iNode LoRa Monitor

- user manual

1. Introduction

iNode LoRa Monitor is an application used to configure sensors from the iNode LoRa family : iNode LoRa EM, iNode LoRa T, iNode LoRa HT. Thanks to the WebUSB functionality, it works in Chrome or Chromium browsers on various operating systems, such as Android OS, Linux or Windows 10, and works directly with USB adapters: **iNode LoRa USB** or **iNode LoRa GSM MQTT**. In other browsers, e.g. FireFox, it is necessary to use the iNode Hub Server application for Windows 10.

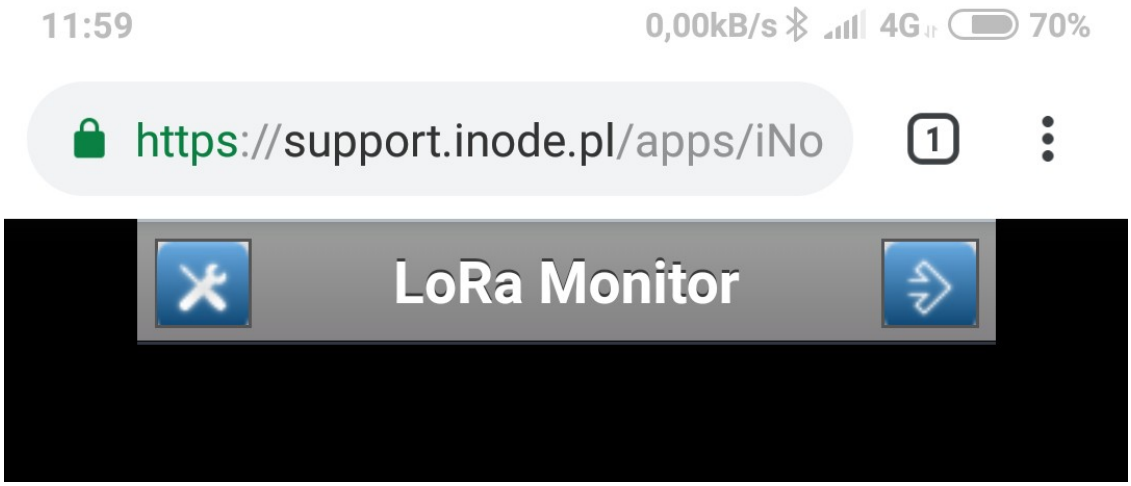
2. Installation of the iNode LoRa Monitor application

The **iNode LoRa Monitor** can be used in Google Chrome by connecting to the **iNode LoRa USB** or **iNode LoRa GSM MQTT** adapter in several ways.

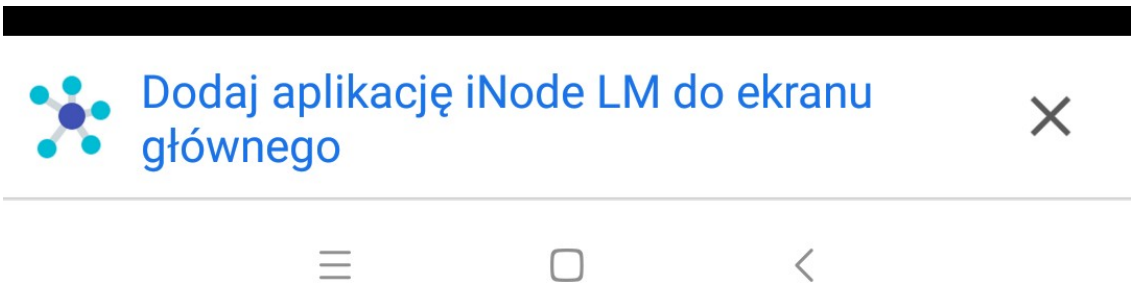
2.1 Android OS

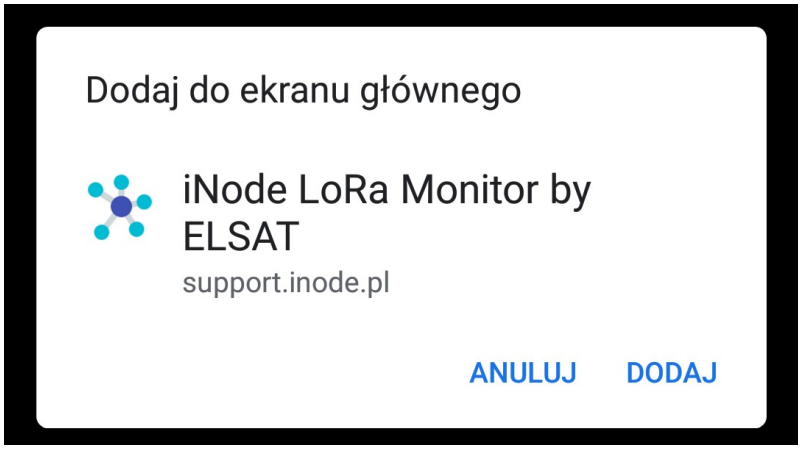
On a tablet or phone with Android OS this is the simplest, because you just need to start the Chrome browser

and then load the **iNode LoRa Monitor** application into it. After the application loads, it can be installed for easier launch later.

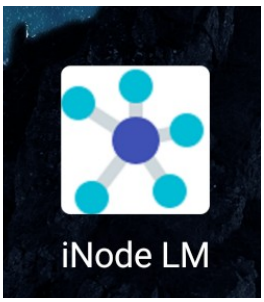


After the application loads, it can be installed for easier launch later.

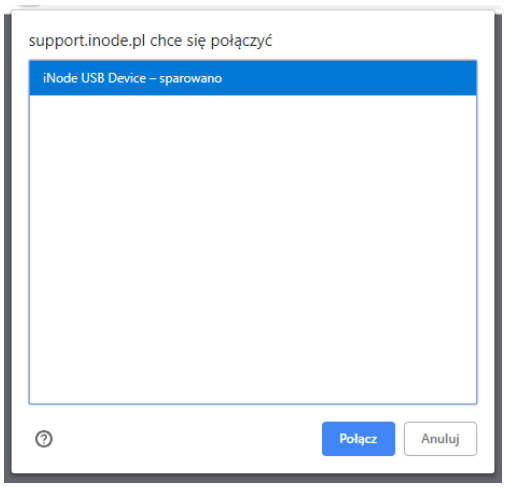




The application icon will appear on the main screen:

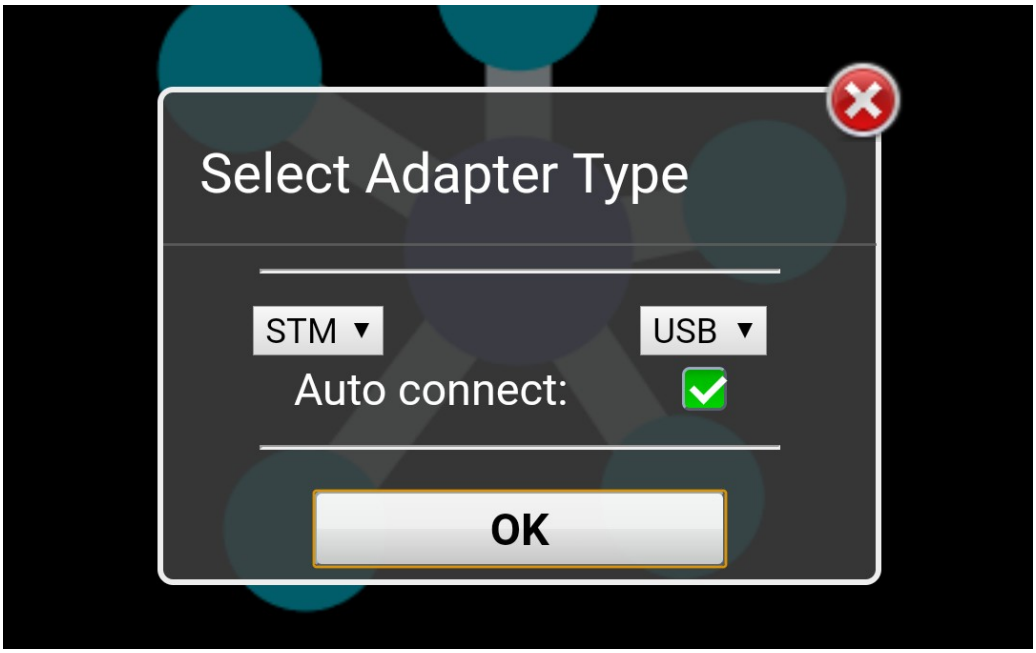


The next step is connecting the **iNode Lora USB** adapter to the tablet or smartphone, using a USB OTG cable with connectors: USB A socket, USB B micro plug. After selecting the button  a system window will appear to choose the USB adapter with which the application can work.

