

Skywire[®] CAT4 LTE Modem Windows Networking Guide

NimbeLink Corp

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1. Introduction

1.1 Overview

This application note describes how to use a NimbeLink CAT4 LTE Skywire to establish an Ethernet over USB connection on a Windows host device.

Windows 8/10 users can use MBIM protocol. See [Section 2](#) for details.

1.2 Orderable Part Numbers

Orderable Device	Cellular Carrier	Network Type
NL-SW-LTE-TC4NAG	AT&T, Verizon	LTE, 3G
NL-SW-LTE-TC4EU	EU Carriers	LTE, 3G, 2G
NL-SWDK	Any	Any

2. MBIM on Windows 8/10

2.1 Overview

The Mobile Broadband Interface Model (MBIM) is a networking protocol created by the USB Implementers Forum, and is designed for USB-capable networking solutions, such as cellular modems. MBIM protocol allows a Skywire modem to serve as an Ethernet over USB Internet connection for a host device running a Windows 8/10 OS.

Note: MBIM mode only supports Windows 8/10 operating systems. Windows 7 users must use RNDIS in order to implement an Ethernet over USB connection.

2.2 Skywire Configuration Procedure

2.2.1 Install Drivers

First, install the most recent Windows drivers for the Skywire. These drivers are located at the following link, and are applicable to both NL-SW-LTE-TC4NAG and NL-SW-LTE-TC4EU Skywire modems:

https://nimbelink.com/Documentation/Skywire/4G_LTE_Cat_4_Telit/Telit_Windows_Desktop_Drivers_Installer_1.10.0002.zip

2.2.2 Preliminary Skywire Setup

Ensure that the modem has an activated SIM card inserted into the SIM slot, or that the modem's soldered-down SIM is active (NL-SW-LTE-TC4NAG modems only).

Power on the modem and allow it to boot up. Open a terminal emulator on the Windows 8/10 host machine, and connect it to the modem's serial or USB interface.

- **SWDK Users:** Refer to the SWDK user manual for detailed setup instructions:

https://nimbelink.com/Documentation/Development_Kits/NL-SWDK/30005_NL-SWDK_UserManual.pdf

- **NL-SW-LTE-TC4NAG Users:** Ensure that the active firmware image corresponds to the SIM card in use. Section 3.9 of the NL-SW-LTE-TC4NAG datasheet contains information regarding the dual image firmware:

https://nimbelink.com/Documentation/Skywire/4G_LTE_Cat_4_Telit/1002147_NL-SW-LTE-TC4NAG_Datasheet.pdf

2.2.3 Configure the USB Interface Composition

Verify that the modem is responsive by issuing:

AT

The modem will respond with:

OK

Before using MBIM protocol, the composition of the modem's USB interface must be altered in order to provide the proper USB ports to the Windows host PC. To check the current composition of the USB interface, send the following command to the modem:

AT#USBCFG?

The modem will respond with something similar to:

#USBCFG: x

If the result code returned by the modem is "**#USBCFG: 2**", then the USB interface is already configured properly.

However, if it is not set to the above mode, then the USB configuration must be set. To do this, issue the following command:

AT#USBCFG=2

The modem will respond with "**OK**" and then reboot.

Note: If the modem's USB path was being used to send AT commands, this port will unenumerate on the host PC when the modem reboots. After the modem finishes rebooting, reconnect to the modem's USB interface to continue.

Once the AT interface is responsive again, verify that the correct setting has been applied:

AT#USBCFG?

The modem should respond with the following if the USB configuration was set properly:

#USBCFG: 2

Once the correct USB composition has been selected, continue with the MBIM setup procedure.

Note: For further information regarding the "#USBCFG" command, please refer to the AT command manual for the chosen modem:

NL-SW-LTE-TC4NAG Modems:

https://nimbelink.com/Documentation/Skywire/4G_LTE_Cat_4_Telit/Telit_LE910Cx_A_T_Commands_Reference_Guide_r2.pdf

NL-SW-LTE-TC4EU Modems:

https://nimbelink.com/Documentation/Skywire/4G_LTE_Cat_4_Telit/Telit-LE910-V2-A-T-Commands-r6.pdf

2.2.4 Configure the PDP Context

A PDP context must be set on the modem before using MBIM protocol. To do so, issue one of the following commands depending on the modem and firmware:

AT+CGDCONT=1,"IPV4V6", "[APN]" // TC4EU, TC4NAG: AT&T FW image

AT+CGDCONT=3,"IPV4V6", "[APN]" // TC4NAG: Verizon FW image

Where "[APN]" is replaced with the APN that corresponds to the SIM card that will be used for the cellular connection. The terminal should respond with "OK".

