

nRF Connect LTE Link Monitor v2.0.1

User Guide

Contents

	Revision history	iii
1	Introduction	4
2	Installing the LTE Link Monitor app.	5
3	Overview and user interface.	6
4	Viewing and sending AT commands.	10
5	Viewing modem events.	11
6	Managing credentials.	12
7	Sample code for locationapi.org.	13
	Glossary	15
	Legal notices.	16

Revision history

Date	Description
2022-09-06	<ul style="list-style-type: none">• Updated for user interface changes in nRF Connect LTE Link Monitor v2.0.1• Added a glossary
2022-02-22	Updated the following topics to match nRF Connect LTE Link Monitor v2.0.0: <ul style="list-style-type: none">• Overview and user interface on page 6• Viewing and sending AT commands on page 10• Viewing modem events on page 11• Managing credentials on page 12
2021-06-02	Editorial changes
September 2019	Updated to match nRF Connect LTE Link Monitor v1.1.1: <ul style="list-style-type: none">• Updated supported devices to include Thingy:91• Updated Installing the LTE Link Monitor app on page 5• Split <i>LTE Link Monitor functionality</i> into Overview and user interface on page 6, Viewing modem events on page 11, and Viewing and sending AT commands on page 10• Added Managing credentials on page 12
May 2019	Updated Installing the LTE Link Monitor app on page 5
December 2018	Updated <i>LTE Link Monitor functionality</i> to reflect the Periodic signal quality requests option.
October 2018	First release

Previous versions

PDF files for previous versions are available here:

- [nRF Connect LTE_Link_Monitor_User_Guide_v2.0.0](#) (corresponds to nRF Connect LTE Link Monitor v2.0.0)

1 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:

Note:

The video is based on nRF Connect LTE Link Monitor version 2.6.1. The functionality demonstrated in the video is valid also for later versions, though the user interface may differ.

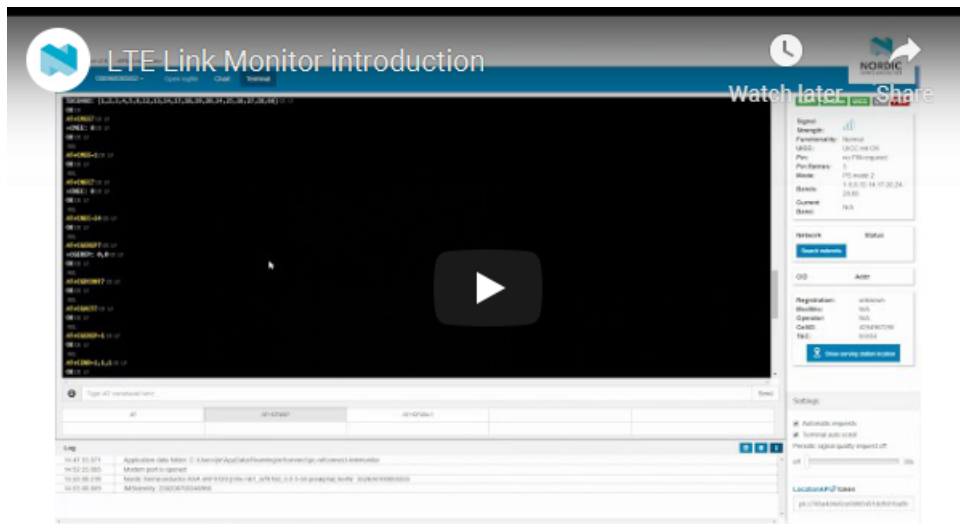


Figure 1: YouTube tutorial

2 Installing the LTE Link Monitor app

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

Before you can install the app, you must download and install [nRF Connect for Desktop](#) (version 3.2.0 or later).

To install the LTE Link Monitor app:

1. Open nRF Connect for Desktop.
2. Find 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**.

3 Overview and user interface

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 has the following elements:

Main view

The main view displays the Terminal, Chart, Certificate Manager or About tab, depending on your selection in the navigation bar.