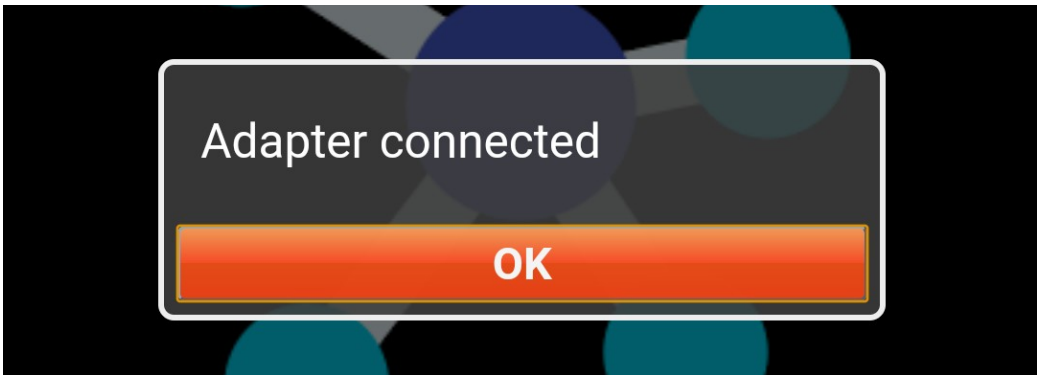


Select it and then press the Connect button.

Then the application window will appear for choosing communication with the adapter and the type of USB adapter.



Mark the options: STM and USB and press the OK button. The application will then try to connect to the selected USB adapter. If it succeeds, a window will appear with the message *Adapter connected*.



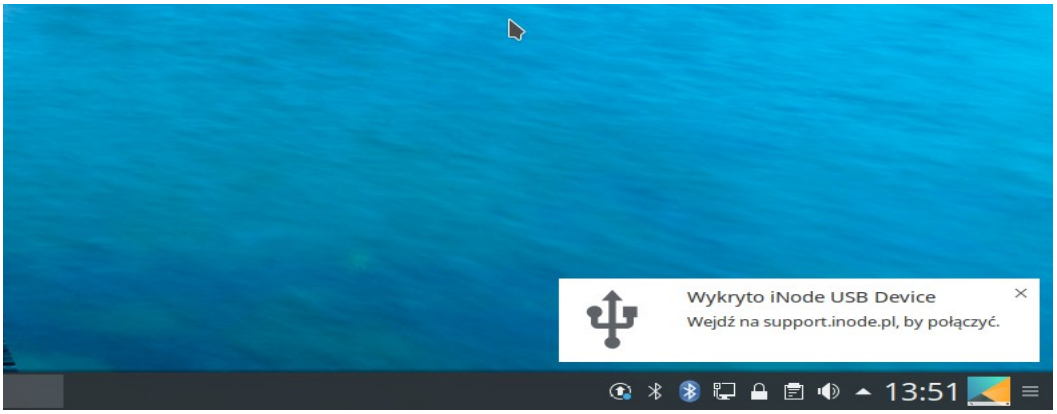
From now on, the **iNode LoRa Monitor** application is ready to work.

2.2 Linux

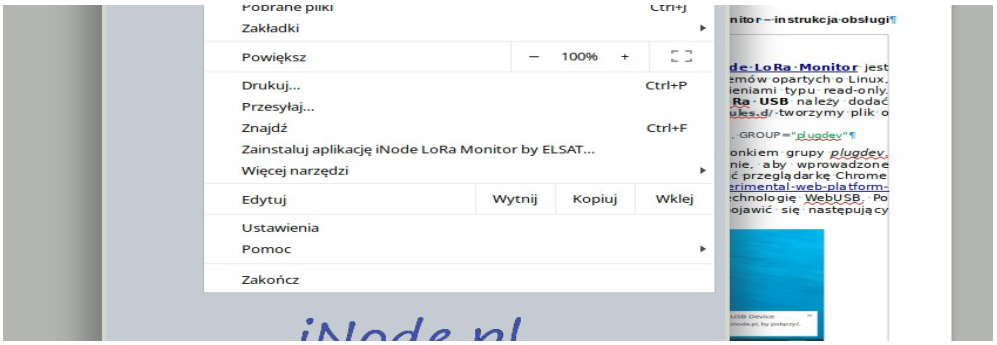
Under Linux, launching the **iNode LoRa Monitor** application is a little more complicated, because on most Linux-based systems, USB devices are normally included with read-only permissions. To allow Chrome to use the **iNode LoRa USB** adapter, you must add a new udev rule. To do this, in the **/etc/udev/rules.d/** directory, create a file called **50-inode.rules** with the following content:

```
SUBSYSTEM=="usb", ATTR{idVendor}=="0483", MODE="0664", GROUP="plugdev"
```

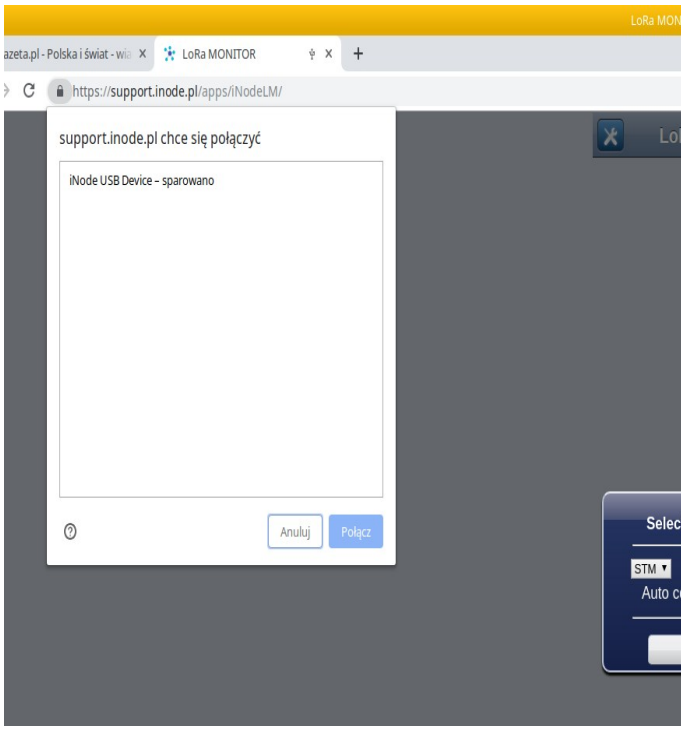
In addition, make sure that the user is a member of the *plugdev* group. Then log out and log in again so that the modifications you make are used. Then we can start the Chrome browser and enter chrome://flags/#enable-experimental-web-platform-features in the address bar so that Chrome can use WebUSB technology. After connecting the **iNode LoRa USB** adapter, the following system message should appear:



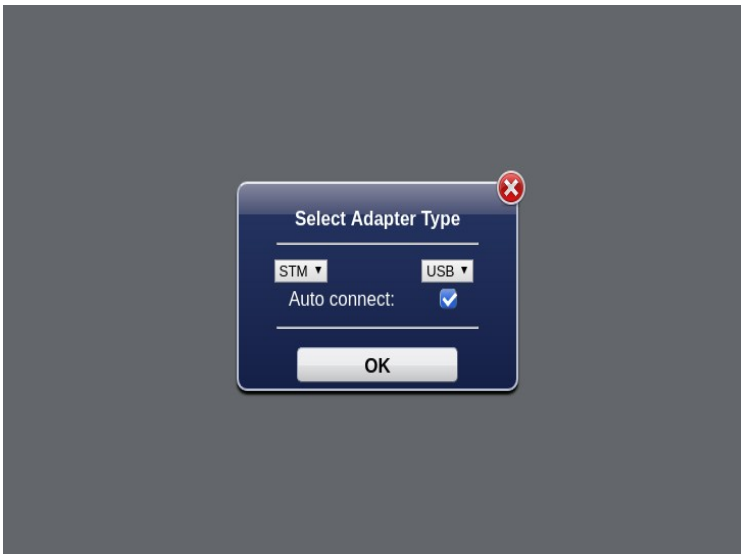
All you have to do is click on it to open the tab (window) with the **iNode LoRa Monitor** application in the browser. It can then be installed on the system. After clicking ⋮ we choose the option in the browser menu that allows:



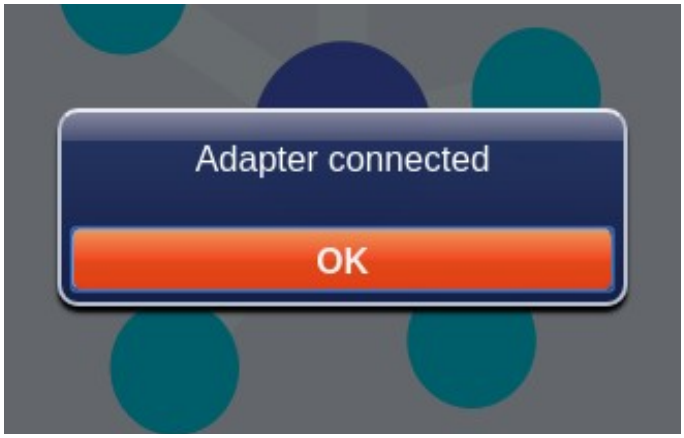
The next step is to inform the application which adapter to use for communication with **iNode LoRa** devices. After selecting the button, a system window will appear to choose the USB adapter with which the application can work.



