

Skywire® NL-SW-LTE-QBG96 and NL-SW-LTE-QBG95 GPS Application Note

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1. Introduction

1.1. Scope

This document serves as a guide for implementing GPS functionality on the NL-SW-LTE-QBG96 and NL-SW-LTE-QBG95 Skywire modems.

1.2. Overview

The NL-SW-LTE-QBG96 and NL-SW-LTE-QBG95 Skywire modems bring exceptionally useful additional location features. GNSS allows global geolocation of a Skywire modem through many different systems. The internal GNSS receiver supports GPS, GLONASS, Beidou/Compass, Galileo, and QZSS location services.

This application note explains the basics of GPS, and describes the procedure for implementing GPS functionality on the NL-SW-LTE-QBG96 and NL-SW-LTE-QBG95 Skywire modems.

1.3. Prerequisites



This document assumes that the initial setup of the requisite modem and development kit has been completed using the [Skywire® Development Kit User Manual](#).

If these steps are incomplete, please refer to the link above and complete the modem setup before proceeding.

1.4. Orderable Part Numbers

Orderable Device	Description	Carrier	Network Type
NL-SWDK	Skywire Development Kit	Any	Any
NL-SW-LTE-QBG96	LTE-M (CATM1)	Any	LTE-M, GSM
NL-SW-LTE-QBG95	LTE-M (CAT M1), NB-IoT (NB1, NB2)	Any	LTE-M, NB-IoT, GSM

1.5. Additional Resources

- [QBG96 Product Page](#)
- [QBG96 GNSS AT Command Manual](#)
- [QBG95 Product Page](#)
- [Skywire® Development Kit Product Page](#)
- [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 2-5 are specific to the Skywire Development Kit and will be different depending on your hardware setup:

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



Left: Primary Cellular U.FL connector (X1); Right: GPS U.FL connector (X3)

- Connect power to the Skywire Development Kit.
- Connect USB connector J14 to your PC. J14 is used to send AT commands to the modem.
- Power on the modem by pressing the "ON BTN" for 3+ seconds, Then wait at least 15 seconds before trying to communicate with the modem.
- **Optional:** Connect USB connector J5 to your PC to receive GPS data on a separate communication line (see Section 3, "Option 2").

3. 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-LTE-QBG96 and NL-SW-LTE-QBG95 Skywire modems.

Before receiving GPS location data, the GPS antenna must be powered on if the modem is using an active GPS antenna. To do this, a GPIO pin on the Skywire must be turned on as described in section 3.1. Devices using a passive GPS antenna should not turn on power to the passive GPS antenna as this may short circuit the antenna and damage the modem.

3.1. QBG95 GPS Note



Due to hardware limitations, the QBG95 can not use GPS and Cellular concurrently. By default, the QBG95 modem is configured into the GNSS priority mode, which can be switched to the WWAN priority mode with the command: **AT+QGPSCFG="priority",1,1** The command takes effect immediately. To revert back to GNSS priority mode use the command: **AT+QGPSCFG="priority",0,1** To query which system is prioritized use the command **AT+QGPSCFG="priority"**. For additional information on this command please refer to the BG95 GNSS AT command manual.

3.2. Power on the GPS antenna:

```
AT+QCFG="gpio",1,64,1,0,0,1 // Enables GPIO 64 as an output
```

OK

```
AT+QCFG="gpio",3,64,1,1 // Sets GPIO 64 to logic level HIGH
```

OK

```
AT+QCFG="gpio",2,64 // Returns the current state of GPIO 64
```

```
+GCFG: "gpio",1
```

OK

Note: GPIO states will persist after reset, and the above AT commands will not need to be reissued each time the modem is powered on. Firmware updates may overwrite saved GPIO states, however.

3.3. Turn on GNSS:

```
AT+QGPS=1
```

OK

The modem should begin attempting to get a GPS fix. Note that it may take up to a few minutes to receive the first GPS fix. If you are getting **"+CME ERROR: 516"**, this means

that the modem has not received a GPS fix yet. Either continue to wait for a few minutes, or move the GPS antenna near a window or outside.

3.4. Obtain Positioning Information

Once the receiver has been turned on Issue the following command:

AT+QGPSLOC?

