Nordic Thingy:91

Getting Started Guide

4418_1447 / 2021-12-15

NORDIC® SEMICONDUCTOR

Contents

Revision history

Date	Description
2021-12-15	Updated: • Introduction on page 4 • Updating Nordic Thingy:91 firmware on page 7 • Updating firmware through USB on page 7 • Activating the iBasis SIM card on page 17 • Connecting to nRF Cloud on page 20 • Using LTE Link Monitor on page 22 • Operating states on page 23 • Recommended reading on page 28 Removed: • Enabling GPS
2021-08-12	First release

1 Introduction

This guide helps you get started with the Nordic Thingy:91™. It tells you how to update the Nordic Thingy:91 application and modem firmware, connect the Nordic Thingy:91 to nRF Cloud, and enable *Global Positioning System (GPS)* on the Nordic Thingy:91.

2 Minimum requirements

Before you start setting up the Nordic Thingy:91, check that you have the required hardware and software.

Hardware requirements

- nano-*Subscriber Identity Module (SIM)* card that supports *LTE-M* or *Narrowband Internet of Things (NB-IoT)* (the Nordic Thingy:91 comes shipped with an iBasis *SIM* card)
- Micro-USB 2.0 cable
- Computer

Software requirements

One of the following operating systems:

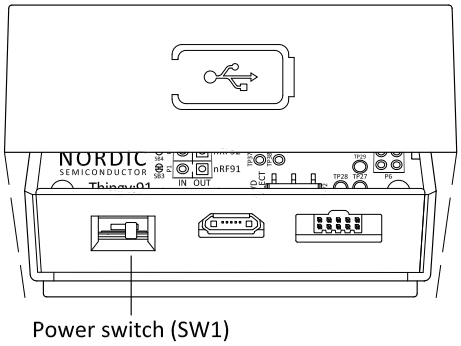
- Microsoft Windows 10
- macOS X latest version
- Ubuntu Linux, latest Long Term Support (LTS) version

3 Preparing for setup

Before you start updating the modem firmware and application on the Nordic Thingy:91, you need to do some preliminary configurations.

Complete the following steps to prepare the Nordic Thingy:91 for setting up.

1. Install the Programmer application on the computer:
   a) Go to nRF Connect for Desktop Downloads.
   b) Download and install nRF Connect for Desktop.
   c) Open **nRF Connect for Desktop**.
   d) Find **Programmer** in the list of applications and click **Install**.
2. Download firmware:
   a) Go to Nordic Thingy:91 Downloads.
   b) Download the zip file containing the latest Nordic Thingy:91 application and modem firmware.
   c) Extract the zip file to a folder of your choice.
3. Prepare the Nordic Thingy:91 hardware:
   a) Open the box and take out the Nordic Thingy:91 and the iBasis *SIM* card it comes shipped with.
   b) Plug the Nordic Thingy:91 into the computer using a micro-*Universal Serial Bus (USB)* cable.
   c) Power the Nordic Thingy:91 on by switching **SW1** to the ON position.



4 Updating Nordic Thingy:91 firmware

Nordic Thingy:91 (v1.5.0 or lower) comes preloaded with the nRF9160: Asset Tracker application firmware and modem firmware on the nRF9160 *System in Package (SiP)* and the Connectivity bridge application firmware on the nRF52840 *System on Chip (SoC)* which enable the device to use the environment sensors and track the device using *GPS*. The data is transmitted to nRF Cloud.

Before you start using the Nordic Thingy:91, it is recommended that you update the application firmware to nRF9160: Asset Tracker v2. You must also update the modem firmware. You can do this through USB (MCUboot) or an external debug probe using the Programmer application.

You can find more information on the firmware and the associated features in the Working with Thingy:91 nRF Connect *Software Development Kit (SDK)* documentation. For more information on the Asset Tracker application, see nRF9160: Asset Tracker v2.

Note: To update the Nordic Thingy:91 through *USB*, the nRF9160 *SiP* and nRF52840 *SoC* bootloaders must be factory-compatible. The bootloaders might not be factory-compatible if the nRF9160 *SiP* or nRF52840 *SoC* has been updated with an external debug probe. To restore the bootloaders, program the nRF9160 *SiP* or nRF52840 *SoC* with the Nordic Thingy:91 firmware files through an external debug probe.

4.1 Updating firmware through USB

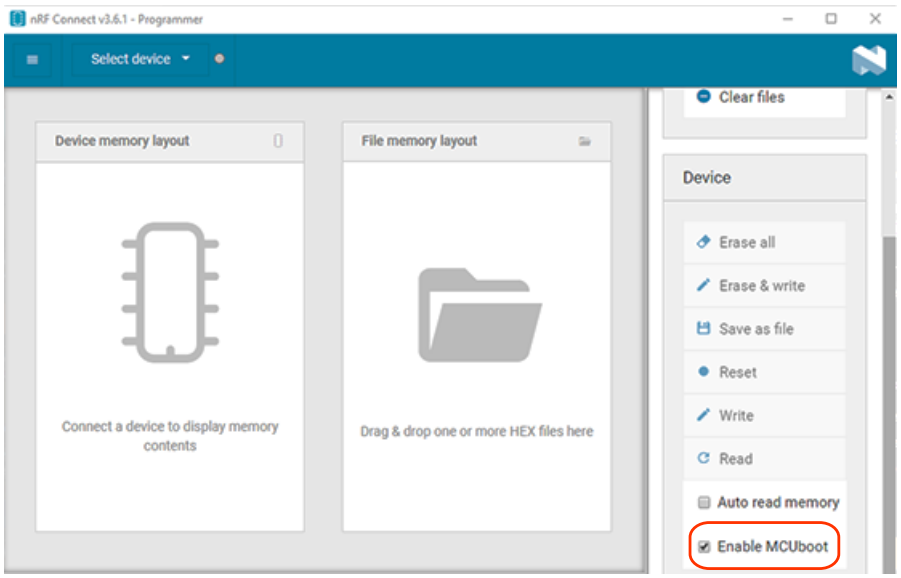
You can update the Nordic Thingy:91 application and modem firmware over *USB* by using *MCUboot*, which is a secure bootloader that can be used to update applications without an external debugger.

Before you start, make sure the Nordic Thingy:91 is connected to the computer with a micro-*USB* cable.

Note: Do not unplug the Nordic Thingy:91 during this process.