Select it on the list and then press the Connect button. Then the application window will appear for choosing communication with the adapter and the type of USB adapter.



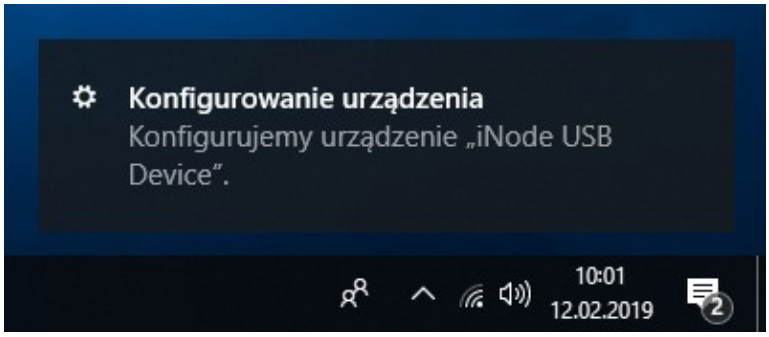
Mark the options: STM and USB and press the OK button. The application will then try to connect to the selected USB adapter. If it succeeds, a window will appear with the message *Adapter connected*.



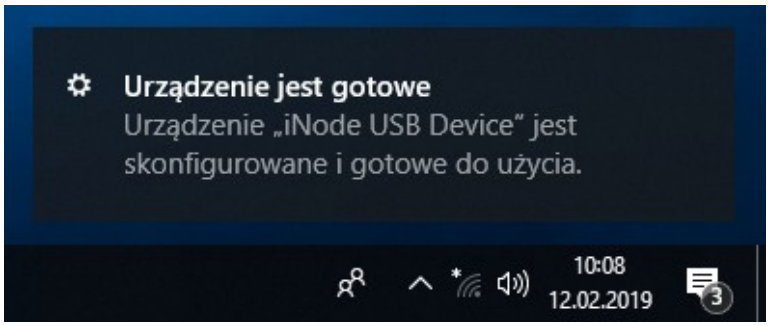
From now on, the **iNode LoRa Monitor** application is ready to work.

2.3 Windows 10

The first time you connect the **iNode LoRa USB** to a computer with Windows 10, it will be recognized as an *iNode USB Device*:



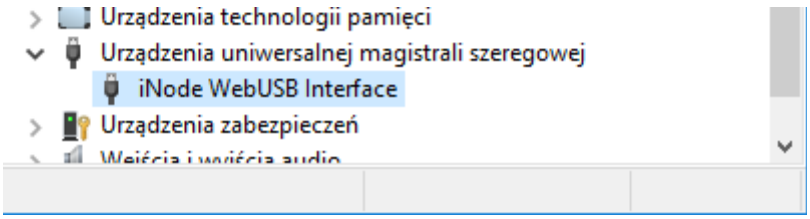
and the installed:



In the device manager, the adapter, as a composite device, is seen in several categories:

as a COM port:

and as a WebUSB interface:

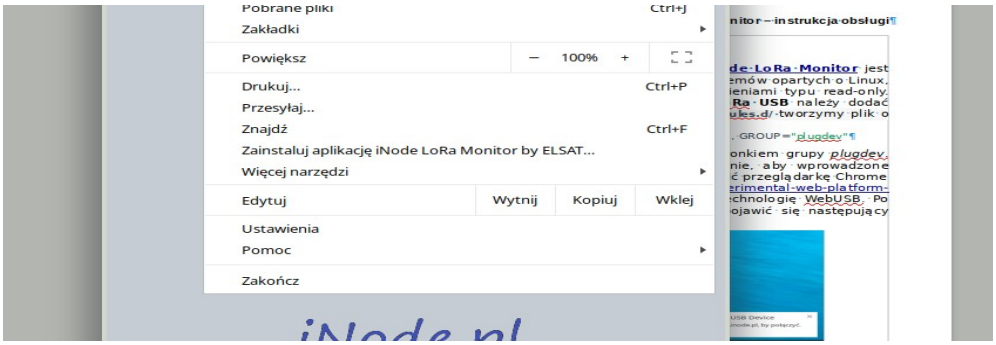


No manual driver installation required for adapter support!

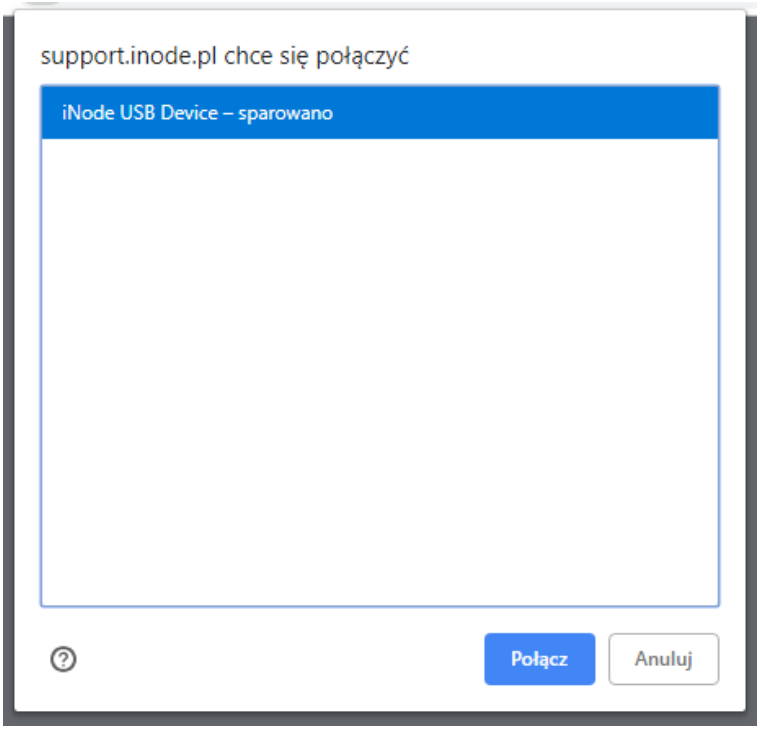
Under Windows 10, the **iNode LoRa Monitor** application can use the adapter in three ways:
- application launched as a Chrome extension; adapter as a COM port, WebUSB interface or via websocket (requires the iNodeHubServer.exe application);
- application running in Chrome; adapter as a WebUSB interface or via websocket (requires the iNodeHubServer.exe application);

You can now start the Chrome browser and type chrome://flags/#enable-experimental-web-platform-features in the address bar so that Chrome can use WebUSB technology.

