Skywire® Development Kit

User Manual

NimbeLink Corp

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# 1. Introduction

## 1.1 Orderable Part Numbers

<table>
<thead>
<tr>
<th>Orderable Device</th>
<th>Description</th>
<th>Carrier</th>
<th>Network Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>NL-SW-DK</td>
<td>Skywire Development Kit</td>
<td>Any</td>
<td>Any</td>
</tr>
<tr>
<td>NL-SW-1xRTT-A</td>
<td>2G 1xRTT</td>
<td>Aeris</td>
<td>CDMA</td>
</tr>
<tr>
<td>NL-SW-1xRTT-S</td>
<td>2G 1xRTT</td>
<td>Sprint</td>
<td>CDMA</td>
</tr>
<tr>
<td>NL-SW-1xRTT-V</td>
<td>2G 1xRTT</td>
<td>Verizon</td>
<td>CDMA</td>
</tr>
<tr>
<td>NL-SW-GPRS</td>
<td>2G GPRS</td>
<td>Any GSM (AT&amp;T, T-Mobile, etc.)</td>
<td>GSM</td>
</tr>
<tr>
<td>NL-SW-EVDO-A</td>
<td>3G EVDO, GPS, GLONASS</td>
<td>Aeris</td>
<td>CDMA</td>
</tr>
<tr>
<td>NL-SW-EVDO-V</td>
<td>3G EVDO, GPS, GLONASS</td>
<td>Verizon</td>
<td>CDMA</td>
</tr>
<tr>
<td>NL-SW-HSPA</td>
<td>3G HSPA+, GNSS, GLOBAL BANDS</td>
<td>Any HSPA/GSM Carrier (AT&amp;T, T-Mobile, etc.)</td>
<td>HSPA/GSM</td>
</tr>
<tr>
<td>NL-SW-HSPA-B</td>
<td>3G HSPA+, GNSS, GLOBAL BANDS</td>
<td>Any HSPA/GSM Carrier (AT&amp;T, T-Mobile, etc.)</td>
<td>HSPA/GSM</td>
</tr>
<tr>
<td>NL-SW-LTE-TSVG-B</td>
<td>LTE without Fallback, GNSS</td>
<td>Verizon</td>
<td>LTE</td>
</tr>
<tr>
<td>NL-SW-LTE-TNAG-B</td>
<td>LTE with HSPA+ Fallback, GNSS</td>
<td>Any GSM Carrier (AT&amp;T, T-Mobile, etc.)</td>
<td>LTE/GSM</td>
</tr>
<tr>
<td>NL-SW-LTE-TEUG</td>
<td>LTE with HSPA+ Fallback, GNSS, EU</td>
<td>Any EU LTE/GSM Carrier</td>
<td>LTE/GSM</td>
</tr>
<tr>
<td>NL-SW-LTE-GELS3-C</td>
<td>LTE CAT1, Verizon</td>
<td>Verizon</td>
<td>LTE</td>
</tr>
<tr>
<td>NL-SW-LTE-GELS3-D</td>
<td>LTE CAT1, Verizon</td>
<td>Verizon</td>
<td>LTE</td>
</tr>
<tr>
<td>NL-SW-LTE-WM14-B</td>
<td>LTE CAT1, GSM</td>
<td>Any LTE Carrier (AT&amp;T, T-Mobile, etc.)</td>
<td>LTE</td>
</tr>
<tr>
<td>NL-SW-LTE-TM1G-V</td>
<td>LTE Cat M1, GNSS</td>
<td>Verizon</td>
<td>LTE</td>
</tr>
<tr>
<td>NL-SW-LTE-TM1G-A</td>
<td>LTE Cat M1, GNSS</td>
<td>AT&amp;T</td>
<td>LTE</td>
</tr>
<tr>
<td>NL-SW-LTE-QBG96</td>
<td>LTE CAT M1, GNSS</td>
<td>AT&amp;T, Orange, Telstra, Telus, T-Mobile, Verizon, Vodafone, and more</td>
<td>LTE</td>
</tr>
</tbody>
</table>
1.2 Product Overview

The Skywire® Development Kit includes one baseboard, antenna, power supply, SIM cards, and debug cables. Skywire modems must be purchased separately. The kit enables you to develop your application directly on the Skywire modem with three different ways to connect:

- Connect your PC to the Skywire modem UART port via onboard USB-to-UART converter and send AT commands directly to the modem through PC terminal applications. You can also connect over USB for access to multiple COM ports.
- The kit is an Arduino shield, so you can plug the kit directly onto an Arduino microcontroller. Please see Section 4: Common Next Steps for links to example documentation.
- To connect the kit to a different processor or development kit, a 14-pin header breaks out the necessary signals for easy connection to any device. The modem supports I/O levels from 1.65-5.5V, simplifying connection to other systems.