+QGPSLOC:

061951.0,3150.7223N,11711.9293E,0.7,62.2,2,0.0,0.0,0.0,110513,09

OK

The modem will respond with the current acquired GPS location in the following format:

**<UTC>,<latitude>,<longitude>,<hdop>,<altitude>,<fix>,<cog>,<spkm>,<spk
n>,<date>,<nsat>**

Where “<latitude>,<longitude>” is formatted as:

ddmm.mmmm N/S,dddmm.mmmm E/W

There is also an unsolicited option for receiving data from the modem. You can specify which type of NMEA sentence you would like to receive using the table below and entering the following AT command:

AT+QGPSCFG="gpsnmeatype",<value>

NMEA Type	<value>
Disable	0
GGA	1
RMC	2
GSV	4
GSA	8
VTG	16
All	31

It is also possible to receive unsolicited GPS data returned by the modem in NMEA format.

Unsolicited NMEA GPS data in the format of “<NMEA SENTENCE><CR>” can be sent over the dedicated USB NMEA port. This option can be enabled by issuing the following AT command:

AT+QGPSCFG="outport","usbnmea"

The output on either the USB port will look similar to the following example. This example is set to display only GGA NMEA sentences:

```
$GPGGA,220703.0,4701.387238,N,09327.689237,W,1,00,0.1,300.0,M,-33.0,M,,*6E
$GPGGA,220705.0,4701.387238,N,09327.689237,W,1,00,0.1,300.0,M,-33.0,M,,*68
$GPGGA,220707.0,4701.387238,N,09327.689237,W,1,00,0.1,300.0,M,-33.0,M,,*6A
$GPGGA,220709.0,4701.387238,N,09327.689237,W,1,00,0.1,300.0,M,-33.0,M,,*64
$GPGGA,220711.0,4701.387238,N,09327.689237,W,1,00,0.1,300.0,M,-33.0,M,,*6D
$GPGGA,220713.0,4701.387238,N,09327.689237,W,1,00,0.1,300.0,M,-33.0,M,,*6F
```

To view NMEA sentences directly, input the following AT command to enable NMEA acquisition:

AT+QGPSCFG="nmeasrc",1

Then, to obtain an NMEA sentence, enter the following command and replace <type> with which type of NMEA sentence you would like to receive from the following: GGA, RMC, GSV, GSA, VTG, GNS.

AT+QGPSTNMEA="<type>"

3.5. Example GPS AT Command Log

The following is a log of a NL-SW-LTE-QBG95 modem configuring GPS and receiving positional data. Comments on each step are in red text and start with "//". User-entered AT commands are in bold.

```
// Wait for boot
APP RDY

// Verify firmware version
AT+CGMR
BG95M3LAR02A03

OK

// Determine if GNSS or WWAN priority is set, 1 is WWAN, 0 is GNSS
AT+QGPSCFG="Priority"
+QGPSCFG: "priority",1,0
```

OK

// Set system to GNSS priority mode and save to NVRAM

AT+QGPSCFG="Priority",0,1

OK

// Enable GPIO 64 as an output

AT+QCFG="gpio",1,64,1,0,0,1

OK

// Set GPIO 64 to logic level HIGH

AT+QCFG="gpio",3,64,1,1

OK

// Return the current state of GPIO 64

AT+QCFG="gpio",2,64

+QCFG: "gpio",1

OK

// Enable GNSS functionality

AT+QGPS=1

OK

// Obtain Position

AT+QGPSLOC?

+QGPSLOC: 061951.0,3150.7223N,11711.9293E,0.7,62.2,2,0.0,0.0,0.0,110513,09

OK

// Set NMEA Format

AT+QGPSCFG="gpsnmeatype",1

OK

// Output Positional Information

AT+QGPSCFG="outport","usbntea"

\$GPGGA,220703.0,4701.387238,N,09327.689237,W,1,00,0.1,300.0,M,-33.0,M,,*6E

\$GPGGA,220705.0,4701.387238,N,09327.689237,W,1,00,0.1,300.0,M,-33.0,M,,*68

\$GPGGA,220707.0,4701.387238,N,09327.689237,W,1,00,0.1,300.0,M,-33.0,M,,*6A

\$GPGGA,220709.0,4701.387238,N,09327.689237,W,1,00,0.1,300.0,M,-33.0,M,,*64

\$GPGGA,220711.0,4701.387238,N,09327.689237,W,1,00,0.1,300.0,M,-33.0,M,,*6D

\$GPGGA,220713.0,4701.387238,N,09327.689237,W,1,00,0.1,300.0,M,-33.0,M,,*6F

4. Document Version Information

Version	Notes	Date
7	<ul style="list-style-type: none">- Updated document to include QBG95 support and document version information	02/09/2021
8	<ul style="list-style-type: none">- Updated document to include QBG95 GNSS/LTE hardware limitation note in section 3.1- Updated QBG95 example to include setting GNSS priority.	02/17/2021