NimbeLink-EVK User Manual

Application Note

Legal Notices

Document Revision History

Revision	Date	Description
1	September 2018	First edition of the Nimbelink GM01Q/NB01Q EVK
2	August 2019	Second edition of the Nimbelink GM01Q/NB01Q EVK

Note: Nimbelink-EVK can be used with modules GM01Q (FCC-IDs 2AAGMGM01Q or 2AAGMGM01QA) and NB01Q (FCC-ID 2AAGMNB01Q1).

Referenced Documents

	Revision	Date	Document Name	Document Title

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Regulatory Information USA

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Labelling Requirements for the Host Device

The host device shall be properly labelled to identify the modules within the host device. The certification label of the module shall be clearly visible at all times when installed in the host device, otherwise the host device must be labelled to display the FCC ID of the module, preceded by the words "Contains transmitter module", or the word "Contains", or similar wording expressing the same meaning, as follows:

Contains FCC ID: 2AAGMNB01Q1

Permitted Antenna

This radio transmitter has been approved by the FCC to operate with the antenna types listed below with the maximum permissible gain indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Interface and frequency range	Type	Max Gain
LTE NB-IoT bands 2	antenna type	X dBi
LTE NB-IoT bands 4	antenna type	X dBi
LTE NB-IoT bands 5	antenna type	X dBi
LTE NB-IoT bands 12	antenna type	X dBi
LTE NB-IoT bands 13	antenna type	X dBi

RF exposure safety

This device complies with FCC RF exposure limits and has been evaluated in compliance with **mobile** exposure conditions.

The antenna must be installed and operated with minimum distance of 20 cm between the radiator and your body.

Class B device notice

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:
    —Reorient or relocate the receiving antenna.
    —Increase the separation between the equipment and receiver.
    —Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

—Consult the dealer or an experienced radio/TV technician for help.

Considerations for the integrator

Information on test modes and additional testing requirements

The module has been evaluated in mobile stand-alone conditions. For different operational conditions from a stand-alone modular transmitter in a host (multiple, simultaneously transmitting modules or other transmitters in a host), additional testing may be required (collocation, retesting…)

If this module is intended for use in a portable device, you are responsible for separate approval to satisfy the SAR requirements of FCC Part 2.1093 and IC RSS-102.

Additional testing, Part 15 Subpart B disclaimer

The modular transmitter is only FCC authorized for the specific rule parts (i.e., FCC transmitter rules) listed on the grant, and that the host product manufacturer is responsible for compliance to any other FCC rules that apply to the host not covered by the modular transmitter grant of certification. If the grantee markets their product as being Part 15 Subpart B compliant (when it also contains unintentional-radiator digital circuity), then the grantee shall provide a notice stating that the final host product still requires Part 15 Subpart B compliance testing with the modular transmitter installed. The end product with an embedded module may also need to pass the FCC Part 15 unintentional emission testing requirements and be properly authorized per FCC Part 15.

1. Introduction

This document provides an overview of the NimbeLink test kit, its basic installation procedures and a quick startup reference.

2. Test Kit Presentation

2.1. Test Kit Contents

Out of the box, the Test Kit is delivered with

- Test Boards: Cellular Modem Development Kit (1) and Nimbelink Skywire® cat-M1 modem (2) based on Sequans GM01Q/NB01Q module
- 5V Power Supply (3)
- One antenna Taoglass (4)
- One USB-MiniUSB cable (5)
- Note: cat-M1 SIM card is NOT delivered as part of the Test Kit.

2.2. Test Kit Software dependencies

The test kit requires external Software to help you performing some operations

- **Mandatory**
  - **Serial Terminal Emulator** under Windows, necessary to interact with the Test Kit through AT Commands. In the example used in this document the examples are using Tera Term Software
- **Optional**
  - **Sequans Point-to-Point Protocol Software** bridge allowing you to send data over PPP to the network –com2ppp- Installing and configuring this Software will declare your Test Kit as modem on your PC
    - When you need to send data from your PC to the network through standard tools, you need to install and use com2ppp Software tool
    - Please refer to Com2ppp installation paragraph

  - **Sequans Debug and Monitoring Tool** –DM Tool-
    - This tool can allow you accessing advanced LTE information while operating the Test Kit
    - Its usage is not mandatory for regular Modem operations
    - Please refer to the DM introduction paragraph

  - **Sequans Software Upgrade** –SFU-
    - When you are invited by Sequans to change the Software version on your Test Kit, you need to install and use this Software tool.
    - Please refer to the SFU introduction paragraph