1.3 Block Diagram

![Block Diagram Image]

*X2 and X3 U.FL connectors not present on all modems.
2. Connect to Kit using a PC

This section covers how to connect your development kit to a PC and provision the modem with your cellular plan. It also covers how to communicate over the serial port to the Skywire modem which only requires the use of USB port and connector marked J14 or USB2 in the diagram below. USB1 (connector J5) is used for high speed data connections and firmware updates to the modem and is not used in this section.

2.1 Unpack Kit Contents
2.2 Skywire Placement

To mount your Skywire Cellular modem follow these steps:

1. Gather the following:
   a. Skywire Development Kit board
   b. Skywire Cellular Modem
   c. U.FL extractor tool (Always use a U.FL extractor tool when placing or removing U.FL cables on the Skywire modem to avoid damaging the U.FL connectors).

2. Line up your Skywire’s cellular U.FL connector(s) on the side of the board closest to the antenna connector. Depending on the type of Skywire Modem you have there may be one, two, or three U.FL connections.

3. To avoid damage to the U.FL connector and maximize connector life, a U.FL removal tool should be used when attaching/removing the U.FL connector. Always insert and remove the U.FL connector with a force perpendicular to the board. If your Skywire is using GPS, attach the GPS antenna to the bottom of the Skywire connector X3. If you are not using your Skywire’s GPS or if your Skywire does not support GPS, continue to step 4.

4. Attach the U.FL cable to the top U.FL connector X1 on the Skywire. If you are using a Skywire with the cellular diversity antenna option attach a second antenna to connector X2.

5. Carefully seat your Skywire into the board’s Skywire socket (U1). Take care to ensure that the pins are correctly aligned. Failure to properly align the pins may damage your Skywire.

A properly mounted Skywire™ Modem with U.FL cable attached to top U.FL connector X1
A common issue is accidentally inserting the modem with pins misaligned by one row. Check pin alignment BEFORE applying power to prevent modem damage.

2.3 Attach Antenna to Baseboard

Antenna screws onto SMA connector with a clockwise rotation

2.4 Ensure header J6 is shorted with 2 pin Jumper

This enables USB to UART communication between the PC and the modem.
2.5 Attach Jumper Wires (NL-SW-LTE-WM14 only)

To power on the NL-SW-LTE-WM14 modem, you must tie the SW_ON_OFF pin to GND. Place a jumper wire to connect header J8 Pins 2 and 8 together.

Please see page 3 of the Skywire Development Kit schematic for pin locations:

2.6 Plug in 12V Power Supply to connector J15

2.7 Plug USB cable into connector J14 and PC
2.8 Press and hold button S1 to power on the modem

Please see the table below for the length of time needed to hold down button S1 for your particular modem.