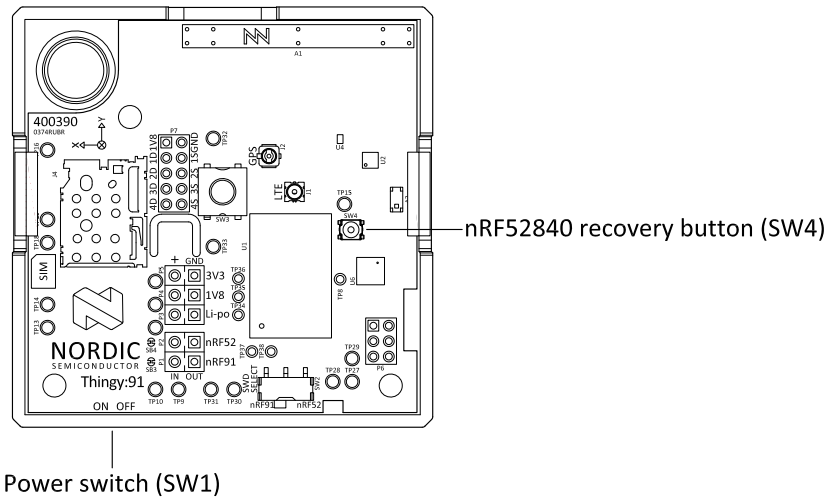
Complete the following steps to update the firmware.

1. Open nRF Connect for Desktop and launch the Programmer application.
2. Scroll down in the menu on the right and make sure **Enable MCUboot** is selected.

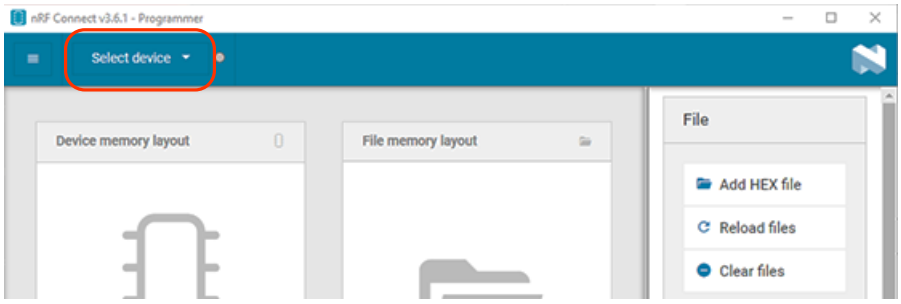


3. Update the nRF52840 *SoC* application:

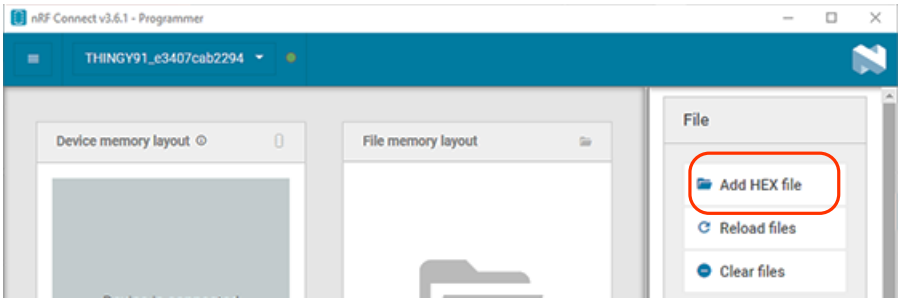
a) Switch off the Nordic Thingy:91.
b) Press **SW4** while switching **SW1** to the ON position.



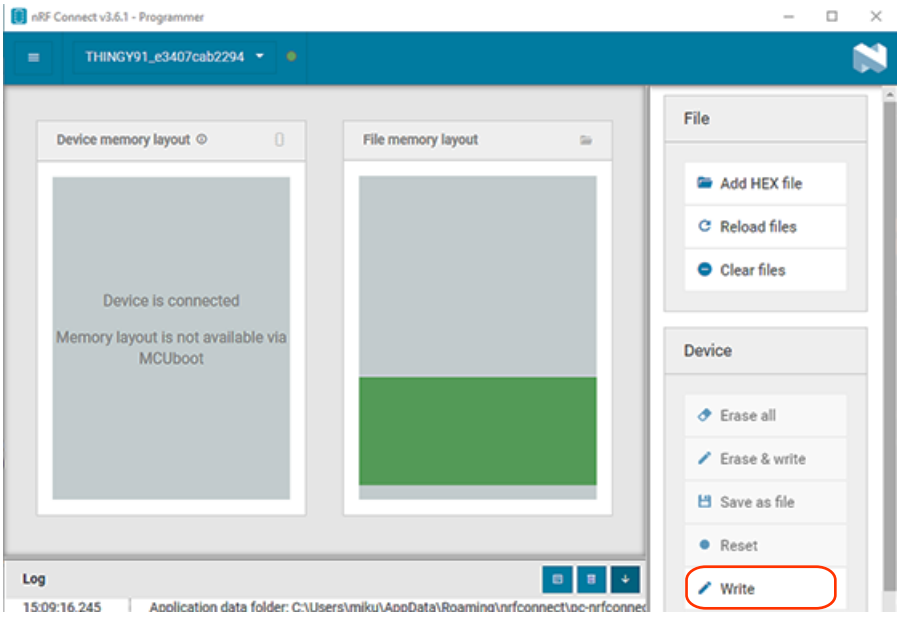
c) In the Programmer navigation bar, click **Select device**.



A drop-down menu appears.
d) In the menu, select Nordic Thingy:91.
e) In the menu on the right, click **Add HEX file** > **Browse...**.



A file explorer window appears.
f) Go to the folder you downloaded and extracted from Nordic's website in step Download firmware.
g) Open the folder that contains the HEX files for updating over *USB*.
See the `CONTENTS.txt` file for information on which file you need.
h) Select the Connectivity bridge firmware file.
i) Click **Open**.
j) Scroll down in the menu on the right to Device and click **Write**.



The **MCUboot DFU** window appears.

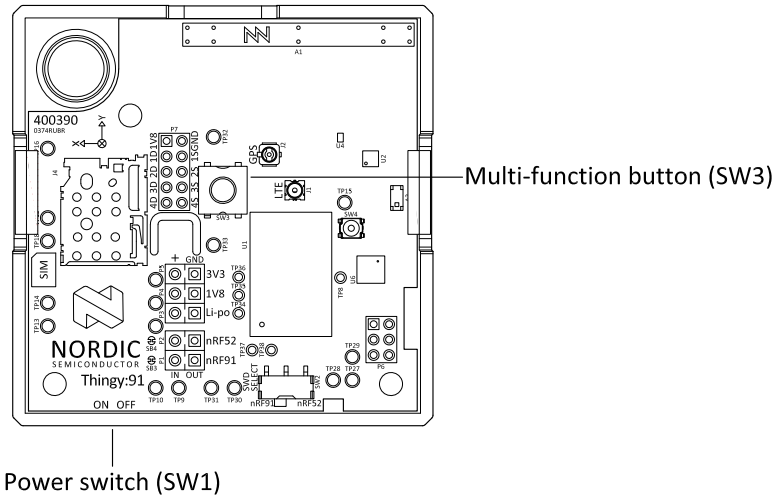
k) In the **MCUboot DFU** window, click **Write**.
When the update is complete, a **Completed successfully** message appears.

l) Scroll up in the menu on the right to File and click **Clear files**.