You can access all the above optional Software tools through your contact at Sequans

2.3. Hardware setup

Carefully snap out the 3FF SIM card size from the SIM card carrier, and insert it into your Skywire modem. The pads on the SIM card should face the pins on the SIM cage, and the keyed corner will go in as shown below:
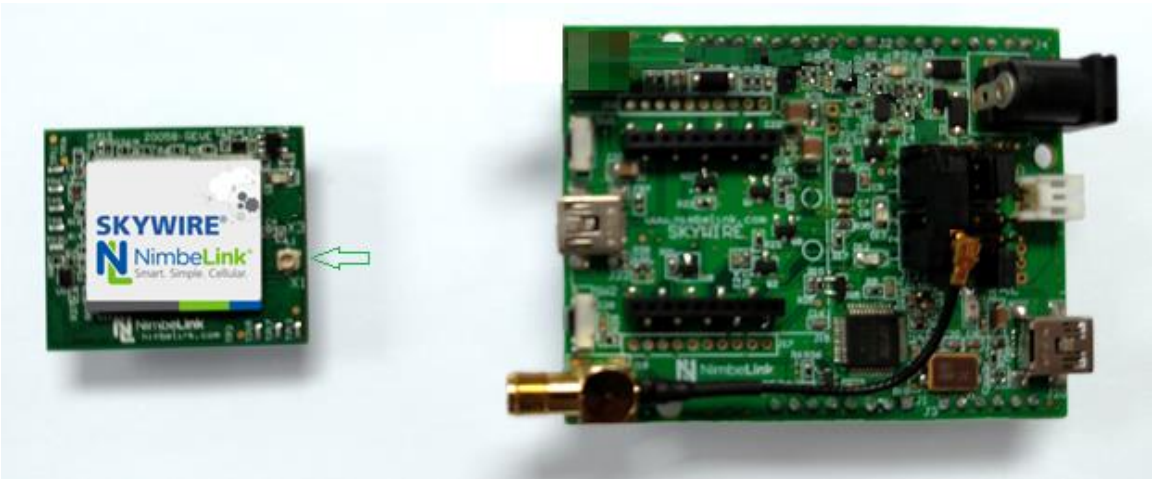

Insert the SIM card into the Skywire

Install the Skywire as shown below. The small circle (with green arrow) on the Skywire modem shows the proper orientation of the U.FL connectors on the Skywire:

Please verify that the installation of the Skywire is correct. If it is installed 180 degrees from the proper orientation, or if the Skywire is installed one pin off, it will damage the Skywire modem when power is applied. This voids the warranty of the evaluation kit.

Attach the antenna cables to the Skywire.

Note: when removing antenna cables from the Skywire, use a U.FL removal tool.

Here is a picture of the fully-installed Test Kit:

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Install the antenna to SMA connector J18 by screwing on the antenna. Make note not to cross-thread the antenna:

Bend the antenna connector so it is pointing vertically. Below is a side view of the installed antenna.
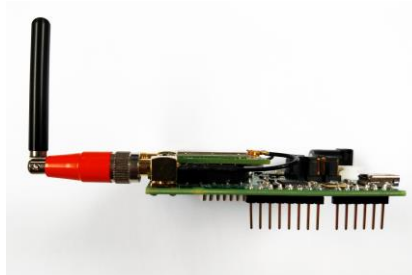
 Note : The board is not powered through USB cable.
It will not work if you do not plug the main power supply

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3. Getting Started

3.1. Board Preparation

- Connect the Antenna or your SMA RF Cable to the board LTE RF Connector
- Insert your 3FF SIM Card in the SIM slot.
- Plug the mini-USB cable from your PC to the board USB **Port A**