<table>
<thead>
<tr>
<th>Device</th>
<th>Hold Time ($t_h$) for Button S1 To Power On the Modem</th>
<th>Wait Time ($t_w$) Before Software Communication*</th>
<th>LED D1 Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>NL-SW-1xRTT-A</td>
<td>1 second $&lt; t_h &lt; 2$ seconds</td>
<td>$t_w &gt; 10$ seconds</td>
<td>Blink once</td>
</tr>
<tr>
<td>NL-SW-1xRTT-S</td>
<td>1 second $&lt; t_h &lt; 2$ seconds</td>
<td>$t_w &gt; 10$ seconds</td>
<td>Blink once</td>
</tr>
<tr>
<td>NL-SW-1xRTT-V</td>
<td>1 second $&lt; t_h &lt; 2$ seconds</td>
<td>$t_w &gt; 10$ seconds</td>
<td>Blink once</td>
</tr>
<tr>
<td>NL-SW-GPRS</td>
<td>$t_h &gt; 5$ seconds</td>
<td>$t_w &gt; 10$ seconds</td>
<td>Blink once</td>
</tr>
<tr>
<td>NL-SW-EVDO-A</td>
<td>1 second $&lt; t_h &lt; 2$ seconds</td>
<td>$t_w &gt; 10$ seconds</td>
<td>Blink twice</td>
</tr>
<tr>
<td>NL-SW-EVDO-V</td>
<td>1 second $&lt; t_h &lt; 2$ seconds</td>
<td>$t_w &gt; 10$ seconds</td>
<td>Blink twice</td>
</tr>
<tr>
<td>NL-SW-HSPA</td>
<td>$t_h &gt; 5$ seconds</td>
<td>$t_w &gt; 2$ seconds</td>
<td>Solid on</td>
</tr>
<tr>
<td>NL-SW-HSPA-B</td>
<td>$t_h &gt; 5$ seconds</td>
<td>$t_w &gt; 2$ seconds</td>
<td>Solid on</td>
</tr>
<tr>
<td>NL-SW-LTE-TS VG</td>
<td>1 second $&lt; t_h &lt; 2$ seconds</td>
<td>$t_w &gt; 15$ seconds</td>
<td>No activity</td>
</tr>
<tr>
<td>NL-SW-LTE-TNAG</td>
<td>1 second $&lt; t_h &lt; 2$ seconds</td>
<td>$t_w &gt; 15$ seconds</td>
<td>No activity</td>
</tr>
<tr>
<td>NL-SW-LTE-TEUG</td>
<td>1 second $&lt; t_h &lt; 2$ seconds</td>
<td>$t_w &gt; 15$ seconds</td>
<td>No activity</td>
</tr>
<tr>
<td>NL-SW-LTE-GELS3</td>
<td>1 second $&lt; t_h &lt; 2$ seconds</td>
<td>$t_w &gt; 30$ seconds</td>
<td>Solid on</td>
</tr>
<tr>
<td>NL-SW-LTE-WM14</td>
<td>n/a (Done in Section 2.5)</td>
<td>$t_w &gt; 30$ seconds</td>
<td>Solid on</td>
</tr>
<tr>
<td>NL-SW-LTE-TM1G</td>
<td>$t_h &gt; 5$ seconds</td>
<td>$t_w &gt; 6$ seconds</td>
<td>No activity</td>
</tr>
<tr>
<td>NL-SW-LTE-QBG96</td>
<td>$t_h &gt; 1$ second</td>
<td>$t_w &gt; 4$ seconds</td>
<td>Solid on</td>
</tr>
</tbody>
</table>

*Note: Depending on your modem and depending on the setup, the modem may be available for use before $t_w$. 

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2.9 Open Tera Term or similar terminal emulator

If you do not have a terminal emulator program, you can get Tera Term here: http://logmett.com/index.php?/download/tera-term-486-freeware.html

Your PC may have multiple COM ports. Select appropriate USB COM port to communicate with the development kit.

![Terminal Emulator](image)

Serial Settings should be as follows (these are the default settings):
- **Baud Rate**: 115,200 bps
- **Data**: 8bit
- **Parity**: none
- **Stop**: 1bit
- **Flow Control**: none

2.10 Test Serial Communication

In the terminal program, type the command:

```
AT
```

followed by the Enter key, and the terminal should respond with:

```
OK
```

**Note**: For the NL-SW-LTE-WM14, you will not see the characters you have typed until hitting the enter key.

**Note**: For the NL-SW-LTE-GELS3, you may need to turn echo on in order to see what you are typing. If you type the command:

```
AT
```

and don’t see it being typed on your screen, hit the Enter key, and type the following command:

```
ATE1
```

followed by the Enter key, and the terminal program should respond with:

```
OK
```

Type the following command:

```
AT
```
to verify you can see the command you are typing. After pressing the Enter key, the terminal program will respond with:

**OK**

Note: The modem will output "ERROR" when a command is entered incorrectly. To enable verbose error mode to see what error is occurring issue AT+CMEE=2 to the modem.

