPTOFSRL?                         //Query download status.
+HTTPTOFSRL: 0,0,0                     //No files download.
                                         //XTRA file server:
AT+HTTPTOFS="http://xtrapath1.izatcloud.net/  1. xtrapath1.izatcloud.net
xtra3grc.bin","/customer/xtra3grc.bin"      2. xtrapath2.izatcloud.net
                                         3. xtrapath3.izatcloud.net
OK
AT+HTTPTOFSRL?                         //Query download status
+HTTPTOFSRL: 1,28691,30575             //Download status and length. Total length is
                                         30575, has download length is 28691.
+HTTPTOFS: 200,28919                  XTRA file xtra3grc.bin period of validity is 3 days.
                                         The path of XTRA file save must be /customer/.
AT+HTTPTOFSRL?                         //Query download status.
+HTTPTOFSRL: 0,30575,30575            //Download completely.
AT+CGNSCPY                              //Copy XTRA file
+CGNSCPY: 0

```

```
OK
AT+CGNSXTRA=1 //Open XTRA function
OK
AT+CGNSCOLD //Cold start GNSS
OK
//Aid XTRA file success
+CGNSXTRA: 0
```

## 4.9 IZAT GNSS configure

Before all IZAT related operations, we should ensure network is registered.

```
AT+CGTP=1 //Configure IZAT NV parameter
OK
AT+CGTP? //Query IZAT NV set
+CGTP:
1,1,gtp1.izatcloud.net,443,gtp2.izatcloud.net,4
43
OK
AT+CGTP //Start IZAT location
OK
+GTPCELL:
32.943878,-117.214508,2019-08-23,17:28:03,133
0.200928
```