3.2. Drivers installation

- When you plug the USB connector for the first time in your PC, you need to wait for about one minute, the time to allow the drivers to be auto-installed on windows.
- The USB is used to power the board. It also connects the on-board UART-USB bridge IC to provide ACM interfaces (virtual COM) in order to access the board through UART.
- You should see a window popping up with the following information
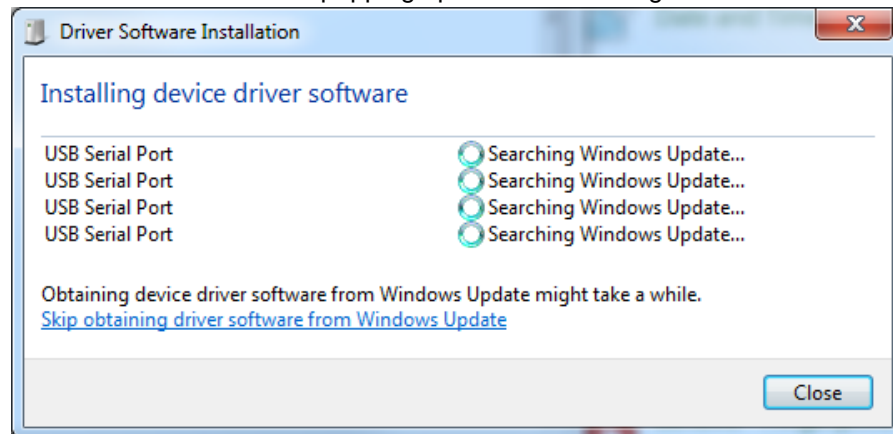
- If for some reasons, the driver fails to auto-install on windows, you can always install them manually from http://www.ftdichip.com/Drivers/VCP.htm FTDI driver labelled UART/USB
- After driver installation, it is safer to unplug the Test Kit and reboot your PC.

3.3. Verifying your installation

- After completing the drivers installation, whenever you plug the USB cable you should be able to see the following, under Windows Control Panel, Device Manager.
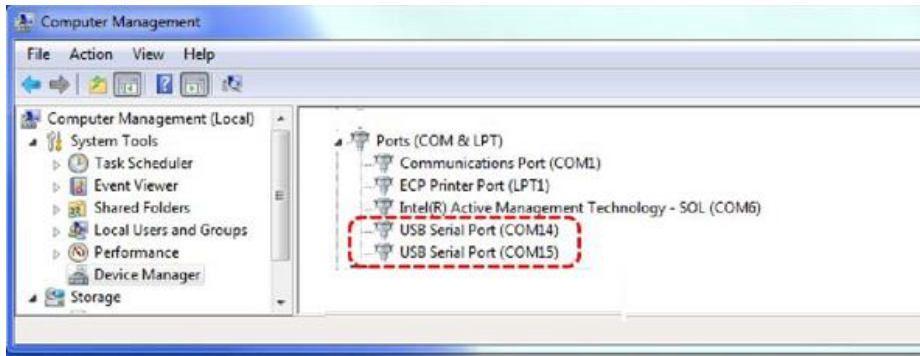
- Indeed, port enumeration can be different on your PC from the given example, depending on your local settings (example COM23, COM24…)

3.4. Overview of the COM ports

- The following table summarizes the COM ports under Windows and their mapping and configuration to the KIT

| Port Enumeration	Sequans Mapping	Usage	Baudrate	Data Bits	Flow Control	Parity	Stop
COMa ex COM14	UART 0	AT Command Data over PPP SFU	921600	8	Hardware	None	1
COMb ex COM15	UART 1	KIT Console	115200	8	None	None	1

COM ports overview Table

Note : COM ports cannot be shared between two different applications in the same time. One of the applications will be in error

## 3.5. Configuring and Verifying installed COM ports

- After COM drivers are installed, open the Windows device manager, expand Ports (COM&LPT) label and click on each one of the USB Serial Port (COMx), tab Port Settings and enter the appropriate values as described in the COM ports overview Table.
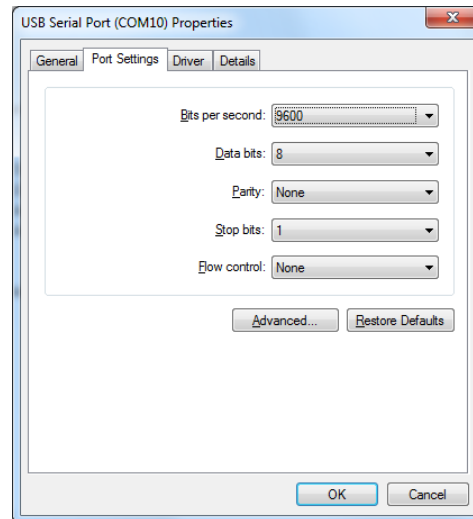