### 2.11 Test Signal Strength

#### 2.11.1 For Non-LTE Modems

In the terminal program, type the command:

`AT+CSQ`

followed by the Enter key, and the terminal should respond with:

`+CSQ: xx,yy`

where `xx` is the signal strength of the antenna, and `yy` is the bit error rate in percent. Typical values are as follows:

<table>
<thead>
<tr>
<th>Values of <code>xx</code></th>
<th>Relative Signal Strength</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 – 9</td>
<td>Poor: &lt;= -95 dBm</td>
</tr>
<tr>
<td>10 – 14</td>
<td>OK: -93 dBm to -85 dBm</td>
</tr>
<tr>
<td>15 – 19</td>
<td>Good: -83 dBm to -75 dBm</td>
</tr>
<tr>
<td>20 – 30</td>
<td>Excellent: -73 dBm to -53 dBm</td>
</tr>
<tr>
<td>31</td>
<td>Excellent: -51 dBm or greater</td>
</tr>
<tr>
<td>99</td>
<td>Not known or not detectable</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Values of <code>yy</code></th>
<th>Bit Error Rate (in percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Less than 0.2%</td>
</tr>
<tr>
<td>1</td>
<td>0.2% to 0.4%</td>
</tr>
<tr>
<td>2</td>
<td>0.4% to 0.8%</td>
</tr>
<tr>
<td>3</td>
<td>0.8% to 1.6%</td>
</tr>
<tr>
<td>4</td>
<td>1.6% to 3.2%</td>
</tr>
<tr>
<td>5</td>
<td>3.2% to 6.4%</td>
</tr>
<tr>
<td>6</td>
<td>6.4% to 12.8%</td>
</tr>
<tr>
<td>7</td>
<td>More than 12.8%</td>
</tr>
<tr>
<td>99</td>
<td>Not known or not detectable</td>
</tr>
</tbody>
</table>

#### 2.11.1 For LTE Modems

To check the signal strength on an LTE modem the user should refer to the RSRP (Reference Signal Received Power) & RSRQ (Reference Signal Received Quality)
values reported by the modem. These signal measurements will more accurately reflect the quality of the cellular link for LTE modems by not only measuring

**For the following product models (NL-SW-LTE-GELS3, NL-SW-LTE-TM1G):**

In the terminal program, type the command:

```
AT+CESQ
```

followed by the Enter key, and the terminal should respond with:

```
+CESQ: <rxlev>,<ber>,<rscp>,<ecno>,<rsrq>,<rsrp>
```

Where `<rsrq>,<rsrp>` are the RSRQ/RSRP values as defined by the modems AT command manual.

**For the following product models (NL-SW-LTE-TSVG, NL-SW-LTE-TNAG, NL-SW-LTE-TEUG):**

In the terminal program, type the command:

```
AT#MONI
```

followed by the Enter key, and the terminal should respond with:

```
#MONI: <netmame> RSRP:<rsrp> RSRQ:<rsrq> TAC:<tac> Id:<id> EARFCN:<earfcn> PWR:<dBm> DRX:<drx>
```

Where `<rsrq>,<rsrp>` are the RSRQ/RSRP values as defined by the modems AT command manual.

**For the following product models (NL-SW-LTE-WM14):**

In the terminal program, type the command:

```
AT%MEAS="97"
```

followed by the Enter key, and the terminal should respond with:

```
%MEAS: EARFCN=<earfsn>1000, CellID=<cid>, RSRP=<rsrp>, RSRQ=<rsrq>
```

Where `<rsrq>,<rsrp>` are the RSRQ/RSRP values as defined by the modems AT command manual.

**For the following product model (NL-SW-LTE-QBG96):**

In the terminal program, type the command:

```
AT+QCSQ
```

followed by the Enter key, and the terminal should respond with:

```
+QCSQ: <sysmode>, <rssi>, <rsrp>, <sinr>, <rsrq>
```

Where `<sysmode>` is the current cellular service mode, `<rssi>` is the RSSI value, `<rsrp>` is the RSRP value, `<sinr>` is the signal to interference plus noise ratio, and `<rsrq>` is the RSRQ value. **Note**: the values for RSRP and RSRQ are returned as raw values (dB or dBm), as opposed to encoded as per the tables on the next page.