Select Device

The **SELECT DEVICE** 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 **Terminal** view to [display and send AT commands](#), the **Chart** view to [display modem events](#), or the **Certificate manager** to [manage credentials](#).

Select the **About** view to display information about the app or create a system report.

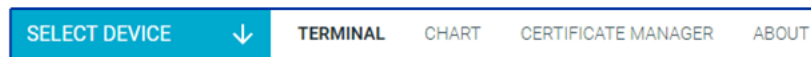


Figure 2: Select Device

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.

The screenshot displays a side panel with a navigation bar at the top containing tabs for UART (red), Modem (green), UICC (green), LTE (green), and PDN (green). The main content is organized into four sections:

- Modem Information:** A box containing a signal strength indicator (three bars), and the following details:
 - Functionality: Normal
 - UICC: UICC init OK
 - Pin: no PIN required
 - Pin Retries: 3
 - Mode: CS/PS mode 2
 - Bands: 2-4,8,12-13,20,28
 - Current Band: 20
- Network Information:** A table with columns 'Network' and 'Status'. The entry 'Telia Norge AS' is highlighted in yellow. Below the table is a blue button labeled 'Search networks'.
- Cell Information:** A table with columns 'CID' and 'Addr'. The entry '0: ibasis.iot' is shown with the address '10.160.149.90' below it.
- Registration Information:** A box containing:
 - Registration: registered, roaming
 - MccMnc: 24202
 - Operator: Telia Norge AS
 - CellID: 35491094
 - TAC: 2305Below this is a blue button with a location pin icon labeled 'Show serving station location'.

Figure 3: Side panel

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.

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

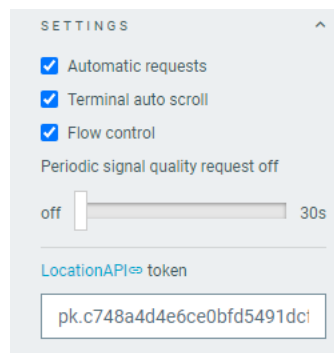


Figure 4: Settings

About

You can view application information, restore defaults, access source code, and documentation. You also can find information on the selected device, access support tools, and enable verbose logging.