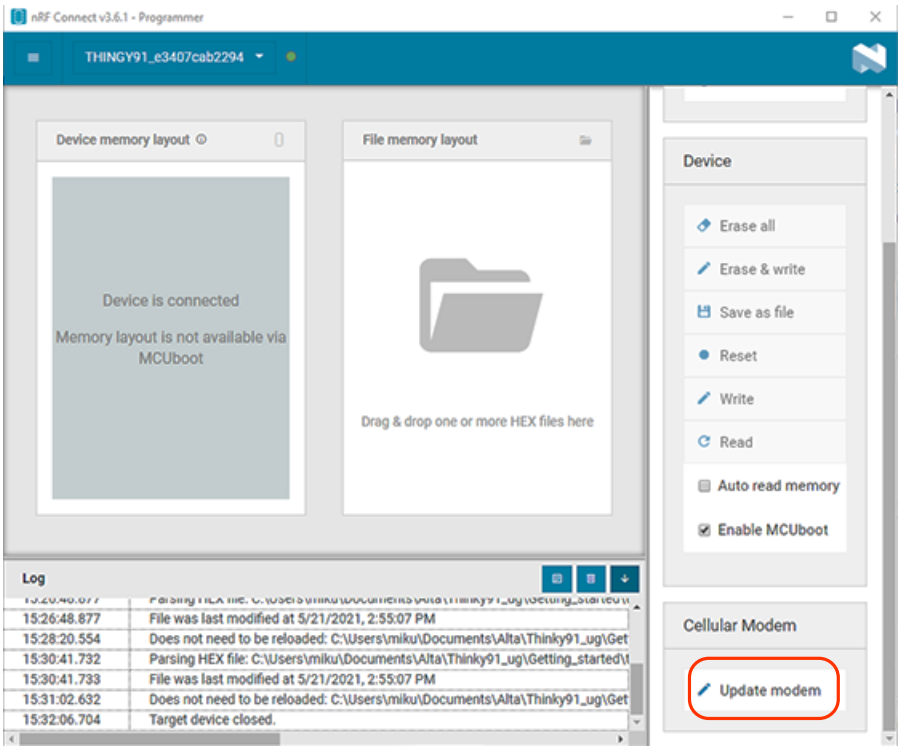
4. Update the modem firmware on the nRF9160 *SiP*:

a) Switch off the Nordic Thingy:91.

b) Press **SW3** while switching **SW1** to the ON position.



c) In the Programmer application, scroll down in the menu on the right to Cellular Modem and click **Update modem**.



A file explorer window appears.

d) Go to the folder you downloaded and extracted from Nordic's website in step Download firmware.

e) Find the modem firmware zip file with the name similar to `mfw_nrf9160_*.zip` and the number of the latest version.

> **Note:** Do not extract the modem firmware zip file.

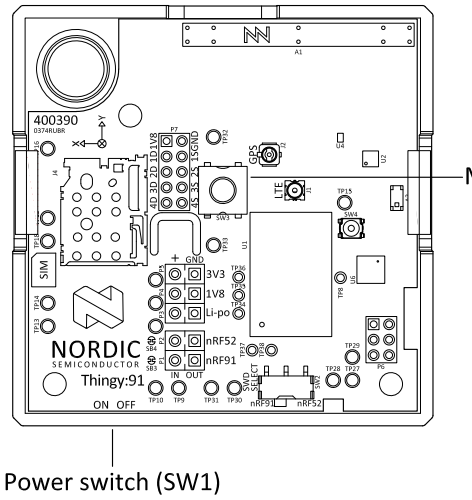
f) Select the zip file and click **Open**.
The **Modem DFU via MCUboot** window appears.

g) In the **Modem DFU via MCUboot** window, click **Write**.
When the update is complete, a **Completed successfully** message appears.

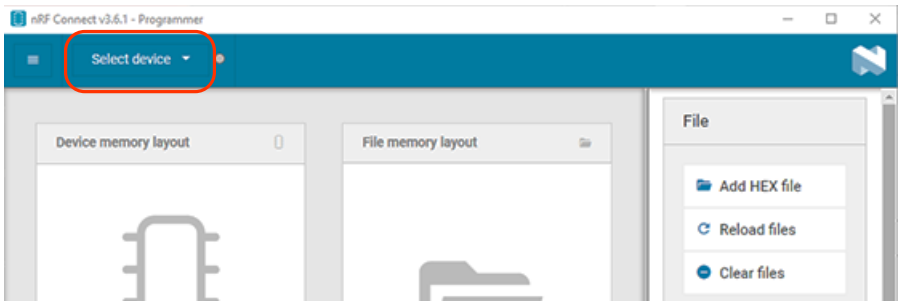
5. Update the nRF9160 *SiP* application:

a) Switch off the Nordic Thingy:91.

b) Press **SW3** while switching **SW1** to the ON position.



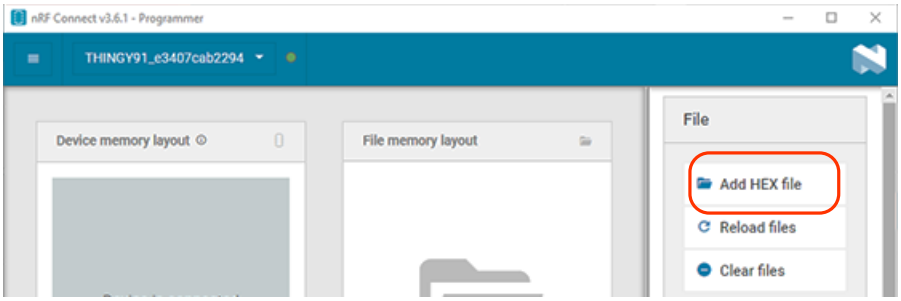
c) In the Programmer navigation bar, click **Select device**.



A drop-down menu appears.

d) In the menu, select Nordic Thingy:91.

e) In the menu on the right, click **Add HEX file** > **Browse...**.



A file explorer window appears.

f) Go to the folder you downloaded and extracted from Nordic's website in step Download firmware.

g) Open the folder that contains the HEX files for updating over *USB*.