For further information regarding the SINR ratio and the `<sysmode>` parameter, please refer to the QBG96 AT command manual.
<rsrq> is the Reference Signal Received Quality (RSRQ) and <rsrp> is the Reference Signal Received Power (RSRP). Typical values are as follows:

<table>
<thead>
<tr>
<th>Values of &lt;rsrq&gt;</th>
<th>RSRQ (Reference Signal Received Quality)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>RSRQ &lt; -19.5 dB</td>
</tr>
<tr>
<td>1</td>
<td>-19.5 dB ≤ RSRQ &lt; -19 dB</td>
</tr>
<tr>
<td>2</td>
<td>-19 dB ≤ RSRQ &lt; -18.5 dB</td>
</tr>
<tr>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>32</td>
<td>-4 dB ≤ RSRQ &lt; -3.5 dB</td>
</tr>
<tr>
<td>33</td>
<td>-3.5 dB ≤ RSRQ &lt; -3 dB</td>
</tr>
<tr>
<td>34</td>
<td>-3 dB ≤ RSRQ</td>
</tr>
<tr>
<td>255</td>
<td>Not known or detectable</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Values of &lt;rsrp&gt;</th>
<th>RSRP (Reference Signal Received Power)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>RSRP &lt; -140 dBm</td>
</tr>
<tr>
<td>1</td>
<td>-140 dBm ≤ RSRP &lt; -139 dBm</td>
</tr>
<tr>
<td>2</td>
<td>-139 dBm ≤ RSRP &lt; -138 dBm</td>
</tr>
<tr>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>95</td>
<td>-46 dBm ≤ RSRP &lt; -45 dBm</td>
</tr>
<tr>
<td>96</td>
<td>-45 dBm ≤ RSRP &lt; -44</td>
</tr>
<tr>
<td>97</td>
<td>-44 dBm ≤ RSRP</td>
</tr>
<tr>
<td>255</td>
<td>Not known or not detectable</td>
</tr>
</tbody>
</table>

Here are estimated signal qualities based on the above values:

<table>
<thead>
<tr>
<th>Values of &lt;rsrq&gt;</th>
<th>RSRQ</th>
<th>Values of &lt;rsrp&gt;</th>
<th>RSRP</th>
<th>Quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>RSRQ &lt; -19.5 dB</td>
<td>0 - 40</td>
<td>RSRP &lt; -100 dBm</td>
<td>Marginal</td>
</tr>
<tr>
<td>1 - 9</td>
<td>-19.5 dB ≤ RSRQ &lt; -15 dB</td>
<td>41 - 50</td>
<td>-100 dBm ≤ RSRP &lt; -90 dBm</td>
<td>Fair</td>
</tr>
<tr>
<td>10 - 19</td>
<td>-15 dB ≤ RSRQ &lt; -10 dB</td>
<td>51 - 59</td>
<td>-90 dBm ≤ RSRP &lt; -80 dBm</td>
<td>Good</td>
</tr>
<tr>
<td>20 - 34</td>
<td>≥ -10 dB</td>
<td>60 - 97</td>
<td>≥ -80 dBm</td>
<td>Excellent</td>
</tr>
</tbody>
</table>

### 2.12 Activate Modem (one-time step)

If you are using a new Skywire™ cellular module, it does not have an active cellular plan. To activate a Verizon, T-Mobile, or AT&T data plan, visit [http://go.nimbelink.com](http://go.nimbelink.com) and create an account and activate your Skywire there.
To activate the NEO SIM for GSM modems, please follow the directions printed on the AERIS SIM Card.

The NEO SIM (2FF size) must be cut to the micro-SIM (3FF) form factor in order to fit into the Skywire modems. Use the template at the following URL to cut your SIM card to size:


Activation of an Aeris SIM required a different process than Verizon activation. Please consult the application notes on the NimbeLink website for the activation procedure.

2.13 SIM Card Detection (GSM Only)

Applies to:
- NL-SW-GPRS
- NL-SW-HSPA
- NL-SW-HSPA-B

If you are using a Skywire GSM modem that uses a SIM card, you need to configure the Skywire modem to detect it.

In the terminal program, type the command:

`AT#SIMDET=1`

followed by the enter key. The terminal program will respond with:
This will enable the Skywire SIM detection.

### 2.14 Send Modem Activation String (1xRTT and EVDO only)

Applies to:
- NL-SW-1xRTT-V
- NL-SW-EVDO-V

In the terminal program, type the command:

```
ATD*22899;
```

followed by the Enter key, and the module will begin the activation process which can take **several minutes**. The terminal should respond with:

```
OK
#OTASP: 0
#OTASP: 1
#OTASP: 2
NO CARRIER
```

For all other responses, review network status responses online.