4. Using the Test Kit

4.1. AT Commands

- The Test Kit configuration and usage is all being done through AT Commands
- In order to send AT Commands to the test Kit, you need to use a Serial Terminal program under Windows. Example, TeraTerm freeware.
- To send an AT command to the kit, you need to connect your Serial Terminal to the "UART 1" port, corresponding to COMc on Windows enumeration –please refer to the table in 3.4 to determine the exact COM port on your PC
- Configure the correct Baudrate 921600 and the other settings in the terminal.
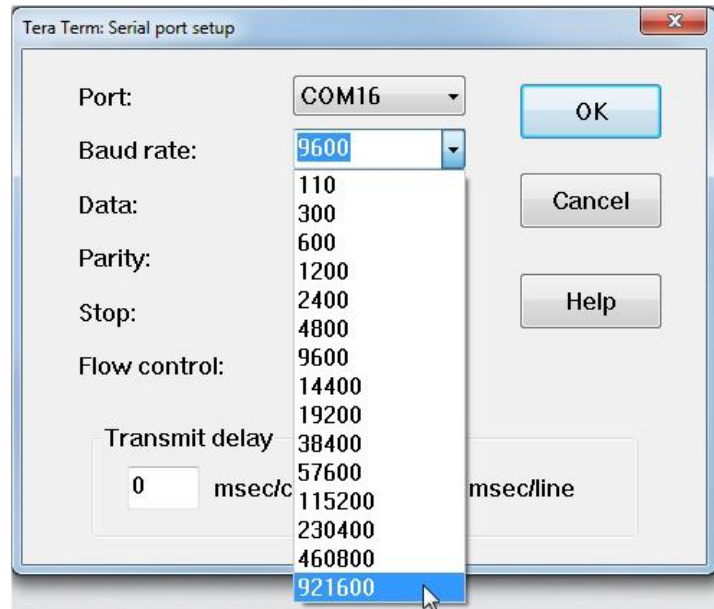
- Once the correct setting is done, you should be able to start sending AT Commands and receiving their corresponding output.
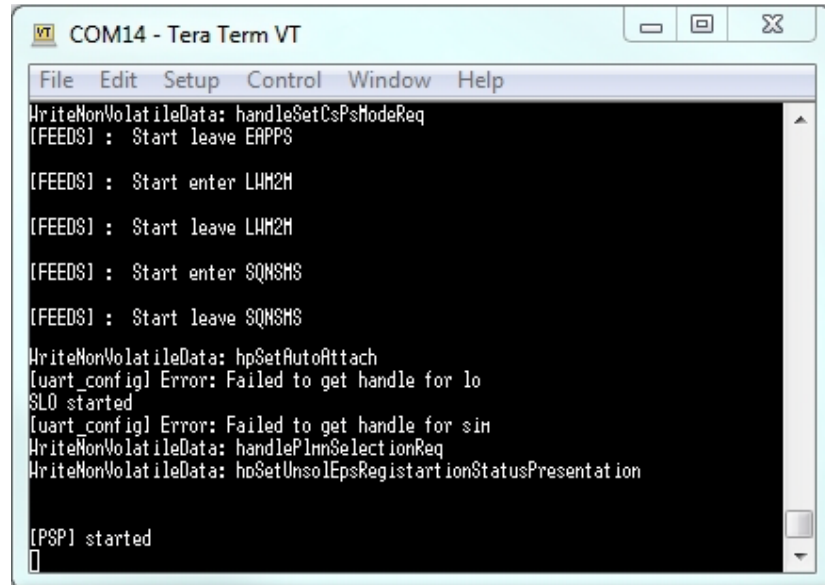- You can start with ATE1 to enable the echo for the current session
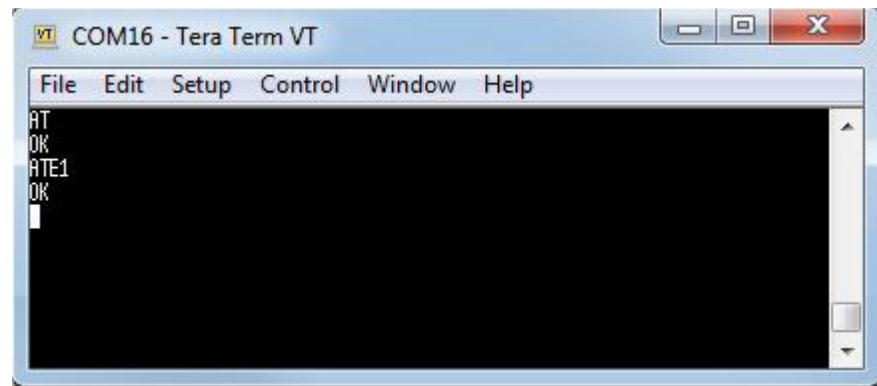
AT Command Window

- **Note** : Upon request, your contact at Sequans can deliver you the latest version of the AT Command Reference Manual, which describe the complete list of AT commands supported by GM01Q/NB01Q Module firmware.