Issue the following AT command to ensure that the PDP context was set as intended:

AT+CGDCONT?

In the response from the modem to the above command, verify that the APN and PDP context have been set correctly.

2.2.5 Enable and Verify Cellular Functionality

Ensure that the modem has its cellular functionality enabled. Issue this command:

```
AT+CFUN=1
```

The modem should respond with "OK", and cellular functionality will now be enabled.

2.2.6 Query the Cellular Signal Strength

To verify that everything is working as it should be, query the cellular signal strength seen by the modem. Enter the following command:

```
AT+CSQ
```

The modem will respond with something similar to "+CSQ: x,y", where "x" and "y" are replaced with positive integer values that represent an encoding for the RSSI and RSRQ of the modem, respectively.

- If the modem is receiving a valid cellular signal, the value of "x" will be between 0 and 31, and the value of "y" will be between 0 and 7.
- If the modem is not receiving a cellular signal (or can't determine if it is) the response to the signal strength query will be: "+CSQ: 99,99".
 - In this case, verify that the hardware is set up properly, and that cellular functionality has been enabled. Then try the "AT+CSQ" command again.
- See the AT command manual for translations from the reported integer values to units of "dBm" for RSSI, and "dB" RSRQ.

2.2.7 Connect the Modem's USB Interface

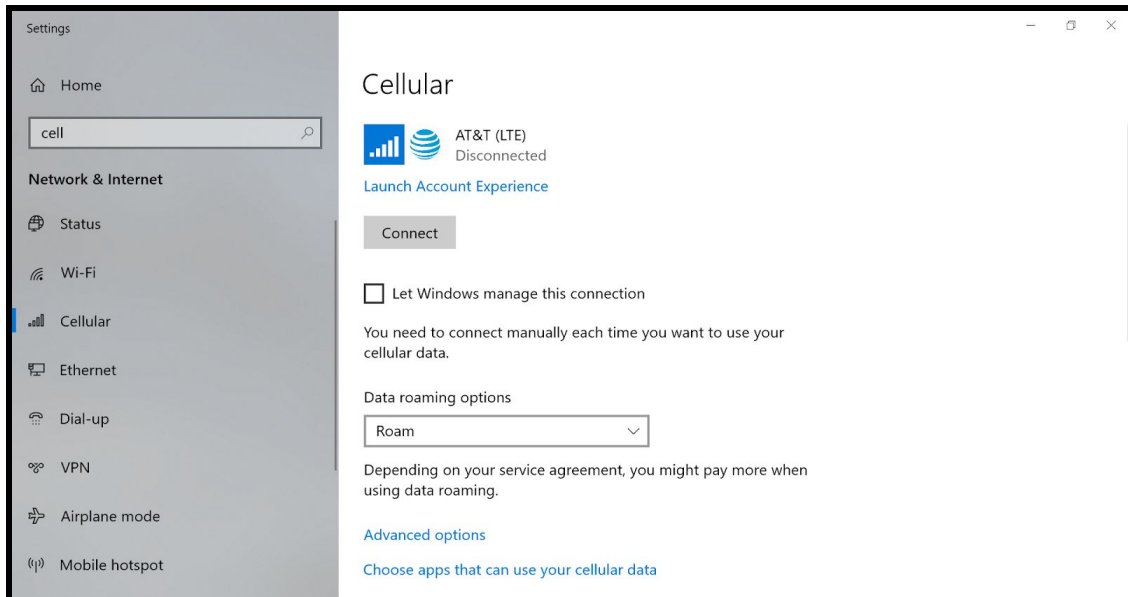
As mentioned previously, MBIM protocol can only be used over USB. Connect the modem's USB interface to the Windows 8/10 host machine if it is not already connected.

