SIM7500_SIM7600 Series_ GNSS_Application Note

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About Document

Version History

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V2.00	2020.8.6	Yunchun He	Update the format
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Scope

This document applies to SIM7500 series and SIM7600 series.

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Contents

About Document 3

Version History 3
Scope 3

Contents 4

1 Introduction 6

1.1 Purpose of the document 6
1.2 Related documents 6
1.3 Conventions and abbreviations 6

2 GNSS Introduction 7

2.1 Overview 7
2.2 GNSS Mode Introduction 7
2.3 gpsoneXTRA Introduction 8
2.3.1 gpsOneXTRA assistance 8
2.3.2 gpsOneXTRA assistance data file content 8
2.3.3 gpsOneXTRA assistance data delivery 8
2.3.4 gpsOneXTRA assistance file source and policy 9

3 A-GNSS Quick Start – Setting 10

3.1 Set A-GNSS Server Address 10
3.2 Set Certificate 10

4 Start GNSS 11

4.1 Start GNSS Standalone Mode 11
4.2 Start A-GNSS Mode 11
4.2.1 AGNSS server which does not support certificate 11
4.2.2 AGNSS server which supports certificate 12

5 Get GNSS Position Information 14

5.1 Standalone Mode 14
5.2 A-GNSS Mode 14

6 Qualcomm gpsoneXTRA Mode 15

6.1 gpsoneXTRA Execute Flow 15
6.2 gpsoneXTRA Setting 15
6.3 gpsoneXTRA AT Flow 16
6.4 Vendor Propositional XTRA Execute Flow 16

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7 GLONASS,BEIDOU,GALILEO QZSS..... 18

8 Q&A..... 19

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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] SIM7500_SIM7600 Series_AT Command Manual

1.3 Conventions and abbreviations

Abbreviation	Description
GNSS	Global Navigation Satellite System

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2 GNSS Introduction

2.1 Overview

Customer can get useful information about SIM7500/SIM7600 GNSS/A-GNSS functions quickly through this document.

GNSS function could be easily realized by AT command interface provided in SIM7500/SIM7600 module via USB interface.

SIM7500/SIM7600 GNSS features:

- Support GPS, GLONASS, BEIDOU, GALILEO and QZSS satellite system.
- Support standalone mode, MS-based mode,MS-assisted and XTRA mode
- Support cold start and hot start.
- Support a subset of the NMEA-0183 standard.
- Support NMEA sentences output in NMEA port port.
- A-GNSS supports UP (user plane) and CP (control plane) method.
- MS-assisted mode supports single fixed; MS-based mode supports seriate fixed.
- Support certificate if necessary.
- Supporting GNSS starts automatically when module powers on, it supports standalone mode only.

2.2 GNSS Mode Introduction

In MS-assisted mode, when a request for position location is issued, available network information is provided to the location server and assistance is requested from the location server. The location server sends the assistance information to the handset. The handset/mobile unit measures the GNSS observables and provides the GNSS measurements along with available network data (that is appropriate for the given air interface technology) to the location server. The location server then calculates the position location and returns results to the requesting entity.

In MS-based mode, the assistant data provided by the location server encompasses not only the information required to assist the handset in measuring the satellite signals, but also the information required to calculate the handset's position. Therefore, rather than providing the GNSS measurements and available network data back to the location server, the mobile calculates the location on the handset and passes the result to the requesting entity.

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In standalone mode, the handset demodulates the data directly from the GNSS satellites. This mode has some reduced cold-start sensitivity, and a longer time to first fix as compared to the assisted modes. However, it requires no server interaction and works out of network coverage. Default use GPS, GLONASS, BEIDOU, can use AT+CGNSSMODE set.

MS-assisted	Server	Module
Location server sends aiding data that is valid for the current fix	Send aiding data	
Module sends code phases		Code phases
Server calculates position	Calculate position	
MS-assisted	**Server**	**Module**
Location server sends aiding data that is valid for the current fix	Send aiding data	
Module calculates position		Calculate position
MS-assisted	**Server**	**Module**
Module demodulates data from GNSS satellite		Demodulates GNSS and GLONASS satellite data
Module calculates position		Calculate position

Table 1 GNSS mode of operation

2.3 gpsoneXTRA Introduction

2.3.1 gpsOneXTRA assistance

It provides enhanced standalone performance, and eliminates the need to demodulate the GNSS signal for ephemeris, almanac, iono, UTC, or health.
Normally requires -144 dBm or stronger for all SVs in view
TTFF can be reduced by 18 to 30 sec (or more in harsh signal environments)

2.3.2 gpsOneXTRA assistance data file content

Current assistance data (ephemeris, almanac, iono, UTC, health)
Predict satellite coordinates and clock biases valid for up to 7 days

2.3.3 gpsOneXTRA assistance data delivery

Propriety binary file (approximately 40 kB, depending on number of active satellites)
File transfer via HTTP
Time assistance via SNTP/HTP

2.3.4 gpsOneXTRA assistance file source and policy

Qualcomm generated the assistance file and Qualcomm partner hosted.