### 2.15 Setup PDP Context (LTE, HSPA, and GPRS Only)

Applies to:
- NL-SW-GPRS
- NL-SW-HSPA
- NL-SW-HSPA-B
- NL-SW-LTE-TSVG
- NL-SW-LTE-TNAG
- NL-SW-LTE-TEUG
- NL-SW-LTE-GELS3
- NL-SW-LTE-WM14
- NL-SW-LTE-TM1G
- NL-SW-LTE-QBG96

Before you can successfully communicate with the network using a GSM or LTE Skywire, you need to define the PDP context.
2.15.1 For AT&T, T-Mobile, and other GSM carriers and the following product models (NL-SW-GPRS, -HSPA*, -TNAG, -TEUG):

In the terminal program, type the command:

\[
\text{AT+CGDCONT} = 1,"\text{IP"},"\text{APN}\"
\]

where APN is the individual APN for your network, followed by the Enter key, and the terminal program should respond with:

OK

Note: Consult Section 3: APN Setup for help with your APN.

To verify that the APN was set correctly, in the terminal program type the command:

\[
\text{AT+CGDCONT?}
\]

followed by the Enter key, and the terminal should respond with:

+CGDCONT: 1,"\text{IP"},"\text{APN}\"

as well as the other PDP context information on the device. To enable this setting, in the terminal program type the command:

\[
\text{AT#SGACT}=1,1
\]

followed by the enter key, and the terminal should respond with:

#SGACT: www.xxx.yyy.zzz

where www.xxx.yyy.zzz is the Skywire modem’s IP address.

If the \text{AT#SGACT} command does not work, the terminal will respond with

#ERROR

and further setup may be necessary. Check the signal strength with \text{AT+CSQ} to verify the Skywire is getting an acceptable signal. Otherwise, consult the Telit AT Command Reference Guide for your particular modem.

2.15.2 For the Verizon CAT3 LTE Skywire (NL-SW-LTE-TSVG):

Users have two options for setting up PDP Context on the CAT3 LTE Skywire™.

Use the VZW network to pull the proper APN:

In the terminal program, type the command:

\[
\text{AT#OTAUIDM}=0
\]

followed by the enter key, then wait for #DRELL response from the terminal.

Next, type the command:

\[
\text{AT+CGDCONT?}
\]

Read the response from the terminal and see what 3rd PDP context changed to.
The second method is to manually set the APN provided by VZW. In the terminal program, type the command:

```
AT#SCFG=3,3,300,90,600,50
```

followed by the Enter key. The terminal should respond with:

```
OK
```

This is configuration information for setting up the context in the next step. In the terminal program, type the command:

```
AT+CGDCONT=3, "IP", "Verizon APN"
```

where **Verizon APN** is the specific APN to connect to for your intended use, followed by the Enter key, and the terminal should respond with:

```
OK
```

**Note:** Consult Section 3: APN Setup for help with your Verizon APN.

To verify that the APN was set correctly, type the command:

```
AT+CGDCONT?
```

followed by the Enter key, and the terminal should respond with:

```
+CGDCONT: 3, "IP", "Verizon APN"
```

as well as the other PDP context information on the device. To enable this setting, in the terminal program type the command:

```
AT#SGACT=3,1
```

followed by the enter key, and the terminal should respond with:

```
#SGACT: www.xxx.yyy.zzz
```

where **www.xxx.yyy.zzz** is the Skywire modem’s IP address.

If the **AT#SGACT** command does not work, the terminal will respond with

```
#ERROR
```

and further setup may be necessary. Check the signal strength with **AT+CSQ** to verify the Skywire is getting an acceptable signal. Otherwise, consult the Telit AT Command Reference Guide for your particular modem.

### 2.15.3 For the Verizon CAT1 LTE Skywire (NL-SW-LTE-GELS3):

In the terminal program, type the following command:

```
ATI
```

followed by the enter key. If the terminal responds with:

```
  Cinterion
  ELS31-V
  REVISION 4.3.1.0c
```
follow instructions for Version 1 Firmware.
If the terminal program responds with:

Cinterion
ELS31-V
REVISION 4.3.2.0

follow instructions for Version 2 Firmware.