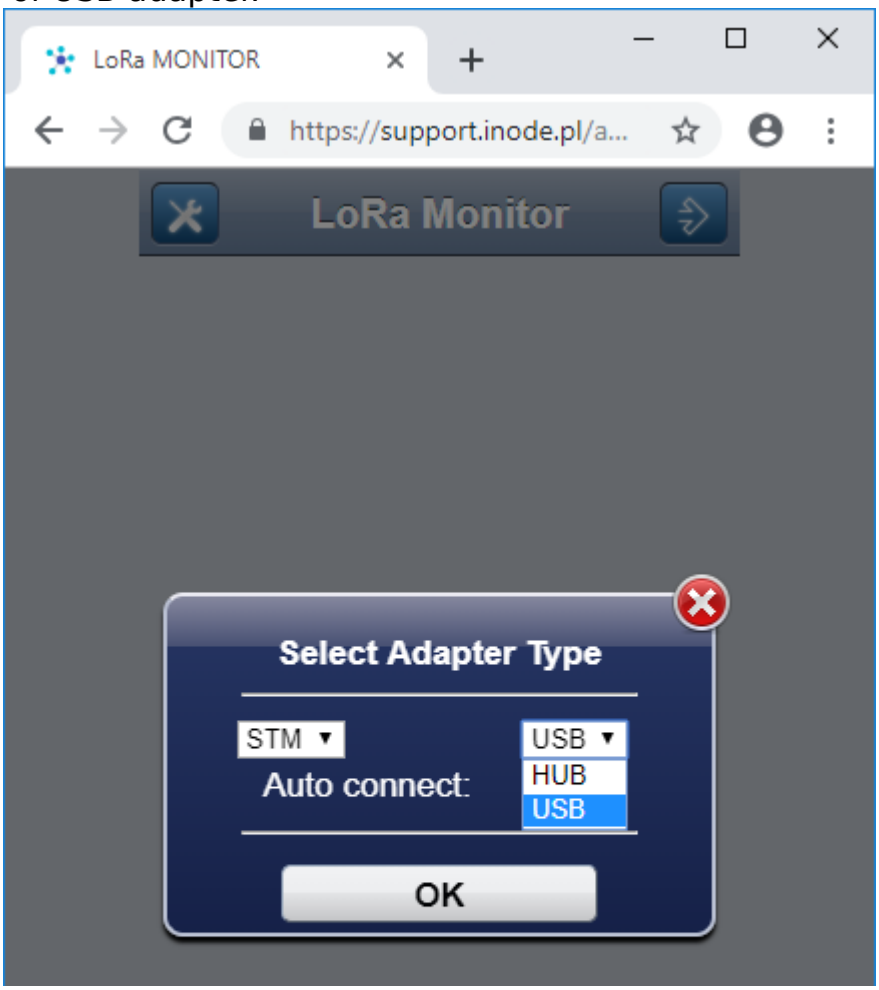
Then we load the **Node LoRa Monitor** application into the browser. It can then be installed on the system. After clicking ⋮ we choose the option in the browser menu that allows:



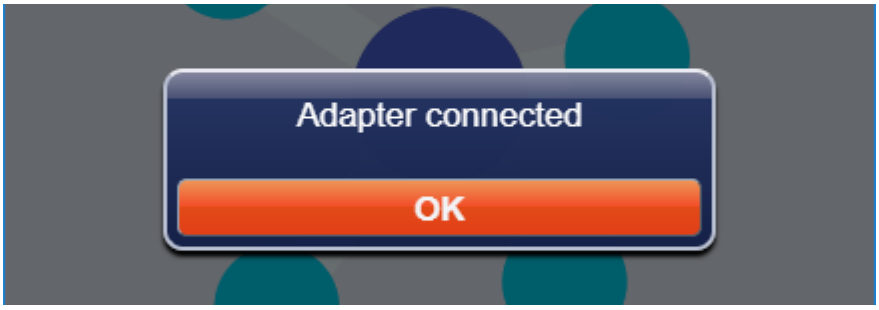
The next step is to inform the application which adapter to use for communication with **iNode LoRa** devices. After selecting the button,  a system window will appear to choose the USB adapter with which the application can work.



Select it on the list and then press the ***Connect*** button. Then the application window will appear for choosing communication with the adapter and the type of USB adapter.



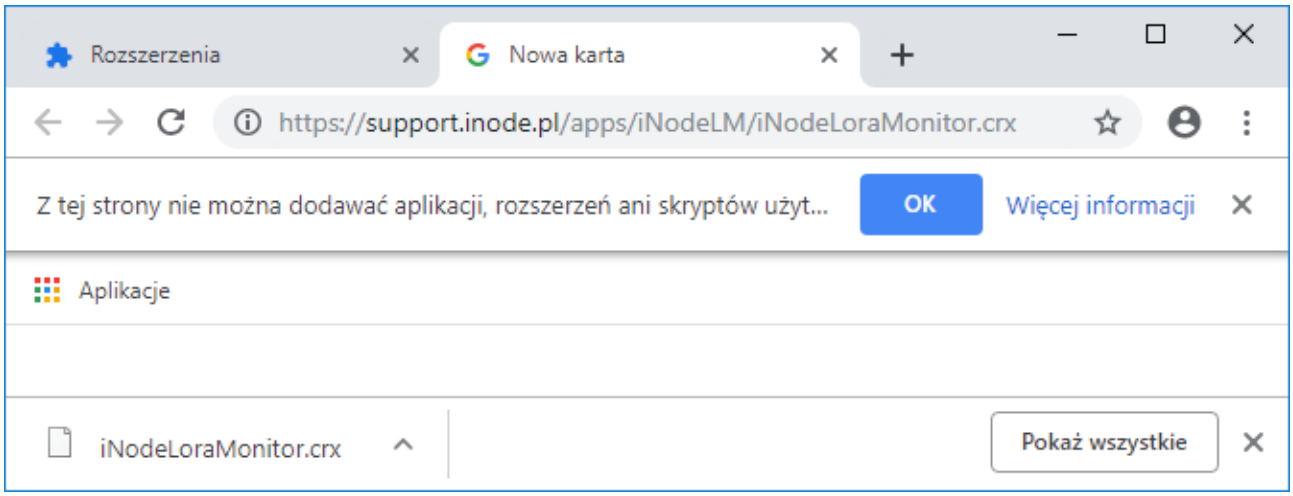
Mark the options: STM and USB and press the OK button. The application will then try to connect to the selected USB adapter. If it succeeds, a window will appear with the message *Adapter connected*.



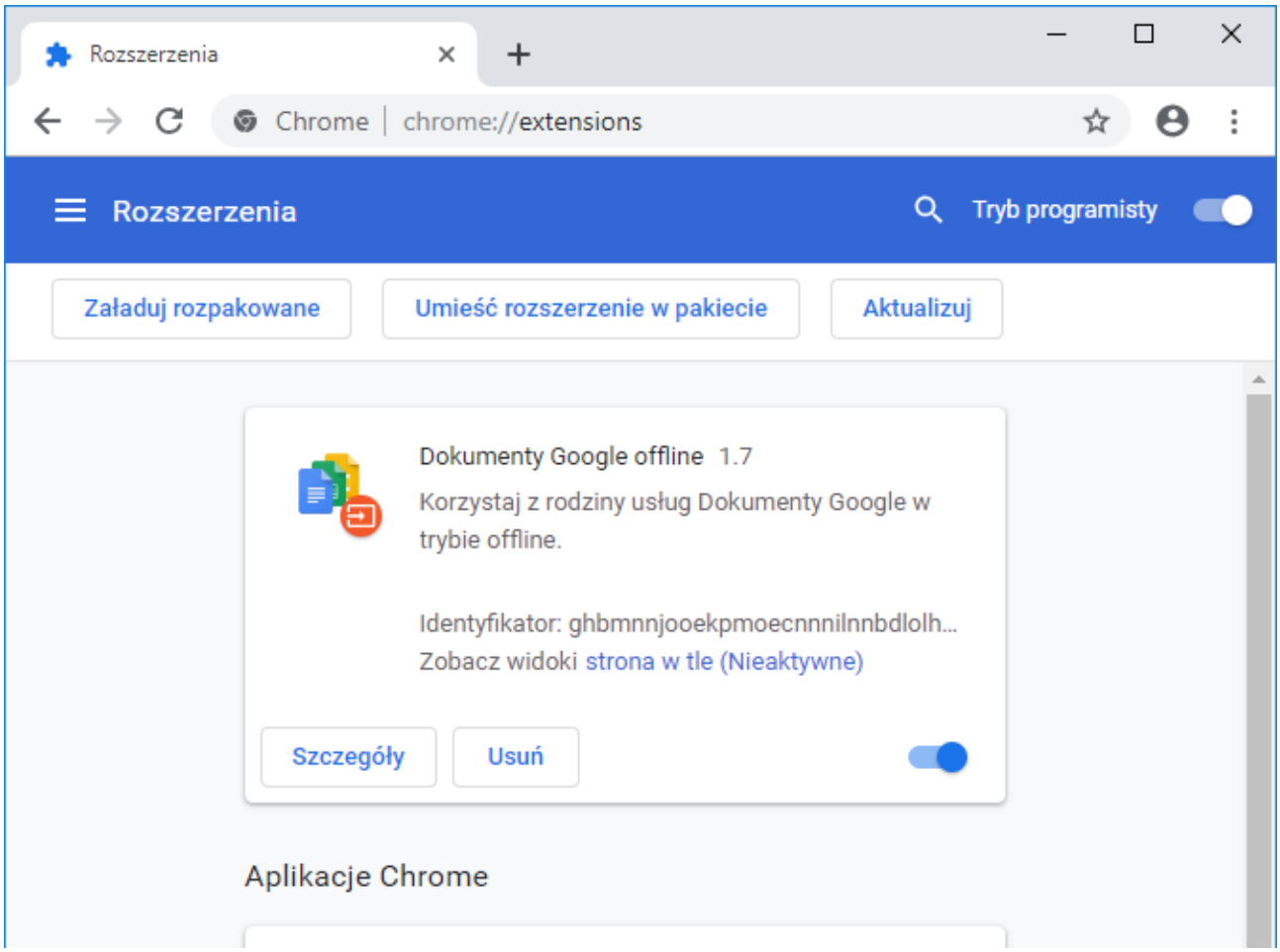
From now on, the **iNode LoRa Monitor** application is ready to work.