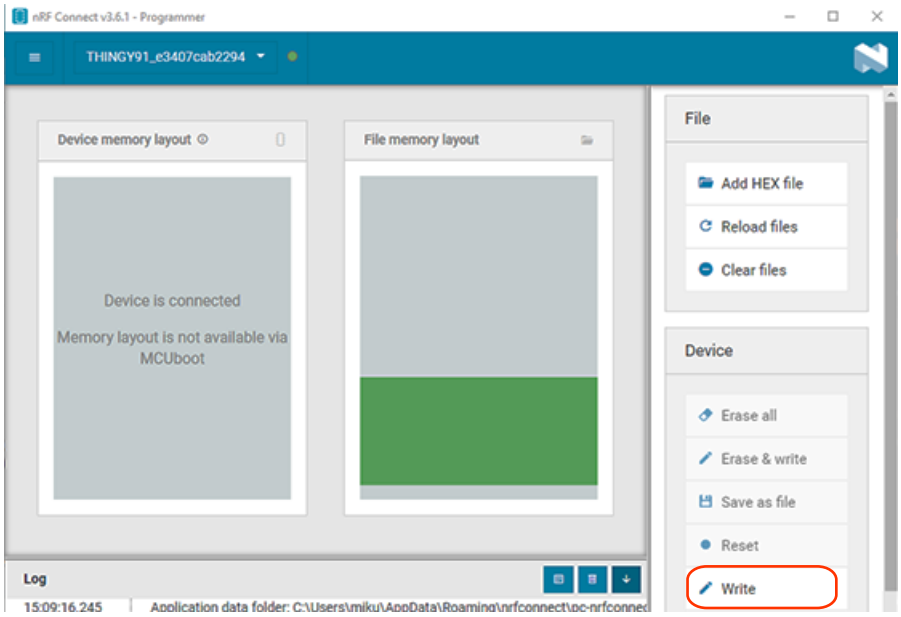
See the `CONTENTS.txt` file for information on which file you need.

h) Select the appropriate Asset Tracker v2 firmware file.

> **Note:** If you are connecting over NB-IoT and your operator does not support ePCO, select the file that has legacy *Protocol Configuration Options (PCO)* mode enabled.

i) Click **Open**.

j) Scroll down in the menu on the right to Device and click **Write**.



The **MCUboot DFU** window appears.

k) In the **MCUboot DFU** window, click **Write**.
When the update is complete, a **Completed successfully** message appears.

l) Scroll up in the menu on the right to File and click **Clear files**.

You can now disconnect the Nordic Thingy:91 from the computer.

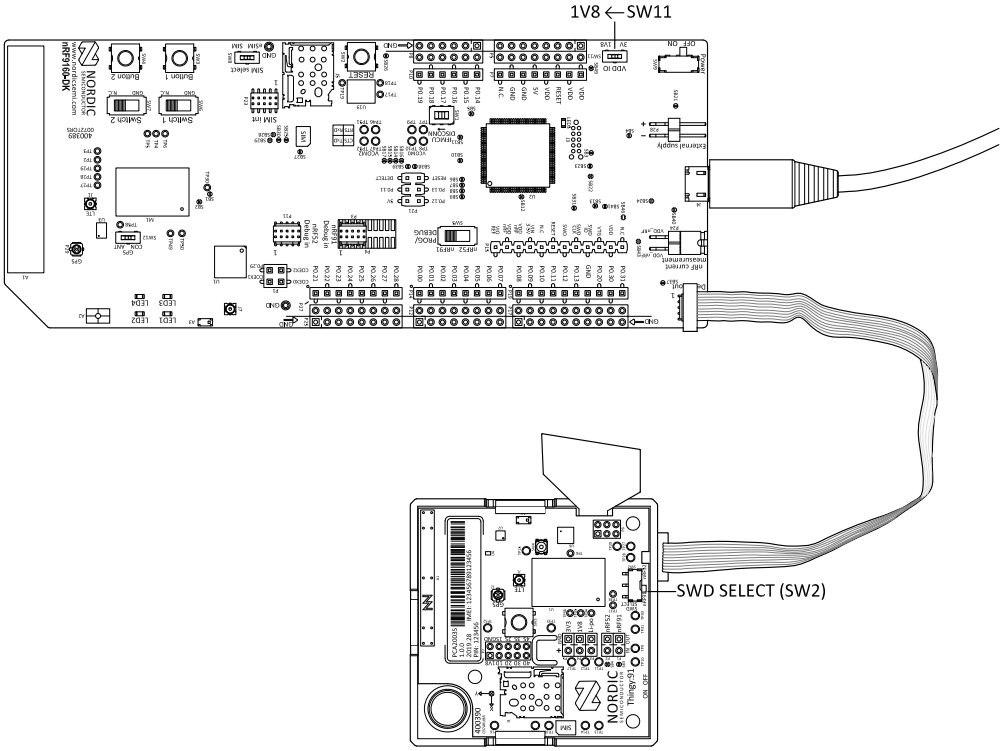
4.2 Updating firmware through external debug probe

You can update the Nordic Thingy:91 application and modem firmware by using an external debug probe.

Note: The external debug probe must support Arm® Cortex®-M33, such as the nRF9160 DK or nRF5340 PDK. You need a 10-pin 2x5 socket-socket 1.27 mm IDC (*Serial Wire Debug (SWD)*) JTAG cable to connect to the external debug probe.

Complete the following steps to update the firmware. In these steps, the nRF9160 DK is used as the external debug probe.

1. Open nRF Connect for Desktop and launch the Programmer application.
2. Prepare the hardware:
   a) Connect the Nordic Thingy:91 to the debug out port on a 10-pin external debug probe using a JTAG cable.

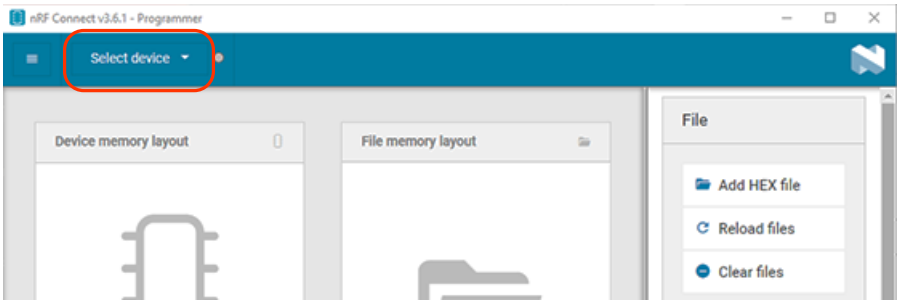


Note: If using nRF9160 DK as the debug probe, make sure that **VDD_IO** (**SW11**) is set to 1.8 V on the nRF9160 DK.

   b) Make sure that the Nordic Thingy:91 and the external debug probe are powered on.