SWDK Users: *The modem's USB port can be connected to the host PC by inserting a mini USB cable to SWDK port, J5.*

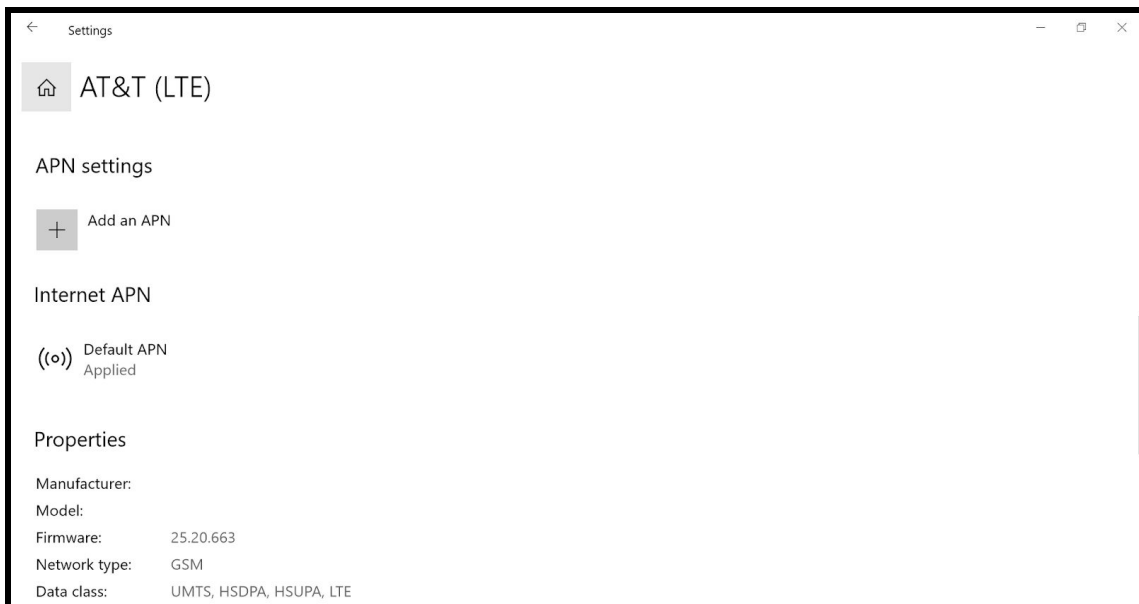
2.3 Windows Settings Configuration Procedure

After completing each of the steps in [Section 2.2](#), the modem is now set up to use MBIM protocol for the Ethernet to USB connection. The next step is to configure the Windows Cellular settings.

Press the Windows key, and search for: "*Change cellular settings*". In the search menu, click on the result with the same name. The window that opens should look like:



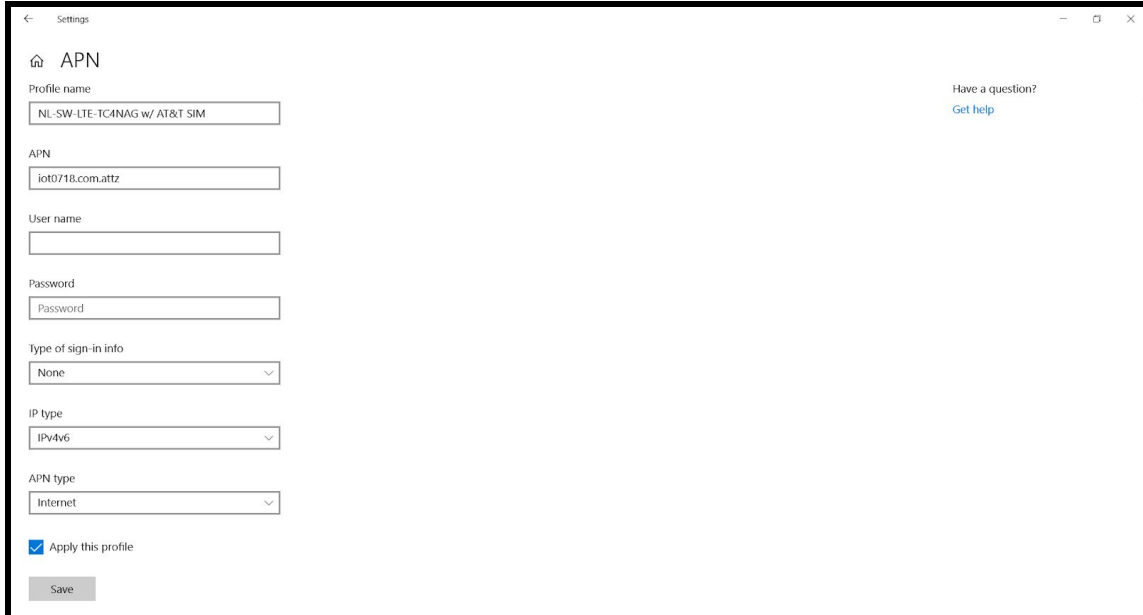
If the box that says *"Let Windows manage this connection"* is checked, uncheck it. Then click on the link that says *"Advanced options"*. A new window will open that looks something like this:



Contained within this window is some information about the modem, including: IMSI, IMEI, manufacturer information, firmware revision, etc. There is also a setting for the APN that will be used for the cellular connection.

