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## Revision history

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| September 2019| 1.0     | Updated to match nRF Connect LTE Link Monitor v1.1.1:  
- Updated supported devices to include Thingy:91  
- Updated Installing the LTE Link Monitor on page 5  
- Split LTE Link Monitor functionality into LTE Link Monitor overview on page 6, Viewing modem events on page 9, and Viewing and sending AT commands on page 10  
- Added Managing credentials on page 11 |
| May 2019      | 0.7.1   | Updated Installing the LTE Link Monitor on page 5 |
| December 2018 | 0.7     | Updated LTE Link Monitor functionality to reflect the Periodic signal quality requests option. |
| October 2018  | 0.5     | First release |
Introduction

LTE Link Monitor is a modem client application that monitors the modem/link status and activity using AT commands.

See the nRF91 AT Commands Reference Guide for the AT commands that are supported by the modem in nRF91 Series devices.

LTE Link Monitor is implemented as an app for the nRF Connect for Desktop application.

Supported devices

- nRF9160 DK (PCA10090)
- Thingy:91 (PCA20035)

This video tutorial gives you an overview of the nRF Connect LTE Link Monitor:

![Figure 1: YouTube Tutorial](image-url)
Installing the LTE Link Monitor

The LTE Link Monitor is installed as an app for nRF Connect for Desktop.

Before you can install the LTE Link Monitor, you must download and install nRF Connect for Desktop (version 3.2.0 or later).

To install the LTE Link Monitor:

1. Open nRF Connect for Desktop.
2. Find the LTE Link Monitor in the list of apps and click **Install**.

Once the app is installed, you can launch it by clicking **Open**.

For easy access, you can create a desktop shortcut by clicking the arrow down button and selecting **Create shortcut**.

If a new version of the app becomes available, an **Update** button is displayed next to the **Open** button. Click this button to install the latest version. To uninstall the app, click the arrow down button and select **Uninstall**.
LTE Link Monitor overview

LTE Link Monitor displays information about connected devices and shows, for example, the signal quality, network information, and the AT communication with the modem.

After starting the LTE Link Monitor, the application window is displayed. It consists of the following main elements:

Main view
The main view displays the chart view, the terminal view, or the certificate manager, depending on your selection in the navigation bar.

Navigation bar
The device selector drop-down menu in the navigation bar displays all supported devices. When you select a device, you can see live information about the current session in the main view. In the chart view, you can alternatively open a log file to load and display the log contents of a previous session.

Note: You cannot open a log file when a device connection is open.

Select the Chart view to view modem events, the Terminal view to view and send AT commands, or the Certificate manager to manage credentials.

Click the three-dash button in the top-left corner to view information about the app, create a system report, or launch another app.

Figure 2: Navigation bar
Side panel

The side panel displays information related to the modem, network, and mobile cell.

The first line of indicators helps to visualize the connection state by displaying the indicators in different colors. Hovering over these indicators lists the possible colors and their meanings.

The following sections show information about the modem state, the network, the packet domain group, and the cell.

In the network group, only the connected network is listed automatically. Click Search networks to display a complete list of available networks. Be aware that this is a long and blocking operation.

If the connected cell can be resolved by the locationapi.org service, you can click Show serving station location to open a small map with the range of the serving station.

![Figure 3: Side panel](image-url)
### Settings

The **Settings** section of the side panel offers the following options:

- **Automatic requests**: Toggles whether LTE Link Monitor should automatically send a new request after receiving a response from the modem. This is required to gather the information that is listed in the side panel.

  **Note:** Any information displayed in LTE Link Monitor is an interpretation of the responses from the modem. Therefore, turning off automatic requests affects the validity of the information.

- **Periodic signal quality requests**: Enable this option to send an Extended signal quality +CESQ command in a specified interval. Requires **Automatic requests** to be enabled.

- **Terminal auto scroll**: Toggles the terminal's auto-scrolling behavior.

- **LocationAPI token**: Used for accessing the online service. The initial token belongs to a free limited account, so it is recommended to create an account and change the token by following the link in the user interface.

- **Auto device/port filter**: Changes the behavior of the device selector to show all available port devices in the system, not only the ones that are detected as supported devices. This can be useful when working with unsupported devices.

![Figure 4: Settings](image)

### Log

The log view at the bottom shows info and error level messages from the application. Click the **Open log file** button to view the full log file, which contains the complete AT communication with the modem.

![Figure 5: Log](image)
Viewing modem events

Switch to the chart view to see modem events and signal quality, either for the connected device or for logged data.

The time-based chart displays signal quality and modem events. The signal quality reported by the modem is the received signal reference power (RSRP) in dBm, displayed on the left axis. The modem events are unsolicited result codes and responses to different commands, separated into different categories displayed on the right axis.