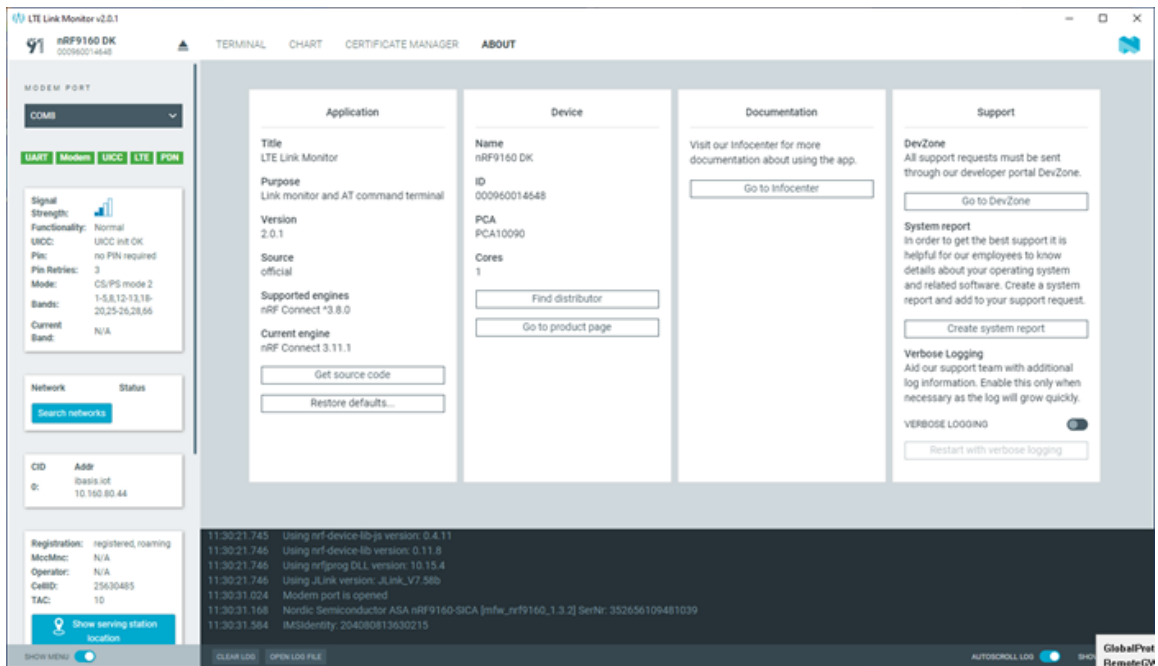


Figure 5: nRF Connect for Desktop Link Monitor About tab

Log

The Log panel allows you to view the most important log events, tagged with a timestamp. Each time you open the app, a new session log file is created. You can find the Log panel and its controls, below the main application Window.

- When troubleshooting, to view more detailed information than shown in the Log panel, use **Open log file** to open the current log file in a text editor.
- To clear the information currently displayed in the Log panel, use **Clear Log**. The contents of the log file are not affected.
- To hide or display the Log panel in the user interface, use **Show Log**.
- To freeze Log panel scrolling, use **Autoscroll Log**.

4 Viewing and sending AT commands

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

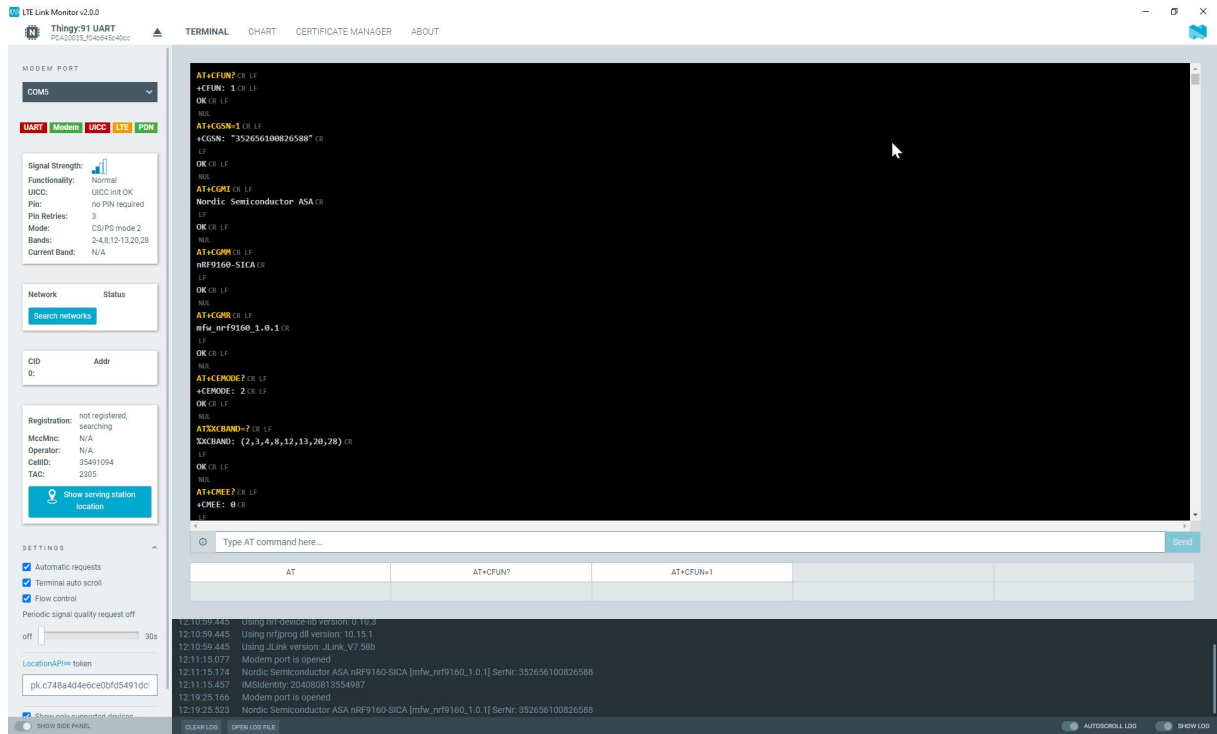


Figure 6: LTE Link Monitor terminal view

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.