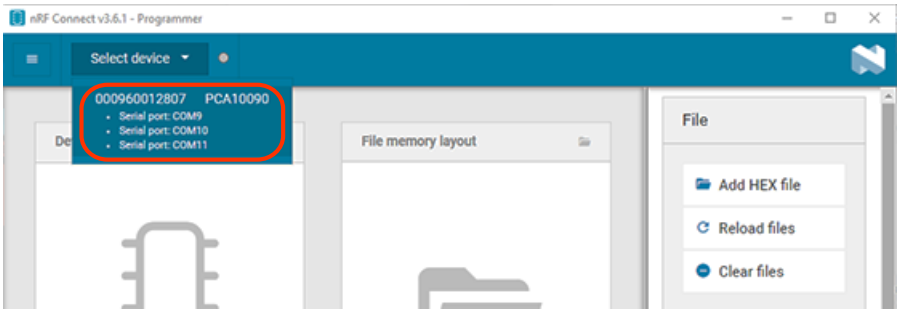
Note: Do not unplug or power off the devices during this process.

   c) Connect the external debug probe to the computer with a micro-USB cable.
   In the Programmer navigation bar, **No devices available** changes to **Select device**.



d) Click **Select device** and select the appropriate debug probe entry from the drop-down list.

You can identify the nRF9160 DK by the fact that it has three COM ports.



If the three COM ports are not visible, press **Ctrl+R** in Windows or **command+R** in macOS to restart the Programmer application.

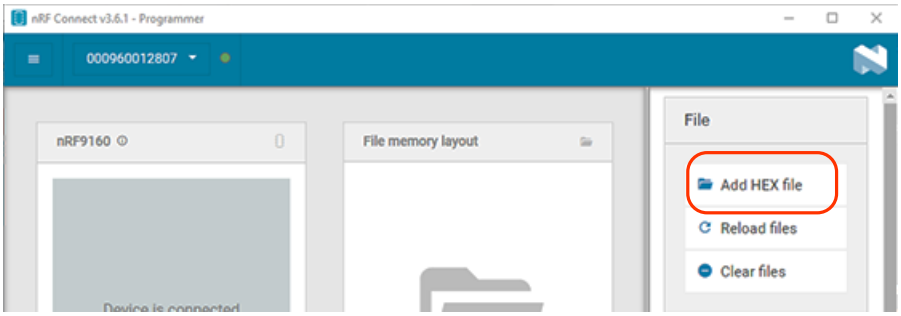
The button text changes to the SEGGER ID of the selected device, and the **Device Memory Layout** section indicates that the device is connected.

3. Update the nRF52840 *SoC* application:

a) Set the SWD selection switch **SW2** to **nRF52**.

See SWD Select for more information on the switch.

b) In the menu on the right, click **Add HEX file** > **Browse...**.



A file explorer window appears.

c) Go to the folder you downloaded and extracted from Nordic's website in step Download firmware.

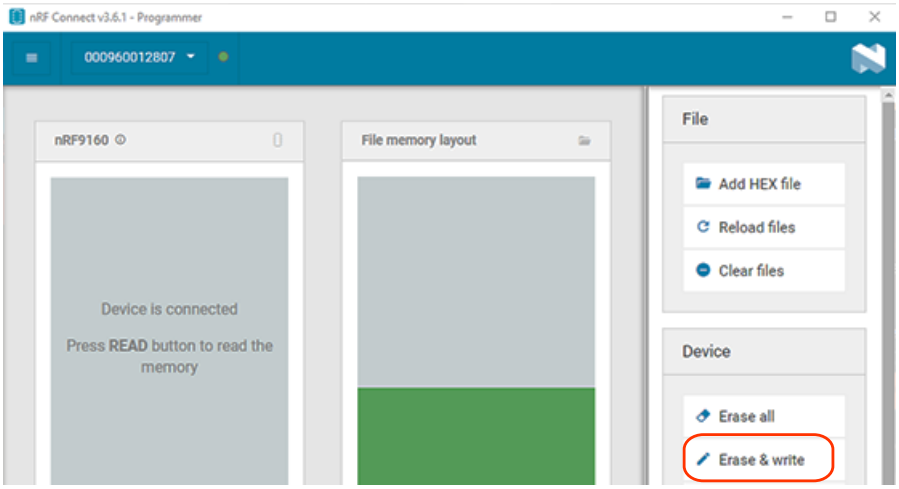
d) Open the folder that contains the HEX files for updating over an external debug probe.

See the `CONTENTS.txt` file for information on which file you need.

e) Select the Connectivity bridge firmware file.

f) Click **Open**.

g) Scroll down in the menu on the right to Device and click **Erase & write**.



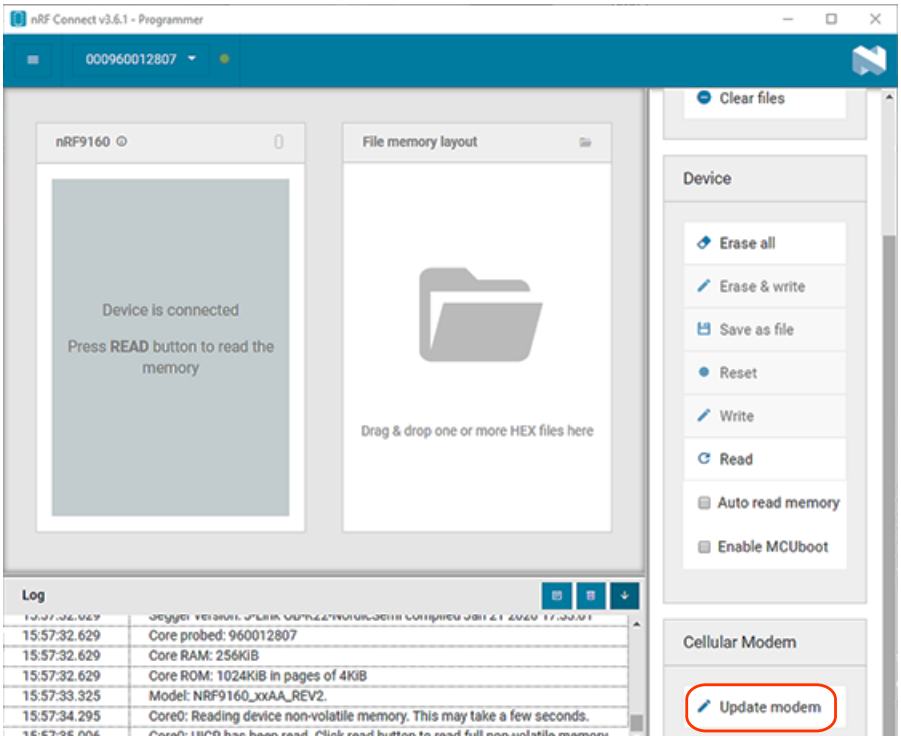
The update is completed when the animation in Programmer's Device memory layout window ends.

h) Scroll up in the menu on the right to File and click **Clear files**.

4. Update the modem firmware on the nRF9160 *SiP*:

a) Set the SWD selection switch **SW2** to **nRF91**.

b) In the Programmer application, scroll down in the menu on the right to Cellular Modem and click **Update modem**.



