

How To Setup GPS on GTM382 Configuration Manual

About this document

Overview and Purpose

This document explains how to use the different variants of GPS on Option GTM382 module, and provides help to setup S-GPS, A-GPS using SUPL servers and gpsOneXTRA. It also explains which parameters are needed to setup the customization process of a module in production.

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Version History

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Apr 17, 2009	V001int	D. Callaert	F. Bilsen J. Boeckx	Review
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July 07, 2009	V003int	J.Boeckx		Added at_ogclk information for assisted GPS
July 07, 2009	V003ext	J.Boeckx	F.Bilsen	Added changes for CCLK and OGCLK.

References

Ref	Document
[1]	PIC-SYE-TN-GPS AT Command Reference (external use)-v0xxdraft.pdf

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1 INTRODUCTION

The Option GTM382 embedded module provides connection to the internet using GPRS/EGPRS/UMTS/HSDPA/HSUPA technology. It also provides GPS functionality.

In order to configure the GPS functionality, Option proprietary AT commands have been developed for testing purpose. More information can be found in ref [1]. When using the device in a production environment, certain GPS parameters are needed to setup the customization process of the module.

The most important frequency used for GPS is located in the L1 band (1575.42 MHz).

This document will explain how to setup/use the following different possibilities for GPS: it will explain setup of S-GPS (standalone GPS), MS-Based A-GPS (Assisted GPS using a SUPL server) and gpsOneXTRA, the GPS service using a standard Qualcomm service.

If your device is not yet installed and/or GPS functionality is not yet enabled, the chapter 2 will explain how to do this.

1.1 Supported GPS Modes

The following modes of operation are supported by the device:

- Standalone GPS
- UE-Assisted GPS
- UE-Based GPS
- gpsOneXTRA

The following protocols are supported:

- OMA SUPL 1.0 UP
- GSM CP (Rel 5)
- UMTS CP (Rel 5)

1.2 GPS and Rx Diversity Functionality

The receiver diversity antenna signal (RxDiv) and GPS cannot be used simultaneously as they are using the same physical antenna connection point. Therefore, using GPS on the GTM module will result in deactivation of the RxDiv signal.

The GTM module can however switch between both modes, meaning when GPS is switched on, the Rx Diversity capability is switched off and vice versa. Re-enabling Rx Diversity after switching off GPS can however take a few seconds.

The secondary antenna, used for the reception of RxDiv and GPS signalling, must be designed to support the both GPS and RxDiv band frequencies.

2 MODULE INSTALLATION AND GPS CONFIGURATION

This section will explain the steps on how to configure the GTM382 module so the GPS connections are setup correctly and the device drivers are installed.

2.1 Prerequisites

It is assumed that following conditions are fulfilled:

- The GTM382 module is configured and working for normal data connections (2G/3G), meaning all necessary drivers for the data connections are correctly installed and working
- A driver package (5.x.y.z) is loaded onto your system
- On a GTM382 module, v1.x firmware 1.9.0.0 (or higher) or v2.x firmware 2.6.0.0 (or higher) is recommended.

You have a working GPS antenna that you have connected to the module. For active GPS antennas, the power needs to be supplied externally. Perform initial tests outside, in a clear area that has very good reception of the GPS satellite signals.

2.2 Hardware setup

Make sure your module is connected to your PC as described in the Option Quick Start Guide that was delivered with the module. Make sure you have tested your setup and that it's working.

Connect a GPS antenna to the auxiliary antenna connector of the module, which is marked by the letter "A" on the PCB (shown in the circle in Figure 2-1).

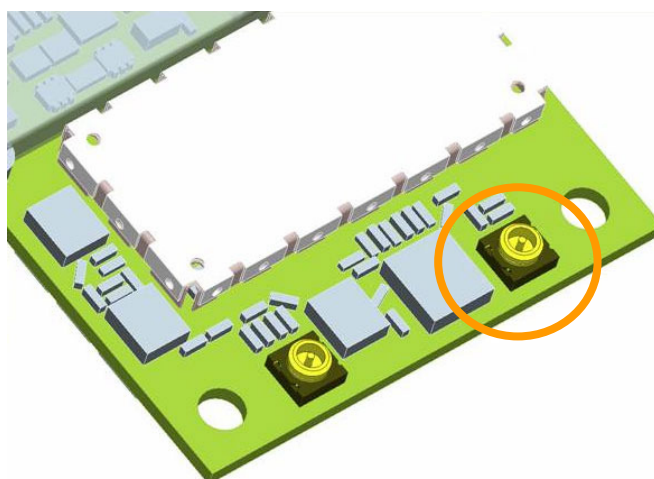


Figure 2-1: auxiliary antenna position

2.3 Connecting to the application interface

Open the Windows Device Manager and determine the COM port number for the module's application interface.