2.4 iNode LoRa Monitor as a Chrome extension

The **iNode LoRa Monitor** can also be installed as a Chrome extension if you want to use it with an adapter working as a COM port or ttyACM. This can be done under Linux, Windows 10, Chrome OS. First, download the file with the **iNodeLoraMonitor.crx** application.

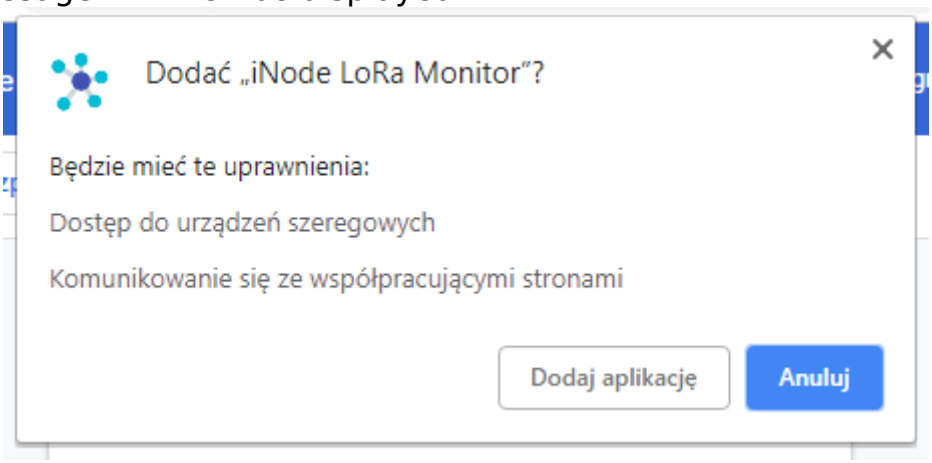


Then, in the address bar of the Chrome browser, type chrome://extensions and turn on the developer mode.

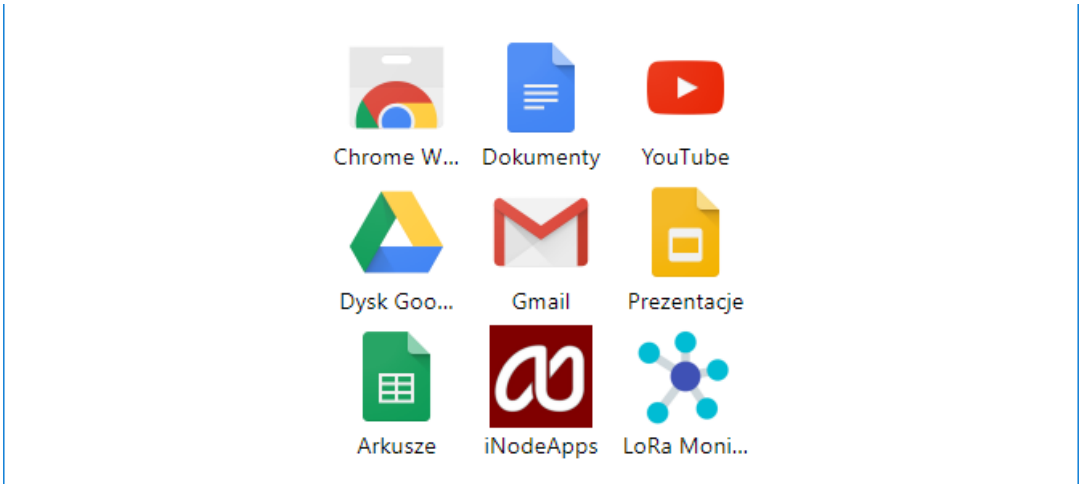


The next step is to drag the downloaded file to the browser screen.

A message will then be displayed.



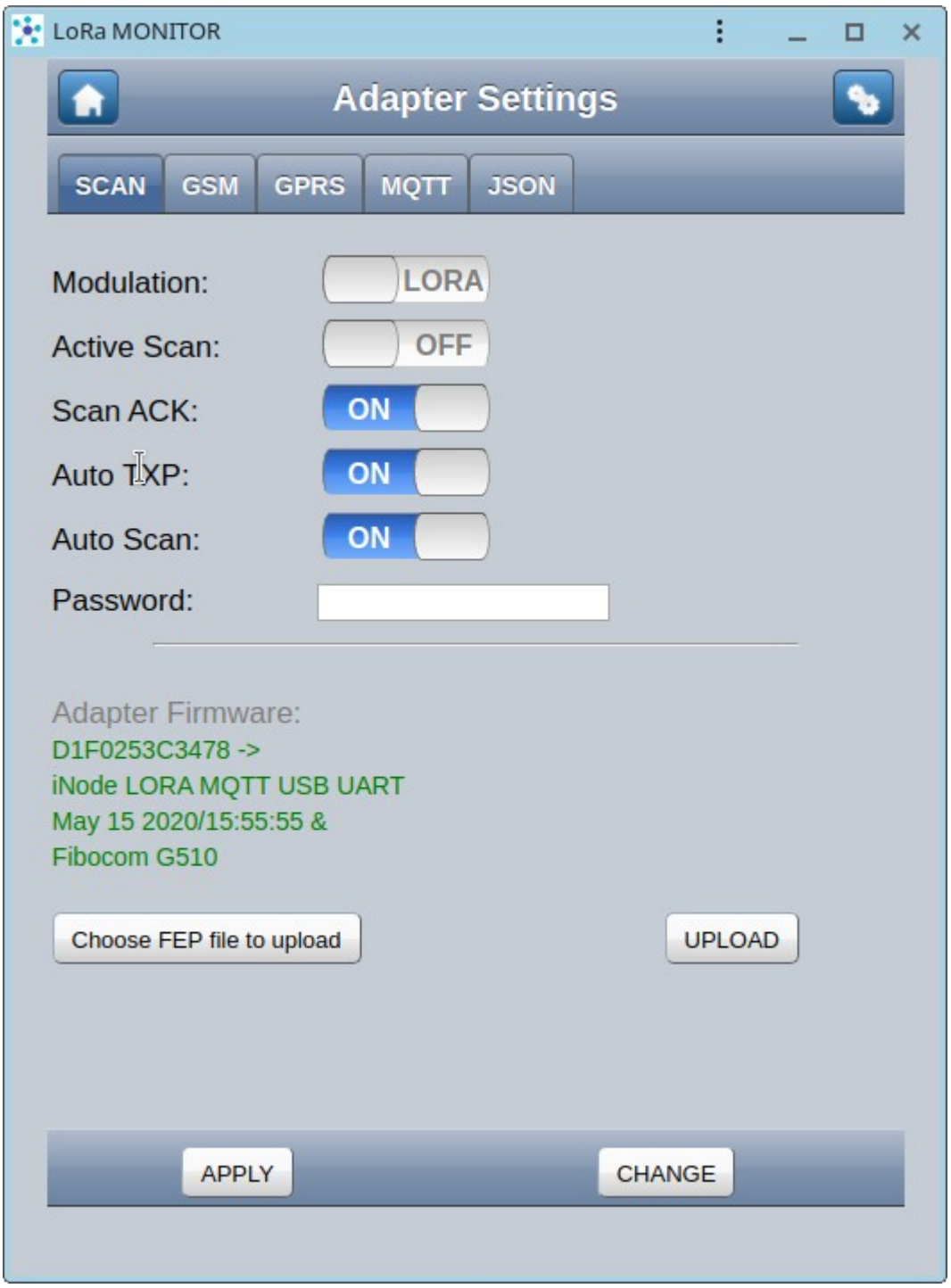
After clicking the ***Add application*** button, it will be added to the application screen and ready to work.



For Linux, make sure that the user is a member of the *dialout* group.