A file explorer window appears.

c) Go to the folder you downloaded and extracted from Nordic's website in step Download firmware.

d) Find the modem firmware zip file with the name similar to `mfw_nrf9160_*.zip` and the number of the latest version.

> **Note:** Do not extract the modem firmware zip file.

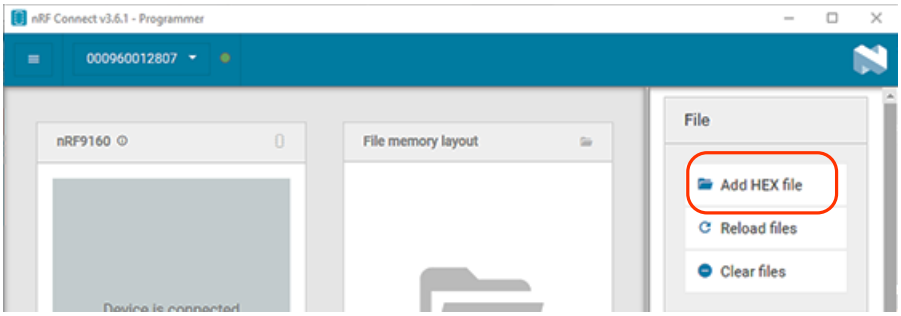
e) Select the zip file and click **Open**.
The **Modem DFU** window appears.

f) In the **Modem DFU** window, click **Write**.

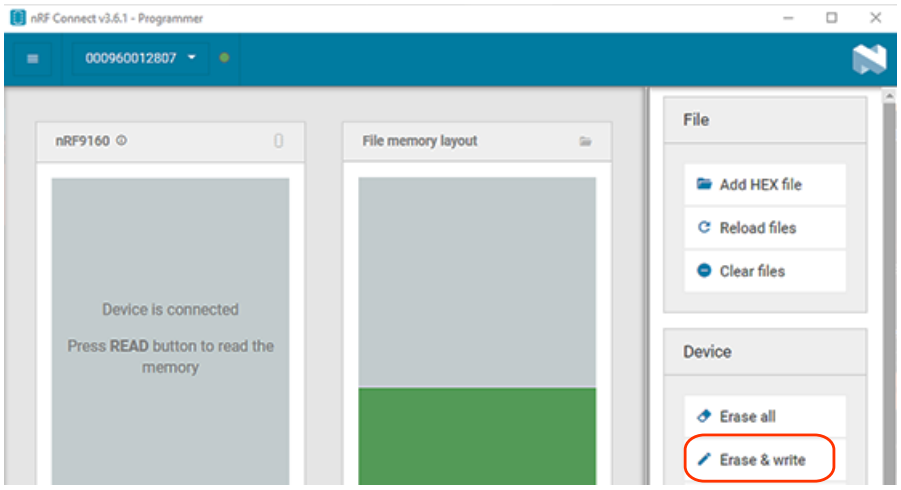
Note: If you have issues updating modem firmware, click **Erase all** before trying to update the modem again. In this case, the contents of the flash memory are deleted and the applications must be reprogrammed.

When the update is complete, a **Completed successfully** message appears.

5. Update the nRF9160 *SiP* application:
   a) Make sure the SWD selection switch **SW2** is set to **nRF91**.
   b) In the menu on the right, click **Add HEX file** > **Browse...**.



   A file explorer window appears.
   c) Go to the folder you downloaded and extracted from Nordic's website in step Download firmware.
   d) Open the folder that contains the HEX files for updating over an external debug probe.
   See the `CONTENTS.txt` file for information on which file you need.
   e) Select the appropriate Asset Tracker v2 firmware file.
   f) Click **Open**.
   g) Scroll down in the menu on the right to Device and click **Erase & write**.



   The update is completed when the animation in Programmer's Device memory layout window ends.
   h) Scroll up in the menu on the right to File and click **Clear files**.

5 Creating an nRF Cloud account

You must sign up with nRF Cloud before you can start using the service.

Complete the following steps to create an nRF Cloud account.

1. Go to nRF Cloud (nrfcloud.com) and click **Create Account**.
2. Enter your email address and choose a password. Then click **Create Account**.

   nRF Cloud sends you a verification email.
3. Check your email for a message sent by no-reply@verificationemail.com. Copy the 6-digit verification code and paste it into the prompt on the nRF Cloud website.

You can now sign in on nRF Cloud with your email address and password. After signing in, you are directed to the dashboard, which displays the number of gateways and devices that are associated with your nRF Cloud account.

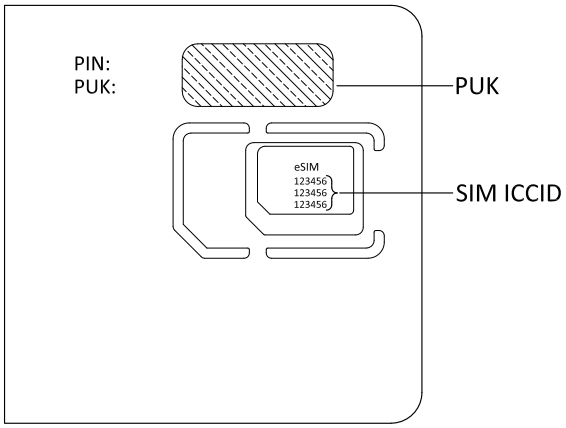
6 Activating the iBasis SIM card

If you are using the iBasis *SIM* card that comes shipped with the Nordic Thingy:91, you need to activate it in nRF Cloud.

Complete the following steps to activate the *SIM* card.

1. Scratch off the bottom area on the back of the iBasis *SIM* to reveal the *Personal Unblocking Key (PUK)* code.

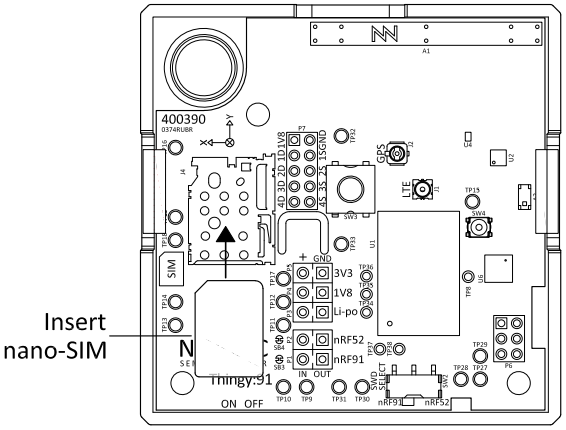
   The *Integrated Circuit Card Identifier (ICCID)* code is the first 18 digits printed on the back.