Check the properties of the Globetrotter Module HSxPA USB device to see which drivers are loaded. Verify that the driver is the correct version (see above).

If a GPS interface is already shown in the device manager, section 2.4 can be skipped.

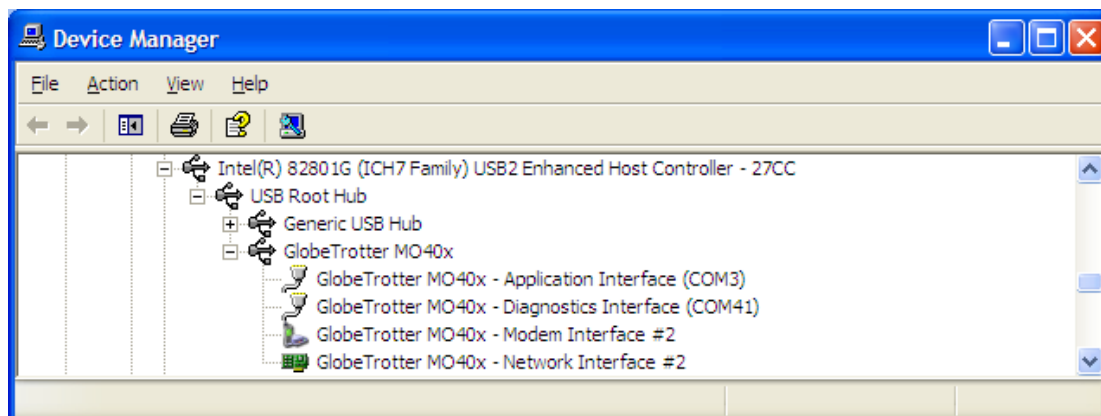


Figure 2-2: Application interface of the Globetrotter module in Device Manager

Open a terminal program (like HyperTerminal) and connect to the application interface (COM3 in the above example but will probably be a different COM port on your system).

To verify the setup, you can type `ATI` in the HyperTerminal. The Globetrotter module will reply with its identification string.

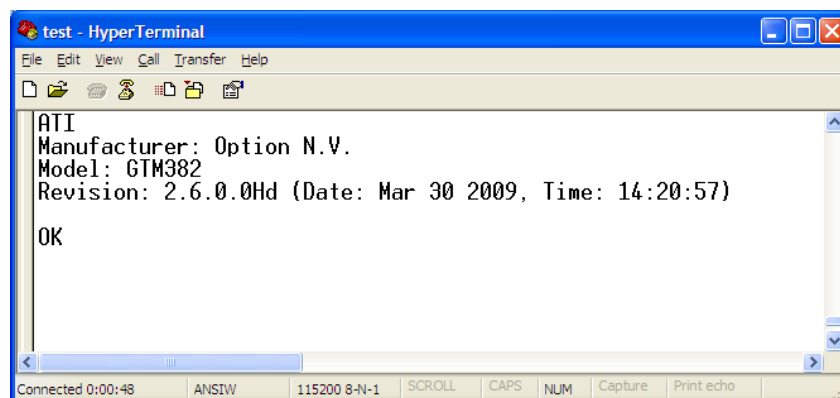


Figure 2-3: Globetrotter identification string

Along with the model number, the firmware version is displayed. Verify that your module's firmware corresponds with the minimum recommended version.

2.4 Activate the GPS interface

The GPS and other interfaces can be turned on and off using the AT command AT_OIFACE. This command is an Option proprietary command and should not be communicated to the end-customers. This chapter will only explain how to enable/disable the GPS interface.

AT_OIFACE? displays the current status of the module's interface configuration.

For example:

```
AT_OIFACE?  
DIAG: 1  
GPS: 0  
APP1: 1  
APP2: 0  
PCSC: 0  
IP: 1  
MODEM: 1  
VOICE: 0  
SD: 1  
CD: 0
```

OK

The part GPS: 0 in the response above shows that the GPS device is disabled.