5 Viewing modem events

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

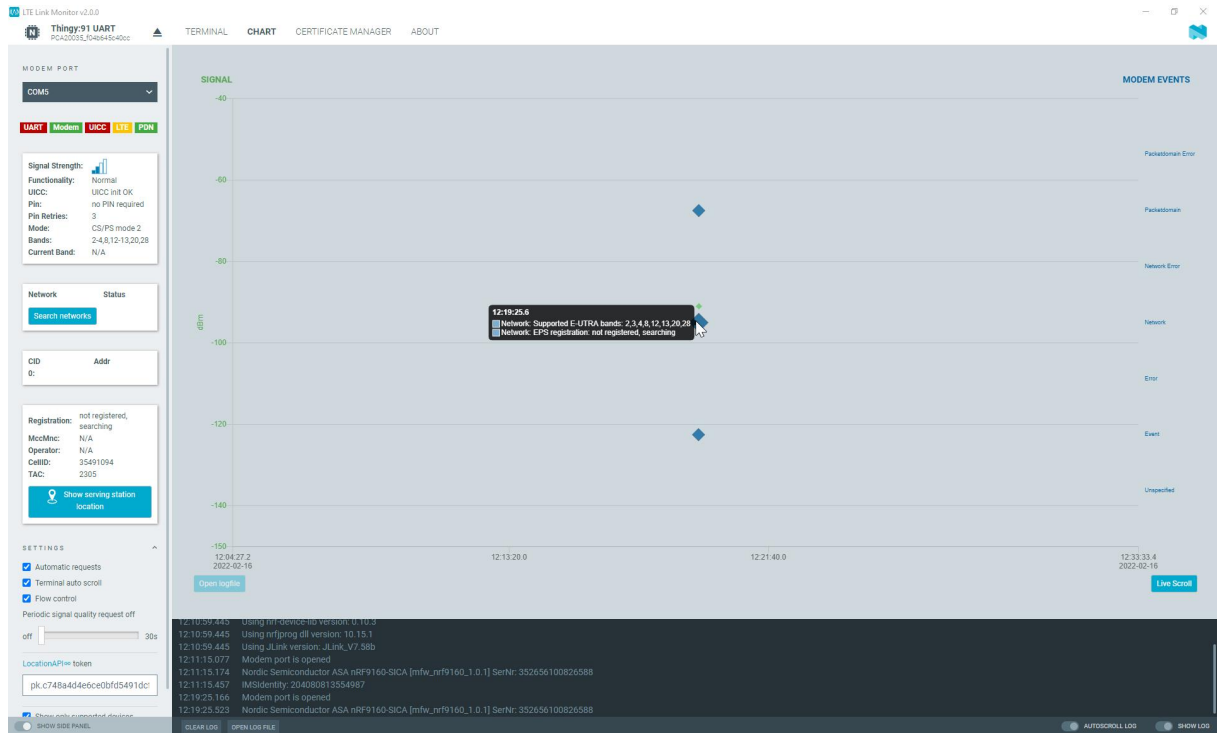


Figure 7: LTE Link Monitor chart view

The time-based chart displays signal quality and modem events. The signal quality reported by the modem is the received signal reference power *Reference Signal Received Power (RSRP)* in *Decibel milliwatt (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.

6 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**.