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3 A-GNSS Quick Start – Setting

The purpose of this section is to help to get start with A-GNSS setting.

3.1 Set A-GNSS Server Address

UP method is through PS region, so customer must set A-GNSS server and PDP context profile. The server address is provided by local carrier.

- Set the PDP context profile method:

```
AT+CGSOCKCONT=1,“IP”,“myAPN”
```

The first parameter is the profile number of CGSOCKCONT, and “IP” is the protocol stack type that MMS will use. “myAPN” is the ASN that will be used for PDP activation, this parameter should be set to the real APN string set by the carrier. Following is the PDP context profile and server URL setting example:

- Set the A-GNSS server method:

```
AT+CGPSURL=“111.222.333.444:8888”
```

3.2 Set Certificate

If the GNSS server requires certificate, customer must select security mode, and input the certificate. The certificate must be imported into EFS by PC tool.

- Select the transport security:

```
AT+CGPSSSL=1
```

The certificate is provided by local carrier.

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4 Start GNSS

4.1 Start GNSS Standalone Mode

Three methods can start GNSS standalone mode:

AT+CGPS=1,1 (or AT+CGPS=1)
AT+CGPSCOLD
AT+CGPSHOT

These commands must be executed after GNSS engine switched off.

NOTE

For SIM7600E-H-M2/SIM7600SA-H-M2/SIM7600A-H-M2, GNSS started should be decided by the physical switch of GNSS flight mode in the module firstly. Close the switch, GNSS will be started automatically, then you can open or close GNSS by AT command, otherwise, GNSS could not be started in any way.

4.2 Start A-GNSS Mode

When using MS-based mode, mode will transform to standalone mode automatically after getting the ephemeris information from the server. MS-assisted mode is single fixed; MS-based mode is serial fixed.

4.2.1 AGNSS server which does not support certificate

MS-assisted	no certificate
Set APN	AT+CGSOCKCONT=1,"IP","*myAPN*"
Set server address	AT+CGPSURL="111.222.333.444:8888"
Set security mode	AT+CGPSSSL=0
Start GNSS	AT+CGPS=1,3
AT port response	+CAGPSINFO:3122256517,12135328531,135,15052009,012749.0
NMEA port response	$GPGSV,3,1,10,02,22,135,26,08,11,045,23,09,11,180,22,1

	0,33,056,22*71 $GPGSV,3,2,10,15,78,281,44,21,22,315,41,24,67,315,47,26,45,225,30*78 $GPGSV,3,3,10,27,33,157,,29,22,247,46*76 ……
MS-based mode	no certificate
Set APN	AT+CGSOCKCONT=1,”IP”,”myAPN”
Set server address	AT+CGPSURL=”111.222.333.444:8888”
Set security mode	AT+CGPSSSL=0
Start GNSS	AT+CGPS=1,2
AT command(get fixed position)	AT+CGPSINFO
AT port response	+CGPSINFO: 3113.393766,N,12121.176625,E,061108,075358.0,19.5,0
NMEA port response	$GPGSV,3,1,11,02,19,142,20,08,16,045,21,09,19,180,22,10,41,063,29*7B $GPGSV,3,2,11,15,77,317,46,18,09,286,31,21,28,315,43,24,73,310,47*7F $GPGSV,3,3,11,26,53,241,31,27,39,158,20,29,30,250,41*45 $GPGGA,013925.0,3113.340070,N,12121.176208,E,1,08,2.9,164.0,M,,,,*08 $GPRMC,013925.0,A,3113.340070,N,12121.176208,E,,,150509,,,A*61 $GPGSA,A,3,08,10,15,18,21,24,26,29,,,,,4.4,2.9,3.3*37 $GPVTG,,T,,M,0.0,N,0.0,K*4E ……

4.2.2 AGNSS server which supports certificate

MS-assisted	use certificate
Import certificate	By PC tool
Set APN	AT+CGSOCKCONT=1,”IP”,”myAPN”
Set server address	AT+CGPSURL=”111.222.333.444:8888”
Set security mode	AT+CGPSSSL=1
Start GNSS	AT+CGPS=1,3
AT port response	+CAGPSINFO:3122256517,12135328531,135,15052009,012749.0
NMEA port response	$GPGSV,3,1,10,02,22,135,26,08,11,045,23,09,11,180,22,10,33,056,22*71 $GPGSV,3,2,10,15,78,281,44,21,22,315,41,24,67,315,47,26,45,225,30*78