- To enable the GPS interface, issue the following AT command:
AT_OIFACE="GPS", 1
A module reboot is needed to configure the GPS interfaces of the module correctly.
- To disable the GPS interface afterwards, issue the following AT command:
AT_OIFACE="GPS", 0
Again a module reboot is needed for the changes to take effect.

As indicated, the Globetrotter module needs to be rebooted for the GPS ports to become available. Unplug the power supply and USB connection to do this. After powering up again, the GPS interfaces will become available in the Windows device manager:

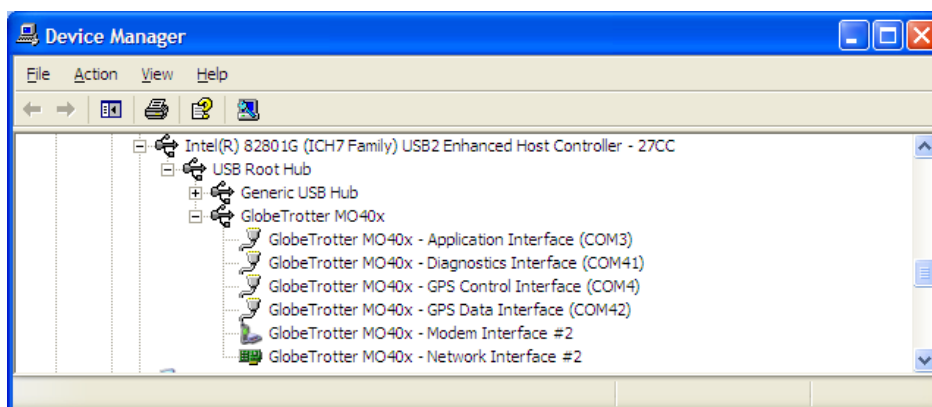


Figure 2-4: GPS interfaces becomes visible in Device Manager

When the module is powered up, 2 extra interfaces will become available:

- **GPS Control Interface**
This interface can be used as an AT command port to configure GPS parameters
- **GPS Data Interface**
This interface will show the NMEA data

2.5 Getting GPS information

The GPS Data interface is a serial port to the module, so you can connect to it with a terminal program. The interface cannot be used for entering AT commands, but the GPS output (NMEA data) will appear on it.

GPS position determination is started using the AT_OGPS command. This will be explained the chapters about S-GPS, A-GPS and gpsOneXTRA.

When there is a sufficiently strong GPS signal, an NMEA data stream will appear on the GPS Data interface. Initially, the module will continuously receive satellite data. The position data will be empty at this time. After a while, the module will get a position fix and display it in the \$GPGGA value.

```

COM31 - HyperTerminal
File Edit View Call Transfer Help
$GPRMC,A,V,,,,,,,,,N*53
$GPGSA,A,1,,,,,,,,,,,,,*32
$GPVTG,T,M,N,K*4E
$GPGSV,2,1,08,12,,,35,09,,,36,07,,,34,14,,,35*78
$GPGSV,2,2,08,05,,,36,04,,,30,02,,,34,01,,,34*75
$GPGGA,,,,,0,,,,,*66
$GPRMC,A,V,,,,,,,,,N*53
$GPGSA,A,1,,,,,,,,,,,,,*32
$GPVTG,T,M,N,K*4E
Connected 0:01:09 Auto detect 115200 8-N-1 SCROLL CAPS NUM Capture Print
    
```