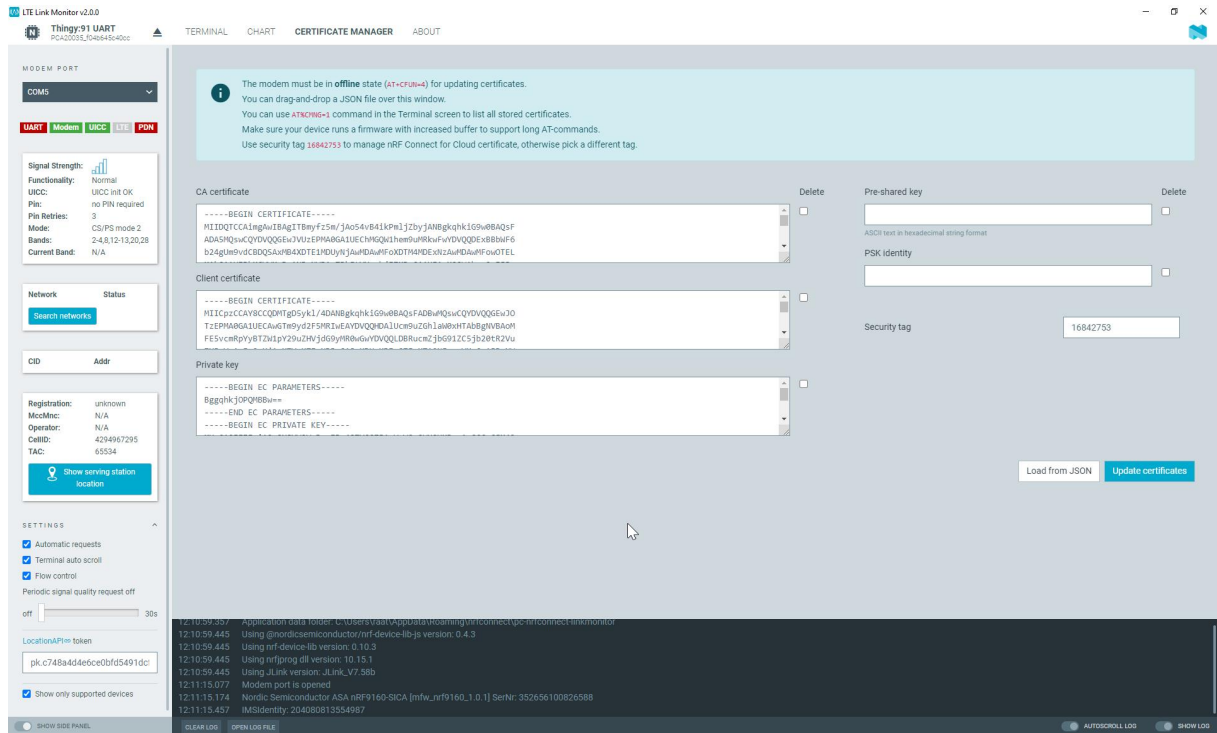


Figure 8: LTE Link Monitor certificate manager

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 Connect for Cloud, you should see a *Certificate Authority (CA)* certificate, a client certificate, and a private key with security tag 16842753 (which is the security tag for nRF Connect for Cloud credentials).

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.

7 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.

```
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),
```

```
        cid: parseInt(ci, 16),
    )))

// construct the locationapi request
.then(({ lac, cid }) => ({
    token: 'pk.c748a4d4e6ce0bfd5491dcfb01ba9b10',
    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());
```

Glossary

AT command

A command used to control the modem.

Long-Term Evolution (LTE)

A wireless broadband communication standard for mobile devices and data terminals, based on the GSM/EDGE and UMTS/HSPA technologies.

Reference Signal Received Power (RSRP)

The average power level received from a single reference signal in an LTE (Long-Term Evolution) network.

Decibel milliwatt (dBm)

A unit for the measurement Reference Signal Received Power (RSRP), expressed in decibels relative to one milliwatt.

Certificate Authority (CA)

A trusted third-party organization that acts to validate the identity of entities (such as IOT devices and websites) and bind them to cryptographic keys using electronic documents known as digital certificates.

JavaScript Object Notation (JSON)

A lightweight data-interchange format.

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