	$GPGSV,3,3,10,27,33,157,,29,22,247,46*76 ……
MS-based mode	use certificate
Import certificate	By PC tool
Set APN	AT+CGSOCKCONT=1,”IP”,”myAPN”
Set server address	AT+CGPSURL=”111.222.333.444:8888”
Set security mode	AT+CGPSSSL=1
Start GNSS	AT+CGPS=1,2
AT command(get fixed position)	AT+CGPSINFO
AT port response	+CGPSINFO: 3113.393766,N,12121.176625,E,061108,075358.0,19.5,0
NMEA port response	$GPGSV,3,1,11,02,19,142,20,08,16,045,21,09,19,180,22,10,41,063,29*7B $GPGSV,3,2,11,15,77,317,46,18,09,286,31,21,28,315,43,24,73,310,47*7F $GPGSV,3,3,11,26,53,241,31,27,39,158,20,29,30,250,41*45 $GPGGA,013925.0,3113.340070,N,12121.176208,E,1,08,2.9,164.0,M,,,,*08 $GPRMC,013925.0,A,3113.340070,N,12121.176208,E,,,150509,,,A*61 $GPGSA,A,3,08,10,15,18,21,24,26,29,,,,,4.4,2.9,3.3*37 $GPVTG,,T,,M,0.0,N,0.0,K*4E ……

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5 Get GNSS Position Information

5.1 Standalone Mode

Command AT+CGPSINFO will return fixed position; also it can report GNSS position string automatically by configured with AT command.

The report format:

```
+CGPSINFO: 3113.393766,N,12121.176625,E,061108,075358.0,19.5,0
```

5.2 A-GNSS Mode

If MS-based mode is enabled, fixed position information is like standalone mode.

If MS-assisted mode is enabled, GNSS position string will report automatically.
The report format is as following:

```
+CAGPSINFO:3122256517,12135328531,135,15052009,012749.0
```

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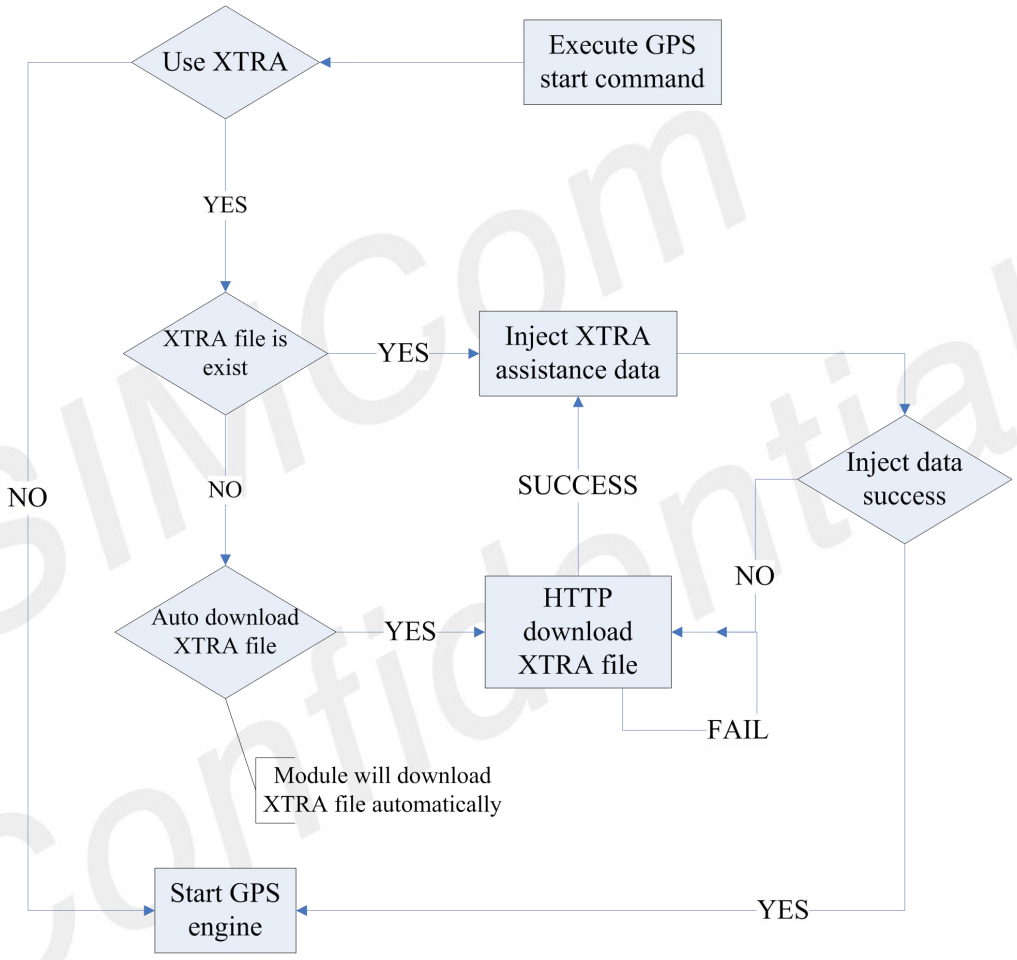
6 Qualcomm gpsoneXTRA Mode

6.1 gpsoneXTRA Execute Flow



6.2 gpsoneXTRA Setting

（1） Make sure the APN is correct (AT+CGSOCKCONT), gpsoneXTRA downloads the assistance file from server by HTTP protocol.