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4.2. Console Terminal

- Connecting a Serial terminal to the COM port mapped on UART 2 of the Test Kit, will allow you to access to the Test Kit Console. The Console is a maintenance window, not necessary for regular operations, however it is useful to have it during maintenance phases, such Firmware upgrade or to observe the boot messages after hitting the reset button.

Console Window

4.3. Connecting the Kit to a network

- If you have access to a Cat-M 4G network or simulator
  - Connect the RF cable or the Antenna in the RF port of the Kit
  - Insert your SIM card in the SIM slot –cf Board Preparation-
  - To check the SIM card state,
    - From the terminal, enter AT+CPIN?
    - Response will be
      - +CPIN: <*code*>
        - <*code*> = Ready : SIM card is present and unlocked

        - <*code*>=SIM PIN : Modem is waiting SIM PIN to be entered

        - <*code*>= SIM PUK : Modem is waiting SIM PUK to be given

      - or ERROR, when SIM is not inserted or not detected

- o From the Terminal, enter : AT+CEREG=1.
  - This command will allow getting notification every time there is a change of the network registration status
- o From the Terminal, enter : AT+CFUN=1
- o Response will be
  - OK
  - Followed by
    - +CEREG=<*stat*>
      - o <*stat*>=**0** : Modem is not registered and is not currently searching an operator to register to.
        - Possible cause : SIM card error or registration ongoing

      - o <*stat*>=**1** : Modem is registered on network –Kit connected-

      - o <*stat*>=**2** : Modem is not registered, but is currently trying to attach or is searching for an operator to register to.
        - Possible causes:
          - No network available
          - Available networks have bad coverage
          - PLMN available but the registration is rejected

      - o <*stat*>= **3** : Registration denied
        - Possible causes:
          - Illegal mobile equipment
          - IMSI unknown at HLR
          - PLMN not allowed
          - Location area not allowed
          - Roaming not allowed in this location area
          - Network failure
          - Network congestion

      - o <*stat*>= **4** : Unknown. Transitory value

      - o <*stat*>= **5** : Modem Registered in roaming mode

4.4. Checking the Signal Strength

- When your Kit is connected to a network, you can check the signal strength and characteristics through the following AT Command
  - AT+CSQ
  - Response will be

    +CSQ:<***rssi***>,<***ber***>

    where <rssi> represents the signal strength at the antenna and <ber> is the bit error rate in %.

<rssi> Conversion Table

<rssi> Parameter	Signal Description with RSSI Value Range
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	Unknown or not detectable

<ber> Conversion Table

<ber> Parameter	Bit Error Rate (in %)
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	Unknown or not detectable

4.5. Sending Data through the Test Kit

- When your Kit is connected to a network, you can send and receive data through it to the network
- To perform this operation, you need to create the modem interface and establish a PPP connection between the Windows host and the Kit.
- A sequans tool labelled ***sqncom2ppp*** needs to be installed and some configurations are needed.

4.5.1. Sqncom2ppp installation procedure

- Ask your contact at Sequans to deliver you the latest SW version of com2ppp
  - Example **com2ppp_setup_1.1-6.exe**
- Run this application
- You will be guided through the following windows

- At this stage, SqnCom2PPP is installed on your PC

4.5.2. Creating the PPP connection

- After Sqncom2PPP installation, the first time you use PPP, you need to do the following:
  Open a CMD Command Prompt in Windows and Run it as administrator
  Change directory to the default installation directory
  - o C:\Program Files (x86)\Sequans Communications\com2ppp

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- From this location you can run the sqncom2ppp program.

  usage:

  sqncom2ppp [-h] {list,create,connect,disconnect,remove}.

  commands:

list	list all COM ports available.
create	configure COM port.
connect	configure COM port and establish connection.
disconnect	find establish PPP connection and terminate it.
remove	destroy PPP interface.

  optional arguments:

  -h, --help show this help message and exit.

