

# Skywire™ 3G HSPA+ GPS and Assisted GPS (A-GPS) Application Note

NimbeLink Corp

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# 1. Introduction

This document covers setting up GPS or Assisted GPS (A-GPS) on the HE910 modem. The reader should be comfortable interfacing with a modem over a serial connection. This guide uses the Skywire™ Development Kit (NL-SWDK) as the platform for communicating with the modem.

## 1.1 Overview

GPS uses a GPS receiver to obtain a location fix. A-GPS uses the cellular data network to download satellite data required to calculate the modem's position faster than using satellite reception alone. Normally this data is received directly from the satellites, but this process can take several minutes if the GPS receiver has been powered off for a long period of time or if it has been moved a significant distance while it was powered off. Using the cellular network to receive approximate location data significantly reduces the time to first fix (TTFF) for the modem.

## 1.2 Notation

Throughout this document, commands for the modem will be in **bold** on their own line, as shown below:

**AT**

**OK**

The first line is the command to be issued (**AT**), and the remaining lines are the response sent back by the modem (**OK**). The response from the modem may be longer than one line.

## 1.3 Orderable Parts

Part Number	Description	Manufacturer
NL-SWDK	Skywire™ Development Kit	NimbeLink
NL-SW-HSPAPG	Skywire™ Cellular Modem, HSPA+, GPS (HE910)	NimbeLink
MA.301.A.AB.001	Cellular and GPS Antenna	Taoglas

## 1.4 Additional Resources

Telit [HE910 Product Page](#)

Telit [HE910 AT Command Set](#)

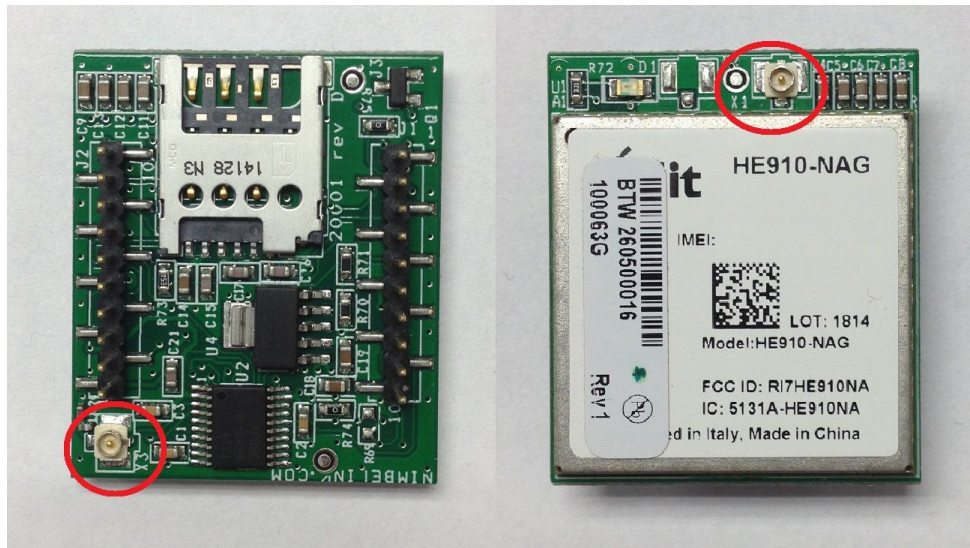
NimbeLink [Skywire Development Kit Documentation](#)

NMEA [Message Format](#)

## 2. Hardware Setup

Before sending commands to the modem, make sure the following hardware connections are set up properly. This guide uses the Skywire™ Development Kit, but this is not required to receive GPS data. Steps 2-4 are specific to the Skywire™ Development Kit and will be different depending on your hardware setup:

- 2.1. Connect a cellular antenna to U.FL connector X1, and connect a GPS antenna to U.FL connector X3 on the Skywire™.



Left: GPS U.FL connector (X3); Right: primary cellular U.FL connector (X1)

- 2.2. Connect power to the Skywire™ Development Kit
- 2.3. Connect USB connector J14 to your PC. J14 is used to send AT commands to the modem.
- 2.4. Power on the modem by pressing and holding the "ON BTN" for at least 5 seconds. Wait at least 10 seconds before trying to communicate with the modem.

## 3. Offline GPS Setup

The following sequence of commands is used to set up the GPS receiver to receive location fix data without assistance from a network connection using the NL-SW-HSPAPG modem based on the Telit HE910-NAG module.

- 3.1. Send a start location services request for autonomous GPS data:

```
AT$GPSSLR=2,3,,,,,1
```

```
OK
```

- 3.2. Enable unsolicited GPS data from the modem:

```
AT$GPSNMUN=2,1,0,0,0,0,0
```

```
OK
```

The modem should immediately begin sending empty **\$GPGGA** messages until it gets a GPS fix, which can take several minutes:

```
$GPGGA,,,,,0,,,M,,M,,*66
```

```
$GPGGA,,,,,0,,,M,,M,,*66
```

... (may take several minutes) ...

```
$GPGGA,191237.000,4700.8722,N,09327.7253,W,1,05,2.25,254.0,M,,M,,0000*6E
```

```
$GPGGA,191238.000,4700.8755,N,09327.7240,W,1,05,2.25,252.0,M,,M,,0000*65
```

If the modem does not start sending data after several minutes, move your GPS antenna so that it has a clear line of sight to the sky and verify that it is connected properly to the modem.