Figure 2-5: NMEA data before position fix

```

COM31 - HyperTerminal
File Edit View Call Transfer Help
$GPGSV,2,2,06,07,29,209,23,09,25,139,42,12,62,073,23,14,40,254,23*7B
$GPGGA,120535.0,5051.974793,N,00439.941280,E,0.05,5.0,1551.5,M,,,,*35
$GPRMC,120535.0,A,5051.974793,N,00439.941280,E,72.5,275.1,121007.0,A*54
$GPGSA,A,1,,,,,,,,,,,,,*32
$GPVTG,T,M,N,K*4E
$GPGSV,2,1,06,01,34,296,22,02,28,085,21,04,18,046,41,05,82,053,24*74
$GPGSV,2,2,06,07,29,209,23,09,25,139,42,12,62,073,23,14,40,254,23*7B
$GPGGA,120536.0,5051.939426,N,00440.000880,E,1.06,5.0,760.0,M,,,,*0C
$GPRMC,120536.0,A,5051.939426,N,00440.000880,E,35.5,294.8,121007.0,A*5E
$GPGSA,A,3,01,02,04,05,09,12,,,,,,,,,9,3,5,0,7,9*17
$GPVTG,294.8,T,M,35.5,N,65.8,K*6F
$GPGSV,2,1,06,01,34,296,21,02,28,085,21,04,18,046,41,05,82,053,25*76
$GPGSV,2,2,06,07,29,209,23,09,25,139,43,12,62,073,23,14,40,254,23*7A
$GPGGA,120537.0,5051.985971,N,00440.344079,E,0.04,9.3,2305.0,M,,,,*31
$GPRMC,120537.0,A,5051.985971,N,00440.344079,E,72.3,275.2,121007.0,A*5A
$GPGSA,A,1,,,,,,,,,,,,,*32
$GPVTG,T,M,N,K*4E
$GPGSV,2,1,06,01,34,296,21,02,28,085,20,04,18,046,40,05,82,053,25*76
$GPGSV,2,2,06,07,29,209,23,09,25,139,43,12,62,073,24,14,40,254,23*7D
$GPGGA,120538.0,5051.987716,N,00440.328086,E,0.04,6.3,2295.5,M,,,,*3B
$GPRMC,120538.0,A,5051.987716,N,00440.328086,E,72.6,275.2,121007.0,A*57
$GPGSA,A,1,,,,,,,,,,,,,*32
$GPVTG,T,M,N,K*4E
Connected 0:01:13 Auto detect 115200 8-N-1 SCROLL CAPS NUM Capture Print echo
    
```

Figure 2-6: NMEA data with position fixed

3 GENERAL GPS INFORMATION

3.1 TTFF

Time To First Fix (TTFF) is a specification detailing the time required for a GPS receiver to acquire satellite signals and navigation data, and calculate a position solution (fix).

The time to first fix can be depending on the state of the GPS receiver, meaning if the receiver already has information of previous fixes or not. This can be divided in 3 scenarios:

Cold start Condition

No position data is stored in the UE or the data is inaccurate. Ephemeris, ionosphere, reference time and position assistance data have been deleted or are not present. In cold start condition, also almanac data can be present.

The TTFF will be around 40 sec.

Warm start Condition

UE has all data except time.

TTFF is shorter than in cold condition (the value depends on the environment you are in)

Hot start Condition

All the data is stored in the UE, therefore

TTFF will be the shortest in this condition (the value depends on the environment you are in).

3.2 Ephemeris – Almanac data

Each satellite continuously transmits messages containing the time the message was sent, precise orbital information (ephemeris data) and the general system health and rough orbits of all GPS satellites (almanac data).

3.3 Expiry of Assistance data

It will take 2 hours for ephemeris data to expire. This will cause a warm start to change into a cold start. Almanac data will expire after 6 months.

3.4 MS-Based and MS-Assisted A-GPS

In **MS-Based** mode, the network provides the satellite information to the device, based on a rough estimate of where the device is located, and the device acquires the GPS signals from the satellites and calculates its location. After the initial fix, the device operates like an autonomous GPS receiver until the satellite information must be refreshed. At this time the device goes back to the network to update the satellite information. MS-Based mode is appropriate for applications that require the device location to be updated rapidly.

In **MS-Assisted** mode, the network elements (for example base station, ...) calculate the location of the device. This mode is suitable for one-shot fixes, wherein the location does not need to be updated frequently.

3.5 NMEA Data

The module supports the following sentences of the NMEA protocol:

- GGA: fix information
- GSA: overall satellite data
- GSV: detailed satellite data
- RMC: recommended minimum data for GPS
- VTG: vector track and speed over the ground

4 STANDALONE GPS

4.1 Introduction

Standalone GPS means that the device can function on its own without for example assistance data from a server. The module demodulates the position data directly from GPS satellites in its 'line of sight'. The disadvantage of S-GPS is reduced cold-start sensitivity as the TTFF (time to first fix) will take longer than assisted gps systems as no assisted data is used and position is only calculated with the information received by satellites.

Not much is needed to setup S-GPS on the module.