- Create the Modem interface, by typing
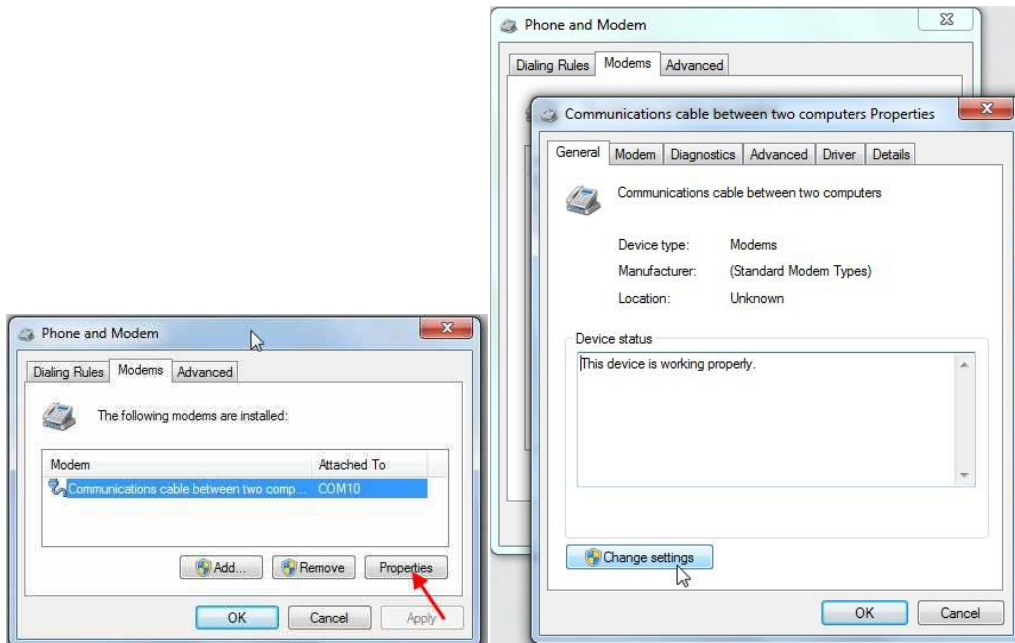
  sqncom2ppp create *COMxx*

  COMxx is one of the COM ports associated to the Test Kit.
  You can use the one associated to AT Commands or to DM Tools

- Configure the Modem interface - the first time you use PPP-

  Open Windows Control Panel, section Phone and Modem. Click on
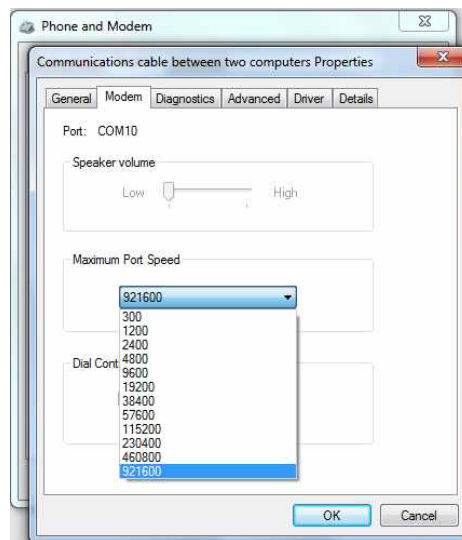 Modems tab. You can see the new modem in the list.
  Then click on Change Settings

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In the Modem tab, set the correct Baudrade as indicated in the **COM ports overview Table**

At this stage, you must **reboot** your computer, in order to take those settings into account.

4.5.3. Running a data session over PPP

In the current example, we consider that AT command is mapped on COM10
We also consider that earlier, you already created the **Modem interface** and also mapped it on COM10

Start the terminal process and connect it to COM10
Then type :

AT+CFUN=1

Wait for the Kit to connect to the network
Please refer to Connecting the Kit to a network Paragraph for more information.

AT+CGDATA="PPP",1,1

This will create the PPP connection
If everything went well, you should get an OK answer.
–otherwise, something went wrong and it needs to be fixed before moving further.

Once you passed the OK stage in response to AT+CGDATA, then you should <u>**disconnect**</u> the serial terminal from COM10.

After this step, from the CMD terminal, run the following command to establish the PPP connection.

sqncom2ppp.exe connect COM10

If you are hitting the following error, you need to check that the COM port configuration is correct, and no other process is using the same COM port.