- 3.3. An alternative to the unsolicited messages is to issue the Get Acquired Position command (**\$GPSACP**). Every time this command is issued, the GPS receiver responds with the current location information:

```
AT$GPSACP
```

```
$GPSACP: 173716.000,4503.2552N,09326.8309W,500.0,-2909.1,2,259.2,4.0,2.1,180316,03
```

```
OK
```

## 4. Assisted GPS (A-GPS) Setup

The following sequence of commands is used to set up and enable A-GPS on the NL-SW-HSPAPG modem based on the Telit HE910-NAG module:

- 4.1. Confirm that the modem has been connected to properly:

```
AT  
OK
```

- 4.2. Verify the modem operator:

```
AT+COPS?  
+COPS: 0,0,"AT&T",2  
OK
```

Your modem operator may be different, but the field should not be blank.

- 4.3. Verify that the PDP context is properly configured. In this example, we will be using PDP context 1:

```
AT+CGDCONT?  
+CGDCONT: 1,"IP",<apn_name>","",0,0  
OK
```

The <apn\_name> field should show the network name for your carrier. If context 1 is not configured properly, it can be set using the following command:

```
AT+CGDCONT=1,"IP",<apn_name>","",0,0  
OK
```

- 4.4. Set the GPS Quality of Service parameters. In order, they are <horiz\_accuracy (in meters)>, <vertical\_accuracy (in meters)>, <response\_time (in seconds)>, <age\_of\_location\_info (in seconds)>:

```
AT$GPSQOS=50,50,100,0  
OK
```

- 4.5. Set the SUPL Location Platform (SLP) address of the server that will provide the A-GPS data:

```
AT$LCSSLP=1,<server_address>  
OK
```

The <server\_address> field should be replaced by the user's SUPL server address. The "supl.nokia.com" server was used in this example.

- 4.6. Lock context 1 for LoCation Services (LCS) use only:

**AT\$LCCLK=1,1**

**OK**

- 4.7. Enable unsolicited NMEA GPS data in the format of <NMEA SENTENCE><CR>. In this example, Global Position System Fix Data is enabled, which includes latitude and longitude measurements. The GPS data will be sent over the main serial communication line once the GPS module is enable:

**AT\$GPSNMUN=2,1,0,0,0,0,0**

- 4.8. Activate context 1 to get an IP address:

**AT#SGACT=1,1**

**#SGACT: <ip\_address>**

**OK**

If the response after **#SGACT:** is blank, your modem is not connected to the network, and you will not be able to receive A-GPS data.

- 4.9. Start GPS location service request. Sending this command sets \$GPSP=1 which enables the GPS module, preventing further \$GPSSLR commands until \$GPSP is set to 0 (the GPS module is turned off). The parameters in this example are <transport\_protocol (1=SUPL)>, <pos\_mode (1=MS Based)>, , , , , <gps\_reporting\_period (in seconds)>:

**AT\$GPSSLR=1,1,,,,,1,255**

**OK**

- 4.10. Response:

The modem should respond unsolicited with the following messages (repeated every second):

**\$GPGGA,213852.000,4600.8755,N,09327.7008,W,1,05,3.00,292.0,M,,M,,0000\*6E**

**\$GPGGA,213853.000,4600.8755,N,09327.7008,W,1,05,3.00,292.0,M,,M,,0000\*6F**

# 5. Troubleshooting

If you are unable to receive GPS data after following the steps above, try the following steps and commands to verify the modem is properly configured:

5.1. Verify that the modem is connected to the network:

**AT+CGREG?**

**+CGREG: 0,1**

A response of "0,1" or "0,5" indicates the modem is connected to the cellular network.

5.2. Check the signal quality being received by the modem's antenna:

**AT+CSQ**

**+CSQ: xx,yy**

The values of "xx" and "yy" are as follows:

Values of xx	Relative Signal Strength
0 - 9	Marginal: -113 dBm to -95 dBm
10 - 14	OK: -93 dBm to -85 dBm
15 - 19	Good: -83 dBm to -75 dBm
20 - 30	Excellent: -73 dBm to -53 dBm
31+	Excellent: -51 dBm or greater
99	Not known or detectable

Values of yy	Bit Error Rate
0	Less than 0.2%
1	0.2% to 0.4%
2	0.4% to 0.8%
3	0.8% to 1.6%



4	1.6% to 3.2%
5	3.2% to 6.4%
6	6.4% to 12.8%
7	More than 12.8%
99	Not known or detectable

- 5.3. Check the firmware version on the modem:

**AT+CGMR**

**##.##.###**

This guide uses firmware version 12.00.316, but other versions may work as well. Contact [product.support@nimbelink.com](mailto:product.support@nimbelink.com) to get the latest firmware if you think your firmware may be out of date.

- 5.4. Verify that the modem has an IP address for the PDP context (context 3 in this example):

**AT+CGPADDR=1**

**+CGPADDR: 1,<IP\_address>**

- 5.5. Verify that the GPS module has been turned on by the start GPS service request. After sending the **AT\$GPSSLR** command, do the following:

**AT\$GPSP?**

**\$GPSP: 1**

**OK**

A response of **\$GPSP: 0** indicates that the GPS module was either not turned on or was shut off after an error was encountered. Check the HE910 AT Command Manual for a list of error codes and their meaning.

# 6. Appendix

## 6.1 AT Commands and Acronyms

+COPS:	Operator Selection
+CGDCONT:	Define PDP Context
\$GPSQOS:	GPS Quality of Service
\$LCSSLP:	Update SLP server address
\$LCSLK:	Lock context for LCS use
#SGACT:	Socket Context Activation
\$GPSNMUN:	Unsolicited NMEA Data Configuration
\$GPSSLR:	GPS Start Location Service Request
GPGGA:	Global Positioning System Fix Data
NMEA:	National Marine Electronics Association