To view the information in the chart:
- Hover over the events in the chart to display the list of events under the mouse cursor.
- To navigate the chart, drag it horizontally.
- Zoom in or out using the mouse wheel or the right mouse button.

Note: When you zoom or drag, the chart stops displaying the latest incoming events. Click Live Scroll under the chart to make sure incoming events are displayed again.
5 Viewing and sending AT commands

Switch to the terminal view to see the AT communication with the modem and to send AT commands.

The terminal displays the AT communication with the modem. Colors are used to differentiate between transmitted commands (yellow), received responses (white), and received unsolicited results (light blue). The abbreviations of control characters are displayed in gray. They are, however, not selectable.

You can toggle the terminal's auto-scrolling behavior in the Settings section of the side panel.

To interact with the modem:

- Enter text in the command line located directly below the terminal and send it to the modem by pressing Enter or clicking Send.
  The CR LF line ending is automatically appended to the line.
- Click the macro buttons below the command line to send their stored content to the modem.
- Configure the empty macro buttons with your frequently used commands.
  To do so, select some text and drag and drop it onto one of the ten buttons.
Managing credentials

You can store and update modem credentials (keys or certificates) manually by sending Credential storage management %CMNG commands to the modem. The certificate manager simplifies this process by offering a graphical user interface for updating credentials.

Before you can update the credentials stored by the modem, you must put the modem into offline state by sending the AT command `AT+CFUN=4`.

Each set of keys and certificates that is stored in the modem is identified by a security tag. This means that all related credentials share the same security tag. Send the command `AT%CMNG=1` in the terminal view to display a list of all certificates that are stored on your device. If you have added your device in nRF Cloud, you should see a CA certificate, a client certificate, and a private key with security tag 16842753 (which is the security tag for nRF Cloud credentials).

**Note:** If you receive an error message when trying to list existing credentials, make sure that your application firmware supports long AT commands (`CONFIG_AT_CMD_RESPONSE_MAX_LEN`).

To manage credentials:
- To add or update credentials, enter a security tag and the new key(s) or certificate(s). Then click **Update certificates**.
Instead of entering the credentials manually, you can also import a JSON file. To do so, click **Load from JSON**.

- To delete a key or certificate, select the check-box next to it. Then click **Update certificates**.

  **Note**: Deleting the text from the text field does not cause the key or certificate to be unset.
Sample code for locationapi.org

The provided code snippet demonstrates the usage of the locationapi.org service. You can use code similar to this in a client application, for example, a mobile app, to display a map showing the location of the device.

To see an example for using the locationapi.org service, click Show serving station location in the side panel of LTE Link Monitor.

Note:

- This code only handles expected successful responses.
- The location request can be further enhanced for better accuracy by specifying neighboring cells, for which you can directly use the response to the AT%NBRGRSRP command.

```javascript
const SerialPort = require('serialport);
const fetch = require('node-fetch');

const port = new SerialPort('COM8', {
    autoOpen: false,
    baudRate: 115200,
    dataBits: 8,
    parity: 'none',
    stopBits: 1,
});

let mcc;
let mnc;

// open the port and execute an AT+COPS? request
new Promise(resolve => port.open(resolve))
.then(() => new Promise(resolve => {
    port.once('data', buf => resolve(buf.toString())).write('AT+COPS?\r');
}))

// pick the 3rd argument of COPS response
.then(plmn => (/COPS: \[0-2],[0-2]","([^"]*)"/.exec(plmn).pop()))
.then(mccmnc => {
    mcc = parseInt(mccmnc.substring(0, 3), 10);
    mnc = parseInt(mccmnc.substring(3), 10);
})

// execute an AT+CEREG? request
.then(() => new Promise(resolve => {
    port.once('data', buf => resolve(buf.toString())).write('AT+CEREG?\r');
}))

// pick the 3rd and 4th field from the response
.then(registration => (/CEREG: \d,\d+","([0-9A-F]{1,4})","([0-9A-F]{1,8})/\`).exec(registration).slice(-2))
.then([tac, ci]) => {
    lac: parseInt(tac, 16),
```
Sample code for locationapi.org

cid: parseInt(ci, 16),
})

// construct the locationapi request
.then({( lac, cid }) => {
  token: 'pk.c748a4d4e6ce0bfa5491dcfd01ba9b10',
  radio: 'lte',
  mcc,
  mnc,
  cells: [{ lac, cid }],
  address: 1,
})
.then(body => console.log(body) || body)

// fetch the result
.then(body => fetch('https://eu1.unwiredlabs.com/v2/process.php', {
  method: 'POST',
  headers: { 'Content-Type': 'application/json' },
  body: JSON.stringify(body),
})
.then(response => response.json())
.then(console.log)
.then(() => process.exit());
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