Typically in the previous example, we decided to use the same COM port for the AT command terminal and for the PPP application. For instance, omitting to disconnect the terminal will block the PPP process from succeeding.
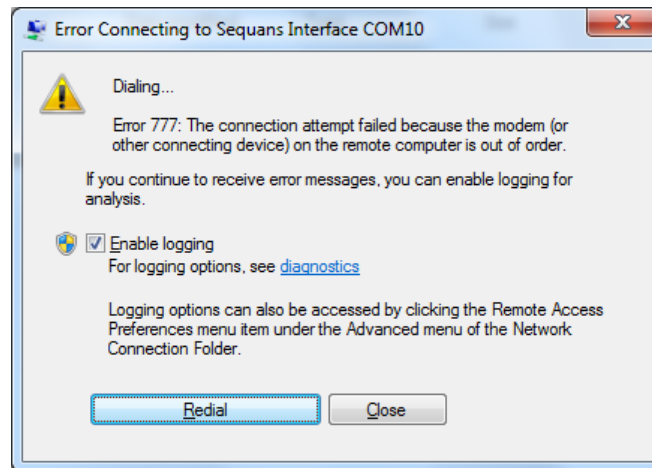

If this step succeeds, you should see the PPP connection among other existing connections, through **ipconfig** command and you should be able to use it.
As long as you do not remove this PPP connection, you should be able to use it on this PC every time you connect the Test Kit.

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5. Firmware Upgrade

5.1. Firmware Upgrade Introduction

- The Test Kit you receive is normally loaded with up to date Software and it is ready to work. However, your support at Sequans may ask you to upgrade the default software for some reasons at any time.
- To upgrade your kit you need to get from Sequans
  - The **S**equans **F**irmware **U**pgrade Tool
    - *sfu_1.1-xxx*
  - The SFU User Manual
    - *Monarch_SFU_UserGuide-RevX.pdf*
    - The new Firmware to upload on the Test Kit, it is a file with the .dup extension, example
      - *GM01M-REV3_B2B3B4B8B12B20_BBA1-RFA3-SKY6800131_LR5.1.1.0-34234.dup*

- The first time you use SFU, you need to install it on your PC
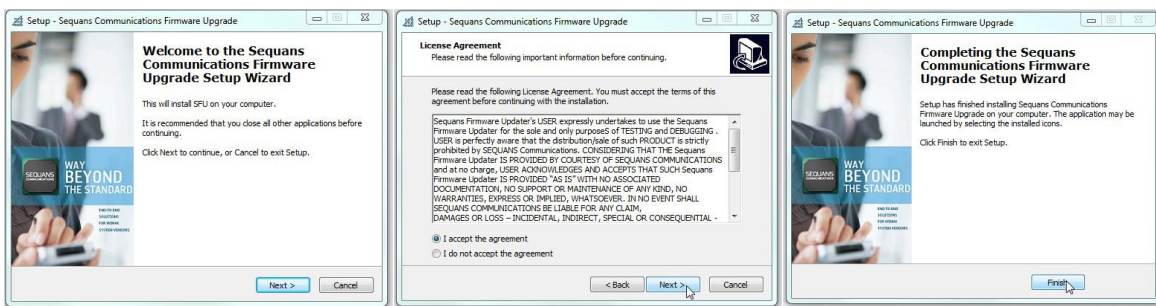
Please note that SFU program operates on "*UART 1*". Refer to **COM ports overview Table** to map it for your setup.

5.2. Upgrading the Test Kit

- For detailed SFU Usage, please refer to the SFU User Manual document.
- **Typical upgrade** operation :
  - Connect a console to the COM associated to UART
  - Open a CMD in Administrator mode
  - Change the working directory to SFU installation directory
  - Run the following command
  - *sfu upgrade -b 921600 -z 2 COM## <xxxxxxxxxxxxxxx.dup>*
    - COM## is your COM port associated to *UART 1*
   - *xxxxxxxxxxxxxxx.dup* file is the new Firmware to upgrade

6. DM Tool

6.1. DM Tool Introduction

- Most of the operations on the Modem can be run through AT Commands.
- However, DM Tool can allow you performing deep Monitoring and Debugging your Test sessions
- When you are invited to Use DM tool, you need to have access to the following deliverables from your Sequans support :
  - ○ *DM Tool Installation Program (`sqn4gdm_setup_1.x-xxx.exe`)*
    - ▪ Basic DM documentations are embedded in the tool itself, through the help Menu
  - ○ *TroubleShooting for DM* Document