Note: *The APN and IP Type settings (e.g. IP vs. IPV4V6 vs. IPV6) in the Windows Cellular settings must match the settings that were configured on the modem in [Section 2.2.4](#). Failure to do so can result in the MBIM session failing when it is started.*

To configure the APN for the connection, click the button that says: "Add an APN". This will open a new window that looks something like this:



Populate each of the fields in this new window according to the instructions below. A sample configuration profile for an NL-SW-LTE-TC4NAG modem with an AT&T SIM is filled out in the image above:

- Enter a memorable name in the "Profile name" field so that the APN profile is easy to distinguish from any other profiles.
- In the "APN" field, enter the same APN that was provided to the Skywire when setting the PDP context in [Section 2.2.4](#)
- If a username and password is required for the APN, add it accordingly.
- The "IP Type" field should be set to the same selection made when configuring the modem's PDP context.
 - It is recommended to set this parameter to "IPV4V6" on both the modem and in the Windows settings.
- The APN type will usually default to "Internet".
 - Try the connection with "APN type" set to "Internet" first, but experiment with the other settings if this does not work.

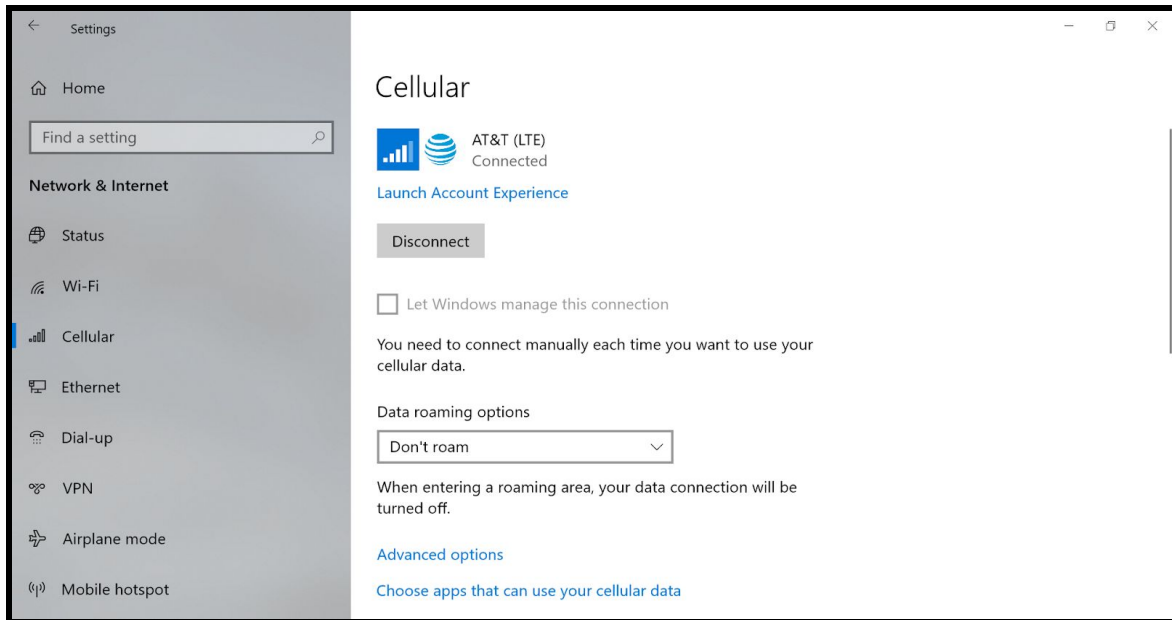
After all of the relevant fields have been filled out, check the box that says "Apply this profile", and press the grey button that says "Save" to save the configuration.

Navigate back to the top level of the Windows Cellular Settings menu by pressing the back arrow in the top left corner of the current window twice.

2.4 Test the Internet Connection

First, ensure that all other sources of Internet connectivity are disabled. Remove any LAN cables from the PC, and disable Wi-Fi in the Windows settings.