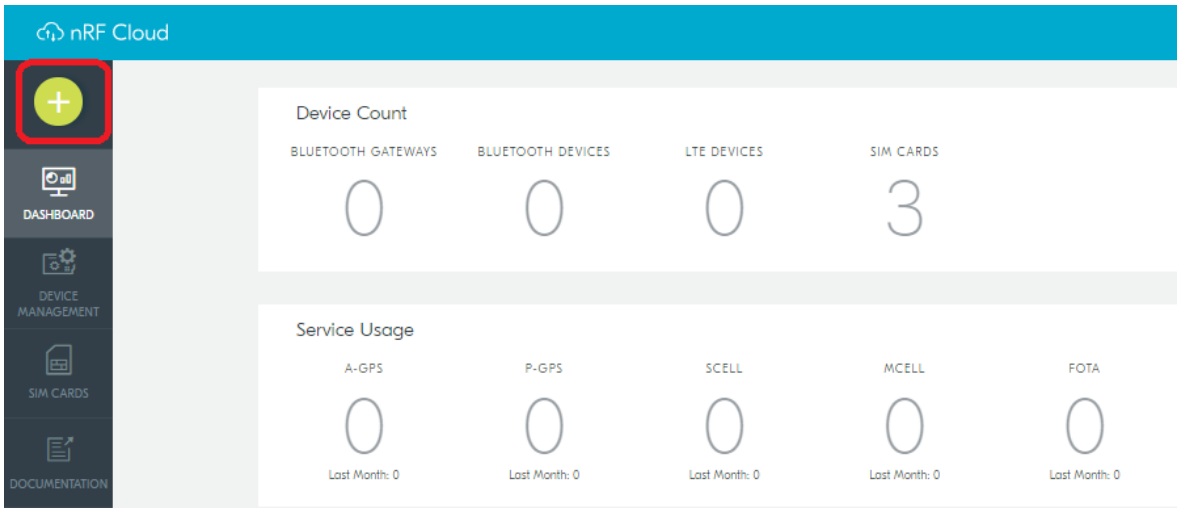
2. Make a note of the *ICCID* and *PUK* codes.

   You will need them later.

3. Pop out the nano-*SIM* card.
4. Take off the silicone cover on the Nordic Thingy:91, and put the card in the nano-*SIM* card holder.

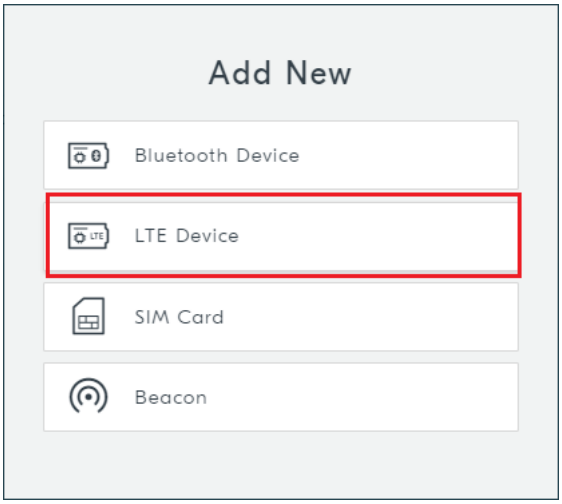


5. Sign in to nRF Cloud.
6. Click the large plus sign in the upper-left corner.

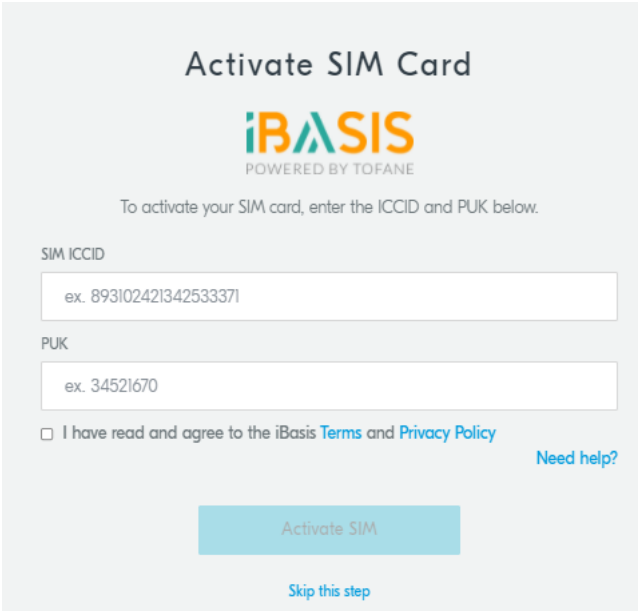


The **Add New** window appears.

7. In the **Add New** window, click **LTE Device**.



The **Activate SIM Card** window appears.



8. In the **SIM ICCID** field, enter the ICCID code that you wrote down.
9. In the **PUK** field, enter the PUK code that you wrote down.

10. Read Terms and Privacy Policy. Then select the box next to them.
11. Click **Activate SIM**.
    The **Activate SIM Card** window appears.
12. Enter your information in the **Activate SIM Card** window. Then, click **Submit**.
    The **SIM Activated successfully** message appears.

7 Connecting to nRF Cloud

To start using nRF Cloud, you need to associate the Nordic Thingy:91 to your user account.

Complete the following steps to connect the Nordic Thingy:91 to nRF Cloud and to associate it with your user account.

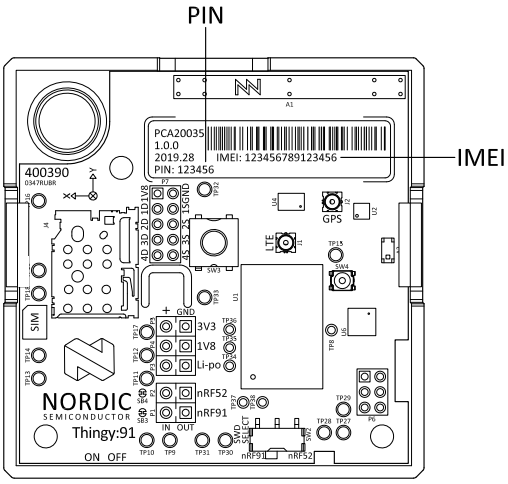
1. Make sure the Nordic Thingy:91 is switched on.
2. Wait for the Nordic Thingy:91 to connect to the network and to nRF Cloud.

   The process of connecting can take up to several minutes if it is the first time. Check Operating states on page 23 to determine the present state of the Nordic Thingy:91.
3. Go to nRF Cloud (nrfcloud.com).
   The **Add LTE Device** window appears.

4. In the **Device ID** field, enter the text “nrf-“ and after it the Nordic Thingy:91 *International Mobile (Station) Equipment Identity (IMEI)* code.

   The *IMEI* is the 15 digit code which you can find on a white sticker on the Nordic Thingy:91.

   The Device ID is case sensitive, so make sure all the letters are lower-case.