6.2. DM Tool Installation

- Run the Installation program on your PC and you will go through the following windows.
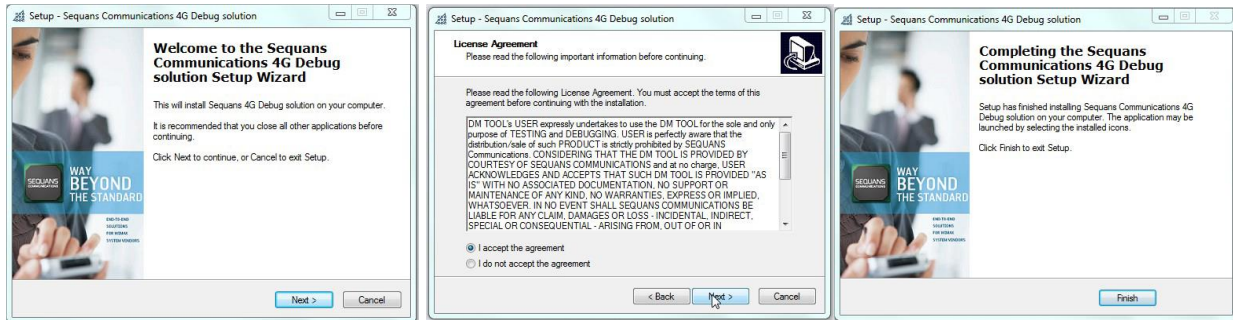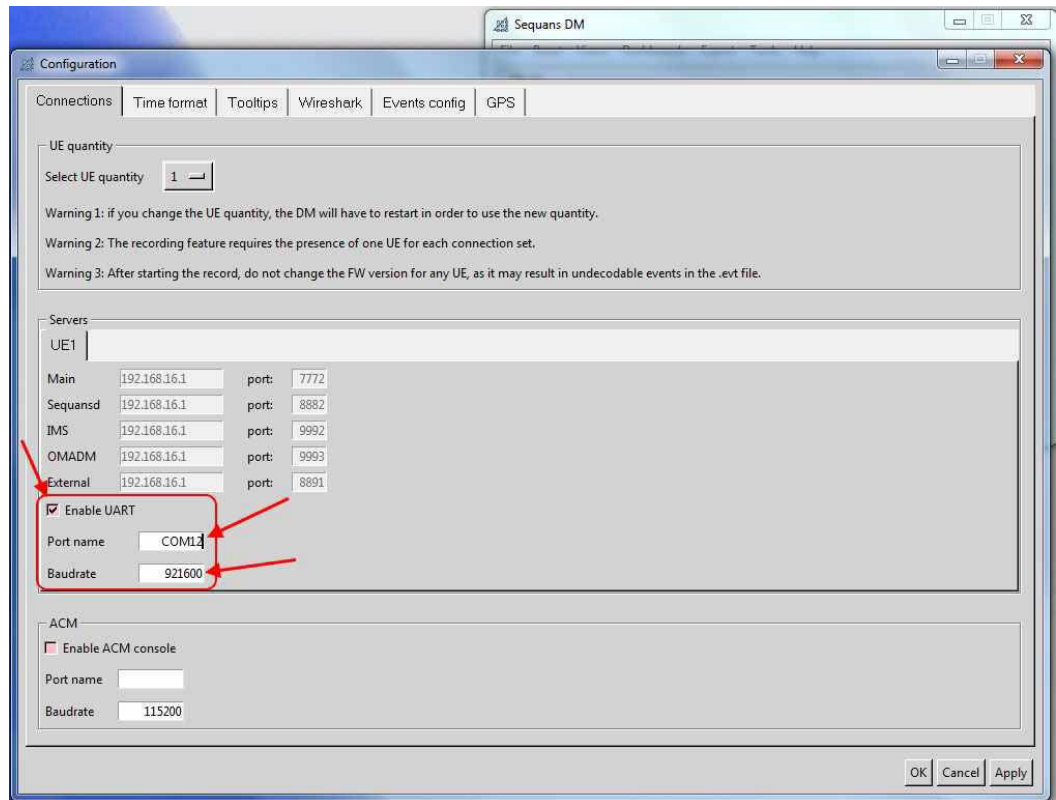
6.3. DM Tool Configuration

- Read the TroubleShooting for DM Manual to become familiar with the DM tool
- Start DM Tool Application on the PC
- Open File -> Preferences on the Connections tab
  - o Check the Enable UART box
  - o Enter the COM port associated to UART 0. Refer to **COM ports overview Table**
  - o Enter the 921600 baudrate instead of the 115200 default value

Annex

The NL-M1DK-ES has the capability to connect to your workstation via a USB-Serial connection, or to different microcontroller platforms. Your NL-M1DK-ES is setup from the factory for the USB-Serial connection. However, if a jumper was knocked off during shipment, here is a diagram for the proper jumper settings:

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