3. iNode LoRa GSM MQTT adapter settings

To configure the **iNode LoRa GSM MQTT** adapter, go to the icon  This is only possible if the communication with the adapter is correct. After reading the settings from the adapter, the following screen will appear with the ***SCAN*** tab selected by default . The ***APPLY*** button changes settings only until the power is turned off or the adapter is reset. The ***CHANGE*** button changes them permanently and saves them in non-volatile memory. Return to ***MONITOR*** mode is also possible after selecting the icon 



3.1 SCAN

This tab allows you to configure the adapter scan parameters and replace the firmware.

3.1.1 Modulation

iNode LoRa GSM MQTT adapter can receive data by radio using two modulation methods: GFSK or LoRa. GFSK is narrowband modulation and has, with the same transmit power, a smaller range than LoRa. In the case of devices of the **iNode LoRa** family, it is used for configuration and firmware replacement, as it ensures higher speed of data transfer. LoRa is a broadband modulation developed by Semtech. It is characterized by the fact that the receiver can receive a signal that is below the noise level.

3.1.2 Active Scan

Depending on the configuration, **iNode LoRa** devices can send, apart from one data packet (so-called broadcast frame) via GFSK, an additional type of packet (so-called active response). The device name is sent in this frame, which the user can change according to his needs. In addition to the unique device address, its name will appear in the **iNode LoRa Monitor** application.

3.1.3 Scan ACK

After enabling this mode of operation, if the adapter works in LoRa, it sends automatically after receiving the broadcast frame, confirmation of its receipt to the sender.

3.1.4 Auto TXP

After activating this mode of operation, if the adapter works in LoRa, it sends automatically after receiving the broadcast frame, confirmation of its receipt to the sender so that it can adjust its transmission power to the ambient conditions.

3.1.5 Auto Scan

After activating this mode of operation and saving it in the adapter, if the adapter is connected to the USB connector, it will immediately go into scan mode. To avoid buffer overflow in the adapter when no application is receiving data from it, USB data transfer is disabled by default. To activate them you must either configure the COM port parameters or send some data to the adapter.

3.1.6 Password

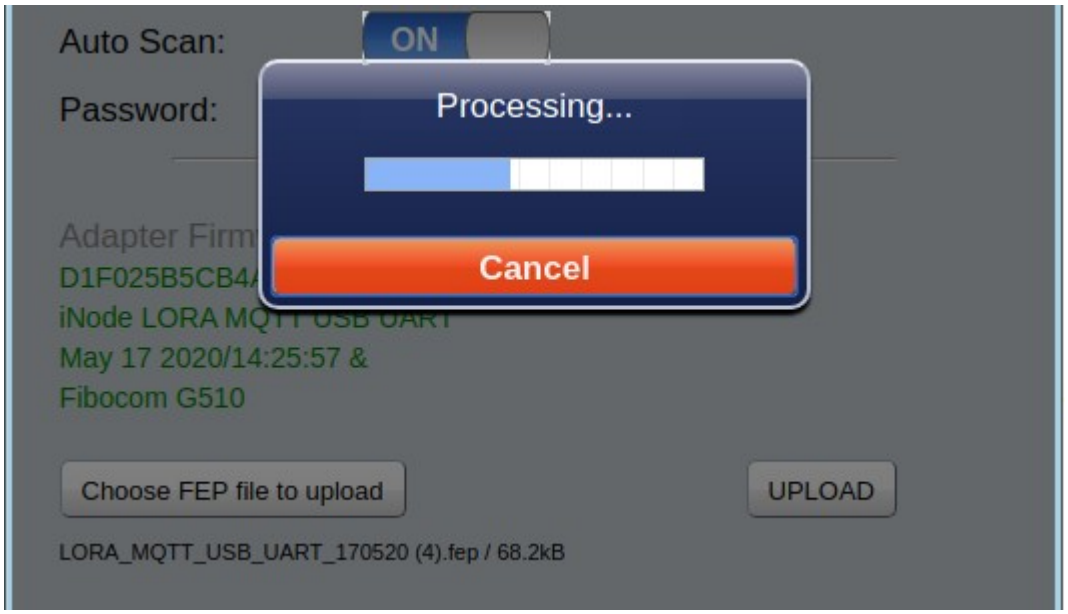
In this window, you can enter a password to limit access to the adapter configuration. At this time this functionality is not active.

3.1.7 Firmware Adapter

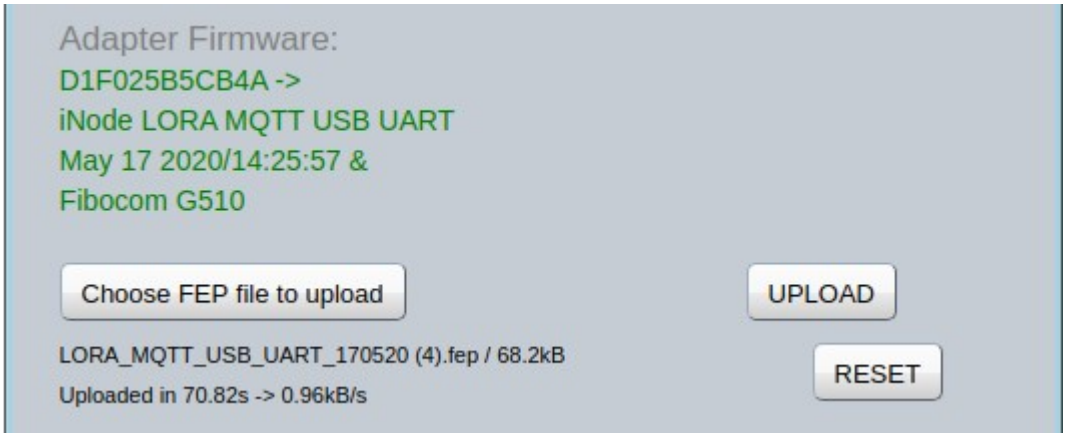
This part of the tab displays information about the firmware located in the adapter and its address . After pressing the ***Choose FEP file to upload*** button , the system browser window will appear for choosing a firmware file. Files with firmware for **iNode LoRa** devices have the extension .fep and contain information for which device they are intended. Therefore, it is not possible to upload to the device firmware intended for another.

When you press the ***UPLOAD*** button, a window will appear showing the progress of sending the firmware to the device.

Make sure that the device does not have a SIM card at the time, because the power consumption of the modem in it may be too high for the USB port to which **iNode LoRa GSM MQTT** is connected . The result will be a power cut when replacing the firmware, which may result in a device failure.



When the firmware is sent, information about the data transfer speed and the ***RESET*** button will appear.



After pressing the ***RESET*** button the firmware will be replaced, the device will restart and be connected again to the **iNode LoRa Monitor** application.

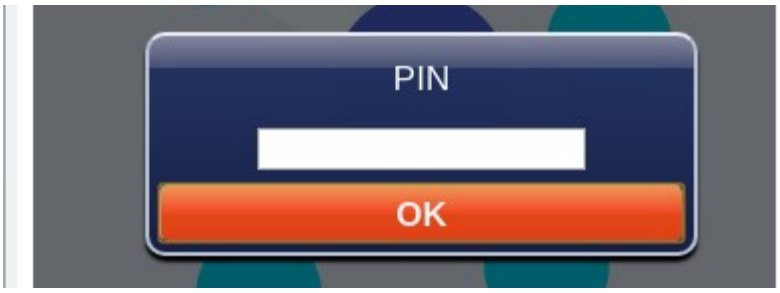
In the case of the **iNode Lora GSM MQTT** adapter are available additional tabs.

3.2 GSM

This tab allows you to configure the parameters associated with the SIM card.

3.2.1 SIM PIN

Here we provide the PIN number to the SIM card located in the device. Its length is 4 digits. The same PIN must be entered to access device settings from the **iNode LoRa Monitor** application.



The application remembers the provided PIN number in the browser.