（2） Module time (AT+CCLK) must be synchronized by HTP protocol, and local time zone must be set.

（3） Enable the XTRA function (AT+CGPSXE=1)

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6.3 gpsoneXTRA AT Flow

（1） Enable the gpsoneXTRA function. Execute AT+CGPSXE=1, then restart the module. (This function will take effect after module restart).
（2） Setting APN. Execute AT+CGSOCKCONT=1,”IP”,”myAPN”.
（3） Download the XTRA assistance file form HTTP server. Execute AT+CGPSXD=0. Module will report +CGPSXD: 0 if download successfully.
（4） Set HTP server AT+CHTPSERV=”ADD”,”www.google.com”,80,1
（5） Set local time zone by AT+CCLK="11/09/27,09:27:31+32" (This time is maybe imprecise, but time zone must set local value. +32 is the Beijing time zone)
（6） Synchronize time by command AT+CHTPUPDATE
（7） Start GNSS AT+CGPSCOLD

6.4 Vendor Propositional XTRA Execute Flow

（1） Time synchronizes: Consumer must synchronize the module time before using XTRA. Time zone must be set by AT+CCLK. If consumers do not want to use HTP to synchronize the time, time also can be set by AT+CCLK. But the time must be accurate.
（2） Download the XTRA file by AT command (AT+CGPSXD). The XTRA assistance file can be used for about 7 days. But suggest customer updates this file daily.
（3） Start the GNSS.

Example:

```
AT+CGPSXE=1
OK
AT+CGPSXD=0
OK

+CGPSXD: 0
AT+CGPSCOLD
OK

AT+CHTPSERV="ADD","www.baidu.com",80,1
OK
AT+CHTPUPDATE
OK

+CHTPUPDATE: 0
AT+CCLK?
+CCLK: "20/06/07,03:16:07"

OK
```

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```
AT+CGPSINFO
+CGPSINFO: 3122256517,12135328531,135,15052009,012749.0
OK
```

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7 GLONASS,BEIDOU,GALILEO QZSS

SIM7500/SIM7600 support GLONASS, BEIDOU,Galileo and QZSS, its assistant for TTFF.
Defalut open GPS+GLONASS+BEIDOU, you can use AT Command set it.

AT+CGNSSMODE

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8 Q&A

Some answers to frequently asked questions may be helpful for using GNSS.

Why GNSS does not start?

Please execute AT+CGPSCOLD, AT+CGPSHOT or AT+CGPS=1 to start GNSS. If customers want to start GNSS automatically when powered on the module, they can set AT+CGPSAUTO=1.

Why can we not get NMEA sentence?

1. Make sure GNSS is running.
2. Check current opened port is NMEA port.
3. Check AT+CGPSNMEA setting is correct.

Why A-GNSS does not get the fixed position?

1. Make sure all the setting is correct. Re. A-GNSS quick start setting.
2. Make sure AGNSS server address is available.
3. Is module camp on WCDMA or GSM network?

Why standalone mode cannot fix?

1. Is GNSS antenna connected normally?
2. Is there existing GNSS signal? If indoor or no GNSS signal, standalone mode cannot fix.

How to get fixed position information?

1. AT+CGPSINFO command should get position information after fixed. It isURC information.
2. Parse NMEA sentence $GPGGA or $GPRMC.
3. If use MS-assisted, fixed position information will report automatically after it is fixed.

Why module cannot download XTRA file by HTTP?

1. Make sure the APN setting correct.
2. Make sure the module camp on the PS, i.e. AT+CGREG? Return 0,1

How to disable or enable the XTRA function?

1. Setting by AT+CGPSXE=<on/off>, the parameter 0 means disable and 1 means enable. Module must be restarted after setting.

Can XTRA enhance the TFF?

1. Yes, TTF can be reduced by 18 to 30 sec (or more in harsh signal environments) for standalone cold start.

Which setting is necessary for XTRA?

1. Time synchronization.
2. Download XTRA file by HTTP.

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If http is used for XTRA download, can it be used for another http connection?

1. No, HTTP is only allowed for one connection.

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