To enable the S-GPS function, the following at commands can be used (refer to [1] for more info):

- AT_OGPSP
- AT_OGPS

AT_OGPSP is used to set the correct parameters that need to be used. By default, the setting for this command will be ok for S-GPS and you do not need to change the parameters. In case you want to switch from assisted GPS settings to standalone GPS, the following at command needs to be used:

```
AT_OGPSP=7,1
```

This commands makes sure position, velocity and height are calculated and S-GPS service is selected.

4.2 Make a single fix

Entering AT_OGPS=1 will start the GPS engine and will make a single fix. After this fix, the GPS engine stops.

4.3 Make a Continuous fix

Entering AT_OGPS=2 will start the GPS engine and will restart it when it turns off. This will usually generate a fix every second until the GPS engine gets disabled by using AT_OGPS=0

5 ASSISTED GPS

5.1 Introduction

A-GPS uses assistance data to get faster to a first fix (faster TTFF). In most cases, this data is received using an internet/data connection.

This chapter will explain how to setup the module, for testing purposes, using MS-Based assistance data from a SUPL server. It will not explain how to setup GSM CP and UMTS CP.

There are two different configurations for connecting to a SUPL server, depending if using a secured or a non-secured SUPL server.

5.2 Using a non-secure SUPL server

In case of using a non-secure SUPL server, several parameters need to be configured on the module.

For testing purposes, Option confidential AT commands can be used.

For commercial use, several parameters need to be set through an Option customization process:

- Network APN – Operator dependent
- SUPL server IP address or URL and Port Number
- Current Time and Date

5.2.1 Setup for testing purpose

To setup assisted GPS using a non-secure SUPL server, the following AT commands can be used for testing reference:

- Setting the GPS mode to MS Based A-GPS:
`AT_OGPSP=7,2`
- Setting the PDP context parameters:
`AT_OGPSCONT=1,"IP","myAPN"`
`AT_OGPSPDPP` should be used when authentication for PDP activation is needed
- Setting the SUPL server:
`AT_OGPSSL=1, "http://www.yourSUPLurl.com:7275"`
This at command can be used to set the URL and port number of the SUPL server.
- Setting the time:
`AT_OGCLK="yy/MM/dd, hh:mm:ss±zz"`
This at command can be used to set the current time, date and time zone.
Until FW 2.9.1.0, `AT_OGCLK` was NOT available and `AT+CCLK` should be used:
`AT+CCLK="yy/MM/dd, hh:mm:ss"` to set the current time and date.

As the Option module has no clock information (or battery to store clock information after shutdown), please keep in mind that the time has to be set after every power on! This time is necessary to decide if a refresh of the assistance data is needed or not.

To start the GPS fix, enter `AT_OGPS=2` (continuous fix).

5.2.2 Setup for commercial use

Option will customize the module based on the customer's input for the following parameters

- Requested GPS type:
 - Standalone
 - A-GPS using secure SUPL
 - A-GPS using non-secure SUPL
 - gspOneXTRA
- SUPL server's URL and Port Number
- Current Time and Date
- Network APN – If available

The network APN parameter will change for different operators. This means in case a device will be distributed by one customer to different operators, this parameter cannot be part of customization, and need to be set by for example a software application that will set the APN depending on the SIM inserted.

5.3 Using a secure SUPL server

In case of using a secure SUPL server, several configurations need to be done on the module, and some can only be done during the Option customization (factory) process of the module, and **not** by the end-user or laptop/MID manufacturer.

This means for setting up A-GPS using a secure SUPL server with the Option device, please check with your Option contact for a customized device.

The following parameters need to be setup for use with a secured SUPL server:

- Security parameters setting: *Option Internal customization*
- SUPL certificate to be stored on UE: *Option Internal customization*
- Setting the GPS mode to MS Based A-GPS: *done by entering AT_OGPSP*
- Setting the PDP context parameters: *done by entering AT_OGPSCONT, AT_OGPSPDPP*
- Setting the time: *done by entering AT_OGCLK (or for FW versions before 2.9.1.0, AT+CCLK should be used)*
- Setting the SUPL server's address: *done by entering AT_OGPSLS*
- Start the GPS engine: *done by entering AT_OGPS*

To setup the device with a secured SUPL server, the device needs to be configured by Option to setup the security specific parameters and certificates.

After the device has been customized (with SUPL server URL, security certificate,...), several parameters need to be entered by the software application (or by AT commands). The following parameters need to be set:

- Current Time and Date – needed to check validity of the assistance data
- Network APN – If available
- Start/Stop of GPS engine (AT_OGPS)