**Version 1 Firmware - 4.3.1.0c**
In the terminal program, type the command:

```
AT+SQNSCFG=3,3,300,90,600,50
```
followed by the Enter key. The terminal should respond with:

**OK**
This is configuration information for setting up the context in the next step.
In the terminal program, type the command:

```
AT+CGDCONT=3, "IP", "Verizon APN"
```
where **Verizon APN** is the specific APN to connect to for your intended use, followed by the Enter key, and the terminal should respond with:

**OK**
Note: Consult Section 3: APN Setup for help with your Verizon APN.
To verify that the APN was set correctly, type the command:

```
AT+CGDCONT?
```
followed by the Enter key, and the terminal should respond with:

```
+CGDCONT: 3, “IP”, “Verizon APN”
```
as well as the other PDP context information on the device.
To enable this setting, in the terminal program type the command:

```
AT+CGACT=1,3
```
followed by the enter key, and the terminal should respond with:

**OK**
If the AT+CGACT command does not work, the terminal will respond with

**#ERROR**
and further setup may be necessary. Check the signal strength with AT+CSQ to verify the Skywire is getting an acceptable signal. Otherwise, consult the AT Commands Manual for Firmware 4.3.1.0.
Version 2 Firmware

In the terminal program, type the command:

\[
\text{AT+CGDCONT}=3, \text{“IPV4V6”, “Verizon APN”}
\]

where Verizon APN is the specific APN to connect to for your intended use, followed by the Enter key, and the terminal should respond with:

OK

Note: Consult Section 3: APN Setup for help with your Verizon APN.

To verify that the APN was set correctly, type the command:

\[
\text{AT+CGDCONT}?
\]

followed by the Enter key, and the terminal should respond with:

+CGDCONT: 3, “IPV4V6”, “Verizon APN”

as well as the other PDP context information on the device.

To enable this setting, in the terminal program type the command:

\[
\text{AT^SICA}=1,3
\]

followed by the enter key, and the terminal should respond with:

OK

To verify that the APN is correct, type the command:

\[
\text{AT^SICA}?
\]

followed by the enter key, and the terminal should respond with:

^SICA: 1,1
^SICA: 2,0
^SICA: 3,1
^SICA: 4,0
^SICA: 8,0

If the AT^SICA command does not work, the terminal will respond with

#ERROR

or AT^SICA? will respond with:

^SICA: 3,0

Check the signal strength with AT+CSQ to verify the Skywire is getting an acceptable signal. Otherwise, consult the NimbeLink AT Command Manual for Firmware 4.3.2.0.
2.15.4 For AT&T, T-Mobile, and other GSM carriers and the following product models (NL-SW-LTE-WM14):

In the terminal program, type the command:

```
AT%PDNSET=1,"APN","IP"
```

where **APN** is the individual APN for your network, followed by the Enter key, and the terminal program should respond with:

```
OK
```

**Note: Consult Section 3: APN Setup for help with your APN.**

To verify that the APN was set correctly, in the terminal program type the command:

```
AT%PDNSET?
```

followed by the Enter key, and the terminal should respond with:

```
%PDNSET: 1,APN,IP,,,,,0
```

as well as the other PDP context information on the device.

Further setup may be necessary. Check the signal strength with **AT+CSQ** to verify the Skywire is getting an acceptable signal. Otherwise, consult the Telit AT Command Reference Guide for your particular modem.

2.15.5 For NL-SW-LTE-QBG96 Skywires:

In the terminal program, type the following command:

```
AT+CFUN=0
```

The terminal should respond with:

```
OK
```

The above command disables cellular functionality, and deactivates any previously activated PDP contexts. Next, enter the command below to configure the APN:

```
AT+CGDCONT=1,"IPV4V6","APN"
```

Where **APN** is replaced with the individual APN for your network. The terminal program should respond with:

```
OK
```

**Note: Consult Section 3: APN Setup for help with your APN.**

Finally, turn on cellular functionality by issuing the following command:

```
AT+CFUN=1
```

The modem should respond with:

```
OK
```
After turning on cellular functionality, the Skywire will automatically activate the specified PDP context. To confirm that the PDP context has indeed been activated, issue the following command:

```
AT+CGACT?
```

The terminal should respond with:

```
+CGACT: 1,1
```

If the modem responds with the above line, then the PDP context has been successfully activated.

### 2.16 Test Network Communication

The commands to test network communication differ depending on the module you have.

To test these modules:
- NL-SW-1xRTT-A
- NL-SW-1xRTT-S
- NL-SW-1xRTT-V
- NL-SW-EVDO-A
- NL-SW-EVDO-V

follow this procedure:

In the terminal program, type the command:

```
AT+CREG?
```

followed by the Enter key, and the terminal should respond with:

```
+CREG: 0,1 or +CREG: 0,5
```

For all other responses, review network status responses online.