To enable the cellular connection, press the button that says "Connect" at the top level of the Windows Cellular Settings. The menu should look something like this:



To test the connection, open a Windows Command Prompt by pressing the Windows key, and searching for "cmd". Test the connection by pinging Google's DNS server:

```
ping 8.8.8.8
```

If the MBIM connection is functioning properly, the Command Prompt window should look something like this:

```
Administrator: Command Prompt
C:\Windows\system32>ping 8.8.8.8

Pinging 8.8.8.8 with 32 bytes of data:
Reply from 8.8.8.8: bytes=32 time=237ms TTL=55
Reply from 8.8.8.8: bytes=32 time=111ms TTL=55
Reply from 8.8.8.8: bytes=32 time=143ms TTL=55
Reply from 8.8.8.8: bytes=32 time=135ms TTL=55

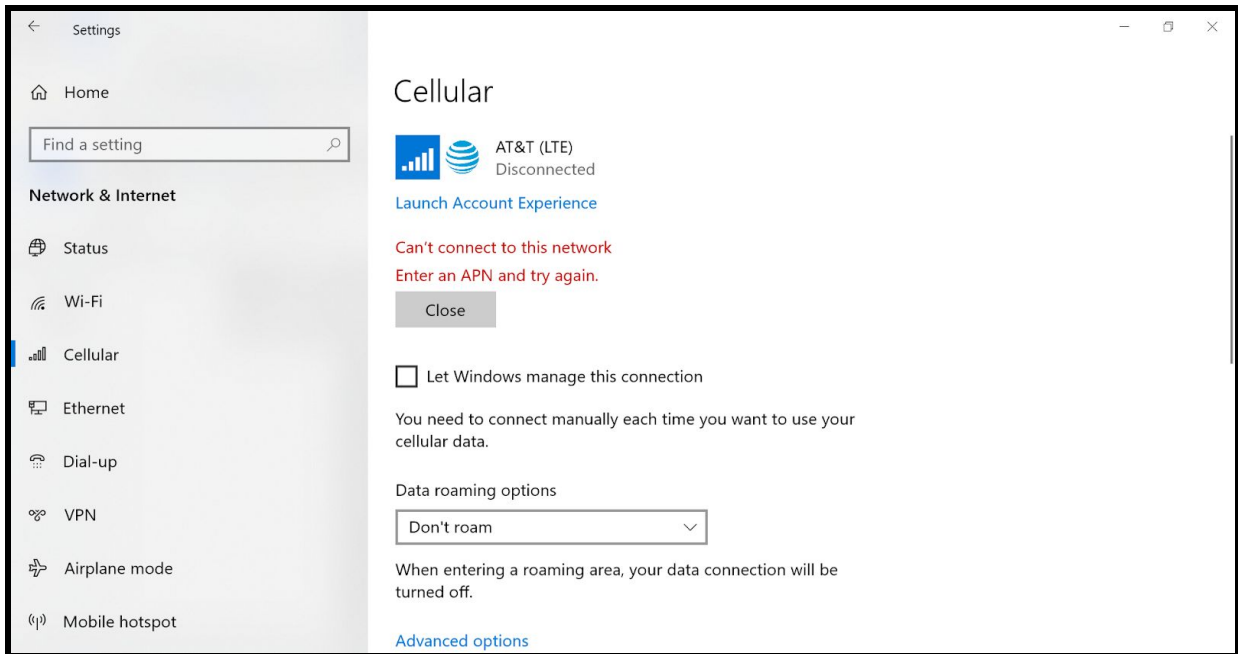
Ping statistics for 8.8.8.8:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 111ms, Maximum = 237ms, Average = 156ms

C:\Windows\system32>
```

2.5 Troubleshooting

Section 2.5 contains some solutions for common difficulties that may arise during the MBIM setup procedure:

If the connection fails with the error message shown below:



This issue is usually caused by one of two things:

1. The user has not entered a custom APN setting.
 - a. Follow the instructions in [Section 2.4](#) to add an APN setting for the connection.
2. The modem has an active PDP context.
 - a. If the modem's PDP context has been activated with the "AT#SGACT" command, the above error message will be received.
 - b. To fix this, simply deactivate the PDP context on the modem using one of the following commands:

```
AT#SGACT=1,0 // TC4EU, TC4NAG: AT&T FW image
```

```
AT#SGACT=3,0 // TC4NAG: Verizon FW image
```