3.2.2 Roaming

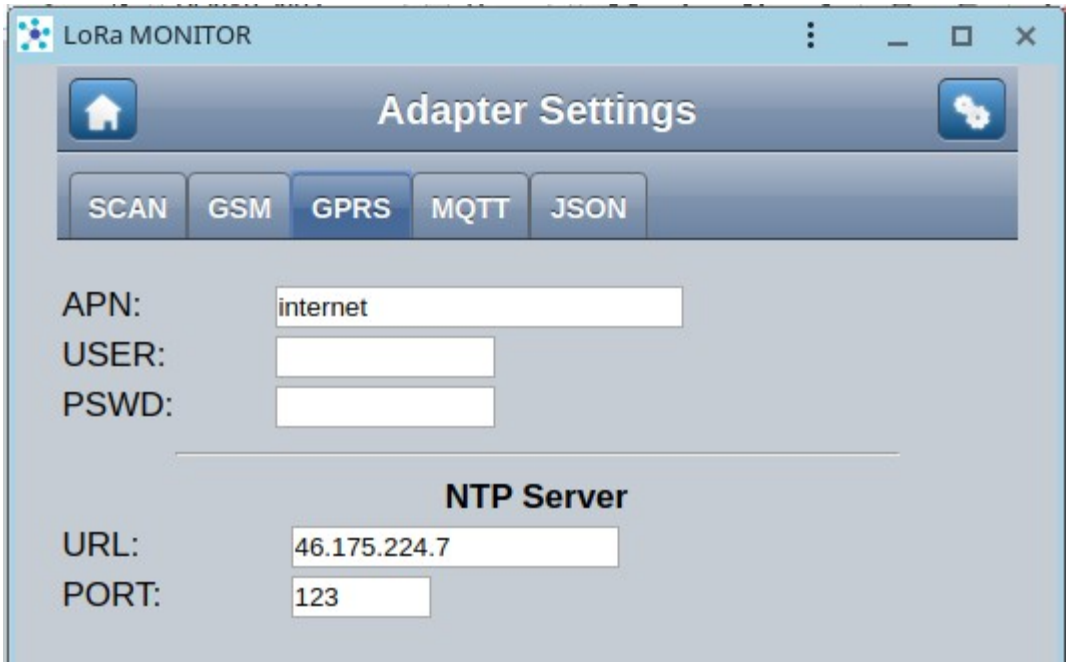
If the SIM card is to work in domestic or foreign roaming, select this option.

3.2.3 Name

Here we provide the name of the device which is forwarded to the MQTT server.

3.3 GPRS

This tab allows you to configure the GPRS connection parameters.



3.3.1 APN

Enter the APN name here. The maximum length is 16 characters.

3.3.2 USER

Here we provide the username appropriate for a given APN. The maximum length is 16 characters.

3.3.3 PSWD

Here we provide the password appropriate for the given user. The maximum length is 16 characters.

3.3.4 NTP Server - URL

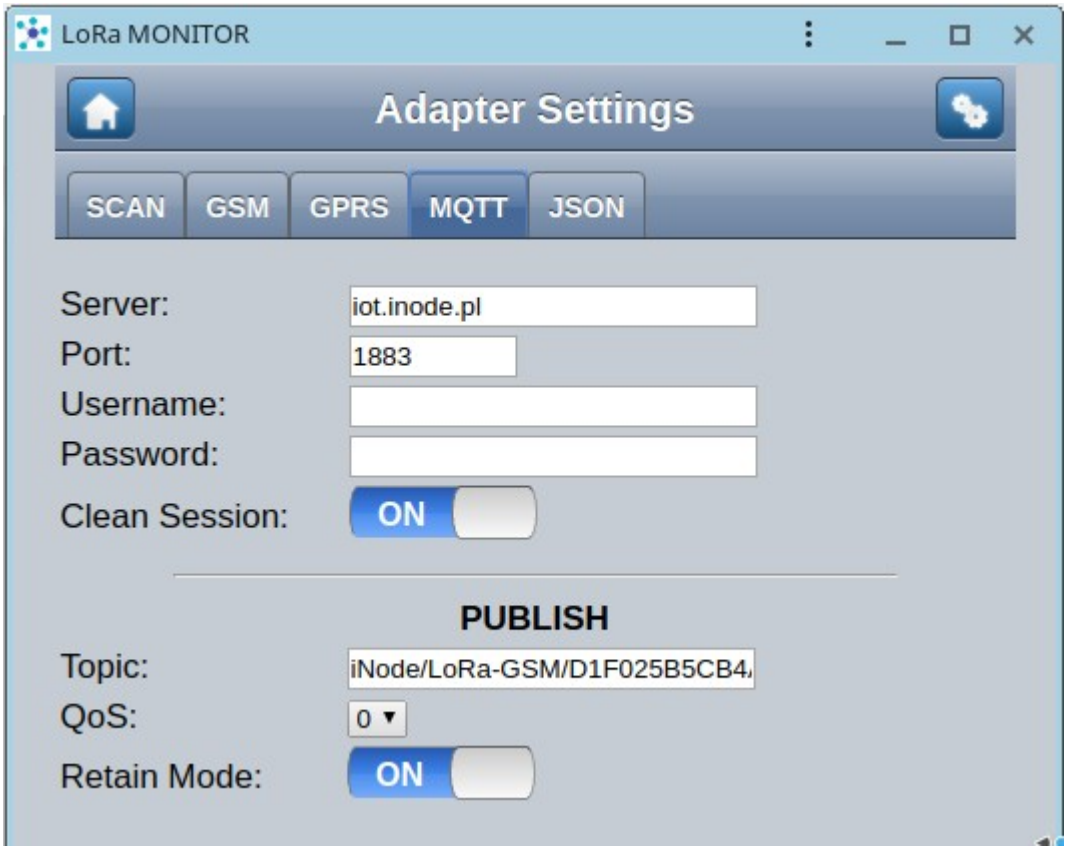
Here we provide the URL of the NTP server in numerical form . The maximum length is 32 characters.

3.3.5 NTP Server - PORT

Here we provide the NTP server port number in the range 0 to 65535.

3.4 MQTT

This tab allows you to configure the parameters of the MQTT server to which the device sends data.



3.4.1 Server

Enter the address of the MQTT server that is to receive data from the device. The maximum length is 32 characters and

3.4.2 Port

Enter the MQTT server port here to receive data from the device. It should be in the range 0 to 65535.

3.4.3 USER

Here we provide the username for access to the MQTT server. The maximum length is 16 characters.

3.4.4 PSWD

Here we provide the password appropriate for access to the MQTT server. The maximum length is 16 characters.

3.4.5 Clean Session

When the ***MQTT Clean Session*** flag is enabled, the client does not want a persistent session. If the client disconnects for any reason, all information and messages in the queue from the previous persistent session are lost.

3.4.6 PUBLISH - Topic

Enter here Topic to which statistical data is sent via **iNode LoRa GSM MQTT**. Data from LoRa sensors are published under the same Topic at the end of which the sensor's MAC is added after the / sign.

3.4.7 PUBLISH - QoS

The meaning of ***MQTT PUBLISH QoS*** is as follows:

- QoS 0 - the client will not receive any confirmation from the server. Similarly, the message delivered to the client from the server does not have to be confirmed. This is the fastest way to post and receive messages, but also the one where you will most likely lose messages.
- QoS 1 - the client will receive a confirmation message from the server after it has been published. If the expected confirmation is not received within the specified time, the customer must retry the message. The message received by the client must also be confirmed in time, otherwise the server will deliver the message again.

3.4.8 PUBLISH – Retain Mode

If it is ON - then the last message sent is remembered by the MQTT server.

Default device settings enable cooperation with the MQTT iNode server - iot.inode.pl

3.5 JSON

This tab allows you to configure the parameters of the MQTT server to which the device sends data. The data received from the **iNode LoRA** sensors are sent to the MQTT server as soon as they are received.

3.5.1 RSSI

Threshold level; further filters only take into account devices from which the received signal level is higher than that set here. The value -128 means any signal level.

3.5.2 MAC - MASK

MAC address mask.

3.5.3 MAC - PATTERN

The MAC address with which the received MAC is compared after the AND operation with the MAC mask.

3.5.4 MANUF - MASK

Manufacturer Specific Data mask.

3.5.5 MANUF - PATTERN

Manufacturer Specific Data with which the received Manufacturer Specific Data is compared after the AND operation with the Manufacturer Specific Data mask.

3.5.6 Period

Time period for sending statistical data by iNode LoRa GSM to the MQTT server.

3.5.7 Encryption

If it is ON - the data sent to the MQTT server is encrypted.