5. In the **PIN/HWID** field, enter the *Personal Identification Number (PIN)* which is printed on the white sticker on the Nordic Thingy:91.
6. Click **Add Device**.
   The message **Device added to account. Waiting for it to connect...** appears.

   Note: If you see an error message, check the error code and go to **Device API** – **Rest API Docs** in nRF Cloud to find out what is causing the error.
7. When the message has disappeared, go to the menu on the left and click **Devices**.
   You should see the Nordic Thingy:91 in your device list and all the sensor data being transmitted to the cloud from the Nordic Thingy:91. The LED on the Nordic Thingy:91 should be blinking green which indicates that it is transmitting all the data to the cloud.

8 Using LTE Link Monitor

You can use the LTE Link Monitor application to get debug output and send *AT command*s to the Nordic Thingy:91.

Complete the following steps to connect to the Nordic Thingy:91 using LTE Link Monitor.

1. Open **nRF Connect for Desktop**.
2. Find LTE Link Monitor in the list of applications and click **Install**.
3. Connect the Nordic Thingy:91 to a computer with a micro-*USB* cable.
4. Make sure that the Nordic Thingy:91 is powered on.
5. Launch the LTE Link Monitor application.
6. In the navigation bar, click **Select device**.
   A drop-down menu appears.
7. In the menu, select Nordic Thingy:91.
8. In the LTE Link Monitor terminal, send an **`AT`** command to the modem.
   If the connection is working, the modem responds with `OK`.

The terminal view shows all of the Asset Tracker v2 debug output as well as the *AT command*s and their results. For information on the available *AT command*, see nRF91 AT Commands Reference Guide.

9 Operating states

On the Nordic Thingy:91 running the Asset Tracker v2 application, the operating state is indicated by a single RGB LED.

The following table describes the operating states of Nordic Thingy:91 running the Asset Tracker v2 application.

Thingy:91 RGB LED	State
Yellow, blinking	LTE connection search
Purple, blinking	GPS fix search
Green, blinking	Publishing data
Light blue, blinking	Active mode
Dark blue, slow blinking	Passive mode
Red, on	Error
White, rapid blinking	Completion of FOTA Update

Table 1: Operating states of Nordic Thingy:91

Glossary

Application Programming Interface (API)

A language and message format used by an application program to communicate with an operating system, application, or other service.

AT command

A command used to control the modem.

Development Kit (DK)

A development platform used for application development.

Global Positioning System (GPS)

A satellite-based radio navigation system that provides its users with accurate location and time information over the globe.

Integrated Circuit Card Identifier (ICCID)

A unique serial number of a SIM card.

Integrated Development Environment (IDE)

A software application that provides facilities for software development.

International Mobile (Station) Equipment Identity (IMEI)

A unique code consisting of 14 digits and a check digit for identifying 3GPP-based mobile devices.

LTE-M

An open standard that is most suitable for medium throughput applications requiring low power, low latency, and/or mobility, like asset tracking, wearables, medical, POS, and home security applications. Also known as Cat-M1.

MCUboot

A secure bootloader for 32-bit microcontroller units, which is independent of hardware and operating system.

Narrowband Internet of Things (NB-IoT)

A narrowband technology standard with longer range, lower throughput, and better penetration in, for example, cellars and parking garages compared to LTE-M. NB-IoT is most suitable for static, low throughput applications like smart metering, smart agriculture, and smart city applications. Also known as Cat-NB1.

Non-access Stratum (NAS)

In telecom protocol stacks, the highest stratum of the control plane between the core network and *User Equipment (UE)*. The layer is used to manage the establishment of communication sessions and for maintaining communications with the UE as it moves.

nRF Cloud

Nordic Semiconductor's platform for connecting IoT devices to the cloud, viewing and analyzing device message data, prototyping ideas that use Nordic Semiconductor chips, and more. It includes a public REST API that can be used for building IoT solutions. See nRF Cloud (nrfcloud.com).

Protocol Configuration Options (PCO)

An element of *Non-access Stratum (NAS)* message used for transferring parameters between the *UE* and the P-GW (Packet Data Network Gateway).

Personal Identification Number (PIN)

An optional security feature in mobile devices used for identifying a user. PIN is a numeric code which must be entered each time a mobile device is started.

Personal Unblocking Key (PUK)

A digit sequence required in 3GPP mobile phones to unlock a *SIM* that has disabled itself after an in correct personal identification number has been entered multiple times.

Serial Wire Debug (SWD)

A standard two-wire interface for programming and debugging Arm CPUs.

Software Development Kit (SDK)

A set of tools used for developing applications for a specific device or operating system.

Subscriber Identity Module (SIM)

A card used in *UE* containing data for subscriber identification.

System in Package (SiP)

A number of integrated circuits, often from different technologies, enclosed in a single module that performs as a system or subsystem.

System on Chip (SoC)

A microchip that integrates all the necessary electronic circuits and components of a computer or other electronic systems on a single integrated circuit.

Universal Integrated Circuit Card (UICC)

A new generation *SIM* used in *UE* for ensuring the integrity and security of personal data.

Universal Serial Bus (USB)

An industry standard that establishes specifications for cables and connectors and protocols for connection, communication, and power supply between computers, peripheral devices, and other computers.

User Equipment (UE)

Any device used by an end-user to communicate. The UE consists of the Mobile Equipment (ME) and the Universal Integrated Circuit Card (UICC).

Acronyms and abbreviations

These acronyms and abbreviations are used in this document.

API
Application Programming Interface

DK
Development Kit

GPS
Global Positioning System

ICCID
Integrated Circuit Card Identifier

IMEI
International Mobile (Station) Equipment Identity

NAS
Non-access Stratum

NB-IoT
Narrowband Internet of Things

PCO
Protocol Configuration Options

PIN
Personal Identification Number

PUK
Personal Unblocking Key

SDK
Software Development Kit

SIM
Subscriber Identity Module

SiP
System in Package

SoC
System on Chip

SWD
Serial Wire Debug

UE
User Equipment

USB
Universal Serial Bus

UICC
: Universal Integrated Circuit Card

Recommended reading

In addition to the information in this document, you may need to consult other documents.

User guides

- Nordic Thingy:91
- nRF9160 DK Getting Started Guide
- nRF9160 DK Hardware
- nRF Connect SDK documentation
- nRF Connect for Desktop
- nRF Connect Programmer
- nRF Connect LTE Link Monitor

Reference information

- nRF9160 Product Specification
- nRF52840 Product Specification
- nRF9160 Errata
- nRF9160 Revision 2 Errata
- nRF52840 Errata
- nRF9160 Compatibility Matrix
- nRF52840 Compatibility Matrix
- nRF9160 Modem Firmware Release Notes (included in the latest nRF9160 modem firmware)
- nRF91 AT Commands Reference Guide

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