To test these modules:
- NL-SW-GPRS
- NL-SW-HSPA
- NL-SW-HSPA-B
- NL-SW-LTE-TSVG
- NL-SW-LTE-TNAG
- NL-SW-LTE-TEUG

follow this procedure:

In the terminal program, type the command:

```
AT+CGREG?
```

followed by the Enter key, and the terminal should respond with:

```
+CREG: 0,1 or +CREG: 0,5
```

For all other responses, review network status responses online.

To test NL-SW-LTE-GELS3, follow this procedure:
If you recently updated the firmware on your NL-SW-LTE-GELS3, verify that cellular functionality is enabled. To do so, type the following command into the terminal program:

```
AT+CFUN=1
```

followed by the Enter key, and the terminal should respond with:

```
OK
```

Next, in the terminal program, type the command:

```
AT+CEREG?
```

followed by the Enter key. For Firmware 4.3.1.0c, the terminal should respond with:

```
+CEREG: 2, 1, xxxx, yyyyyyy, z
```

For Firmware 4.3.2.0, the terminal should respond with:

```
+CEREG: 0,1 or +CEREG: 0,5
```

For all other responses, review network status responses online in your respective AT Commands Manual.

To test NL-SW-LTE-WM14, follow this procedure:

In the terminal program, type the command:

```
AT+CEREG?
```

followed by the Enter key, and the terminal should respond with:

```
+CEREG: 2, 1, xxxx, yyyyyyy, z
```

For all other responses, review network status responses online in your respective AT Commands Manual.

**For NL-SW-LTE-QBG96 Skywire Modems:**

In the terminal program, issue the following command:

```
AT+CEREG?
```

The modem should respond with:

```
+CEREG: x,1
```

Where `x` indicates the state of the `+CEREG` unsolicited response code, and `1` indicates that the modem is registered to the home network. The modem may also respond with:

```
+CEREG: x,5
```

Which indicates that the modem is registered, and roaming on the cellular network. For all other responses, review network status responses online in your respective AT Commands Manual.

For information on the `+CEREG` URC, please refer to the AT command manual on the QBG96 product page.

Reset power, and repeat steps 2.5 through 2.15 (as applicable) before moving on to Section 4.
3. APN Setup

3.1 Introduction

GSM and LTE-based Skywire modems can be setup to use different APNs. For Skywires that use AT&T and T-Mobile service, the correct APN is often needed to register on the network and pass data. For Verizon Skywires, it may be beneficial to use a setup that necessitates using a different APN.

3.2 Common Verizon APNs

The most common reason for needing a different APN is because you are using a particular IP address type.

If you activated your Skywire modem on https://go.nimbelink.com, it uses a Private IP address and the APN:

**NIMBLINK.GW12.VZWENTP**

If you have changed your IP address type to a Public Dynamic IP address, the APN will be:

**VZWINTERNET**

Finally, if you have changed your IP address type to a Public Static IP address, the APN is most likely:

**MW01.VZWINTERNET**

However, it may be different depending on your location.

For changing your IP address type, or to get your APN, please contact us at product.support@nimbelink.com.

Please include the following information:

- IMEI of your Skywire modem
- Model of your Skywire modem
- SIM ID of your SIM card

If you activated your service for your Skywire from Verizon directly or another carrier, please contact your representative at that company for the APN you should use.

3.2 Common AT&T/T-Mobile APNs

Cellular carries based on AT&T and T-Mobile service requires using a unique APN to register on the network and pass data.

If you activated your Skywire modem on https://go.nimbelink.com, here are the following APNs to use:

**AT&T Service**

**10569.mcs**
If you activated your service for your Skywire from AT&T or T-Mobile directly or another carrier, please contact your representative at that company for the APN you should use.

4. Common Next Steps

Once the network setup and testing is complete, you are ready to start developing with your Skywire modem. Common application examples include sending and receiving SMS messages, FTP file transfer, TCP/UDP packets, and using the modem with an external microcontroller, such as an Arduino. Please consult these application notes on the Skywire Development Kit page (http://nimbelink.com/skywire-development-kit/) or your Skywire-specific page for specific examples of each type of operation.