3.5.8 KEY

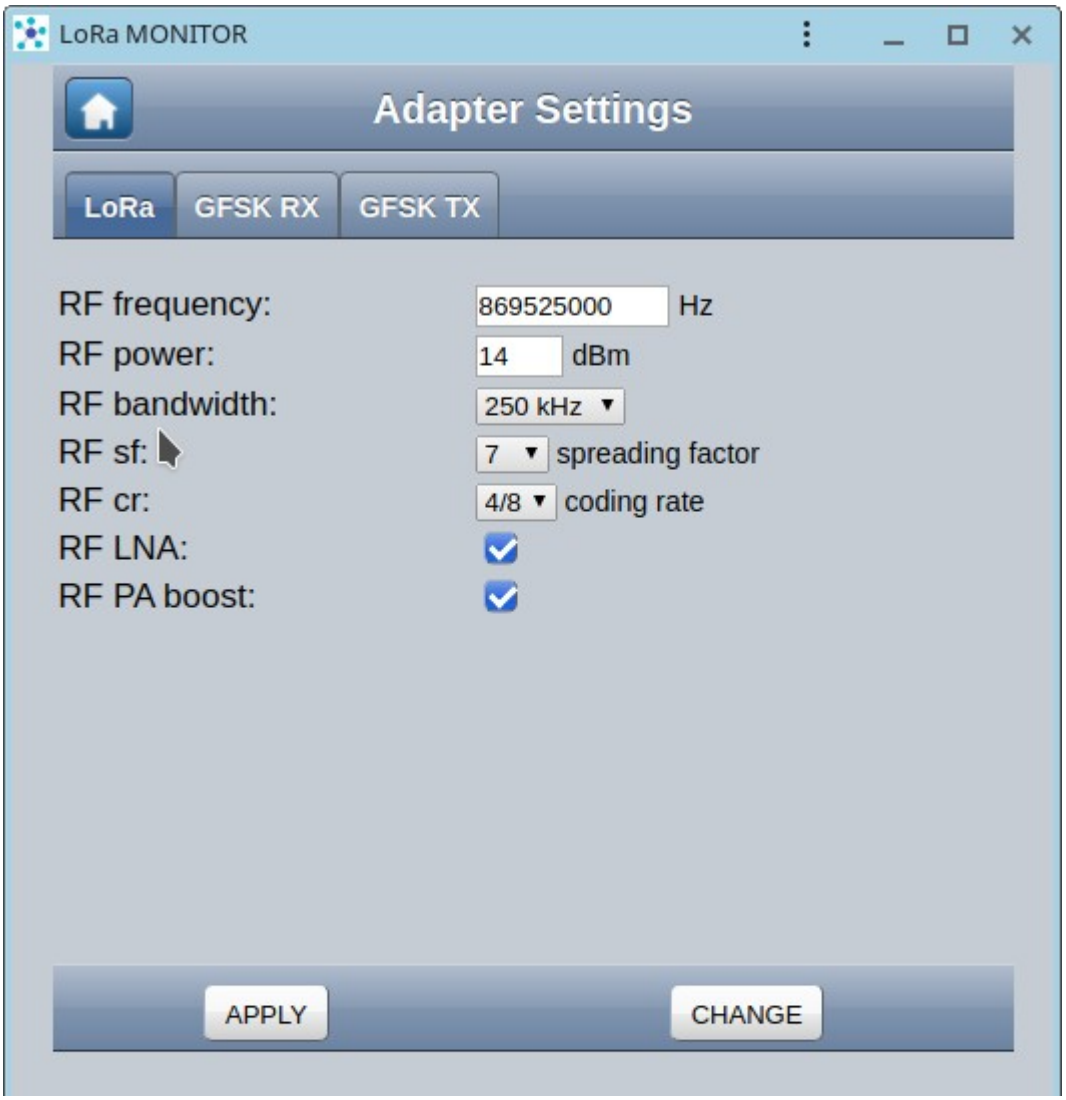
Master key for encrypting data. **iNode LoRa GSM MQTT** encrypts the sent JSON data using a different temporary key each time, which is encrypted with the master key and placed at the beginning of the JSON data.

The key length is a maximum of 16 characters. The same key must be later entered in the **iNode MQTT Monitor** application so that it can decode the data. During the firmware exchange operation, when the default settings of the device are changed - a random one is created for a new key.

After selecting the button  the **iNode LoRa Monitor** application will allow you to configure the RF (radio) parameters of the device.

3.6 LoRa

This tab allows you to change the adapter LoRa modulation parameters. Please note that these parameters must be the same in the sending **iNode LoRa** device, otherwise the adapter will not receive any data from it. Below all parameters information is displayed, what is the maximum permissible value of DC factor in a given frequency band, and what is obtained by the device - LORA TX DC. This information is only helpful and the user should confirm it with the regulator. The maximum output power allowed in Europe by ETSI is +14 dBm.



3.7 GFSK RX

This tab allows you to change the GFSK modulation parameters of the device in RX mode, i.e. receiving data. Please note that these parameters must be the same (GFSK TX) in **iNode LoRa** devices, otherwise the adapter will not receive any data from them.

3.8 GFSK TX

This tab allows you to change the GFSK modulation parameters of the device in TX mode, i.e. sending data. Please note that these parameters must be the same (GFSK RX) in **iNode LoRa** devices, otherwise they will not receive any data from the **iNode LoRa GSM MQTT**. Below all parameters information is displayed, what is the maximum permissible value of DC coefficient in a given frequency band, and what is obtained by the device - GFSK TX DC. This information is only helpful and the user should confirm it with the regulator. The maximum output power allowed in Europe by ETSI is +14 dBm.

4. MONITOR

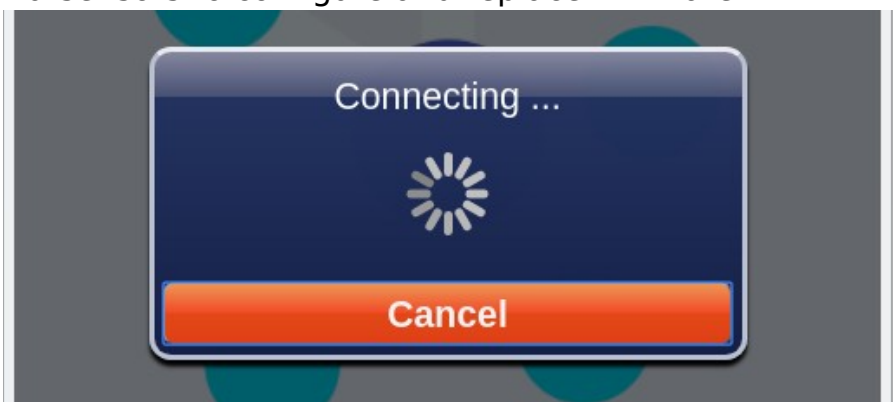
In this mode, **iNode LoRa Monitor** shows from which devices **iNode LoRa** adapter receives broadcast frames. Whether this is in GFSK or in LoRa depends on the adapter configuration. Each type of **iNode LoRa** device has a different icon.

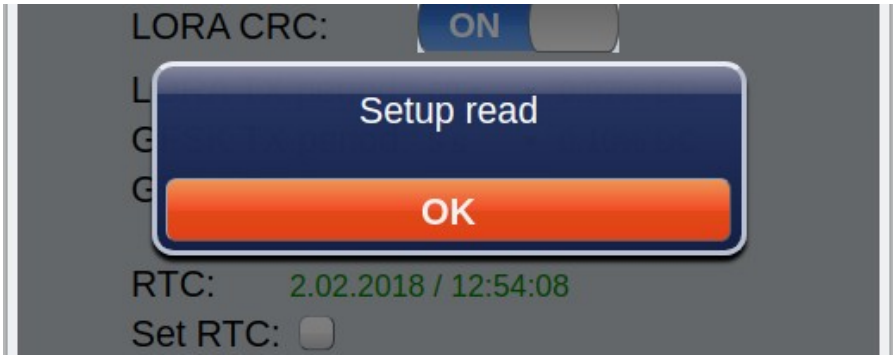
Scanning effect in LoRa.

Scanning effect in GFSK.

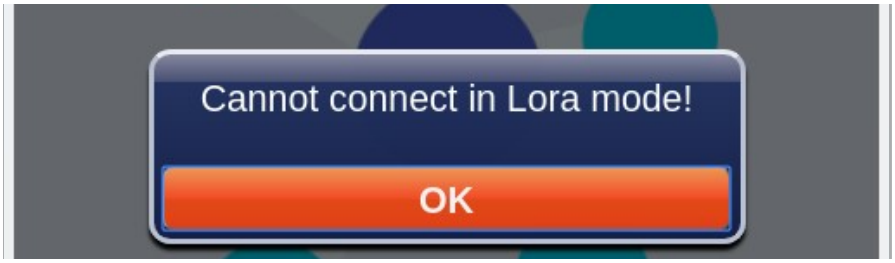
Depending on whether the scan is in GFSK or LoRa, there may be other devices in the list.

The icon  allows establishing connection with the **iNode LoRa** device. This is only possible if the adapter is in GFSK mode and the device you want to connect to also works in this mode. Due to the fact that GFSK modulation enables faster data transmission than LoRa modulation, it was used in **iNode LoRa** sensors to configure and replace firmware.





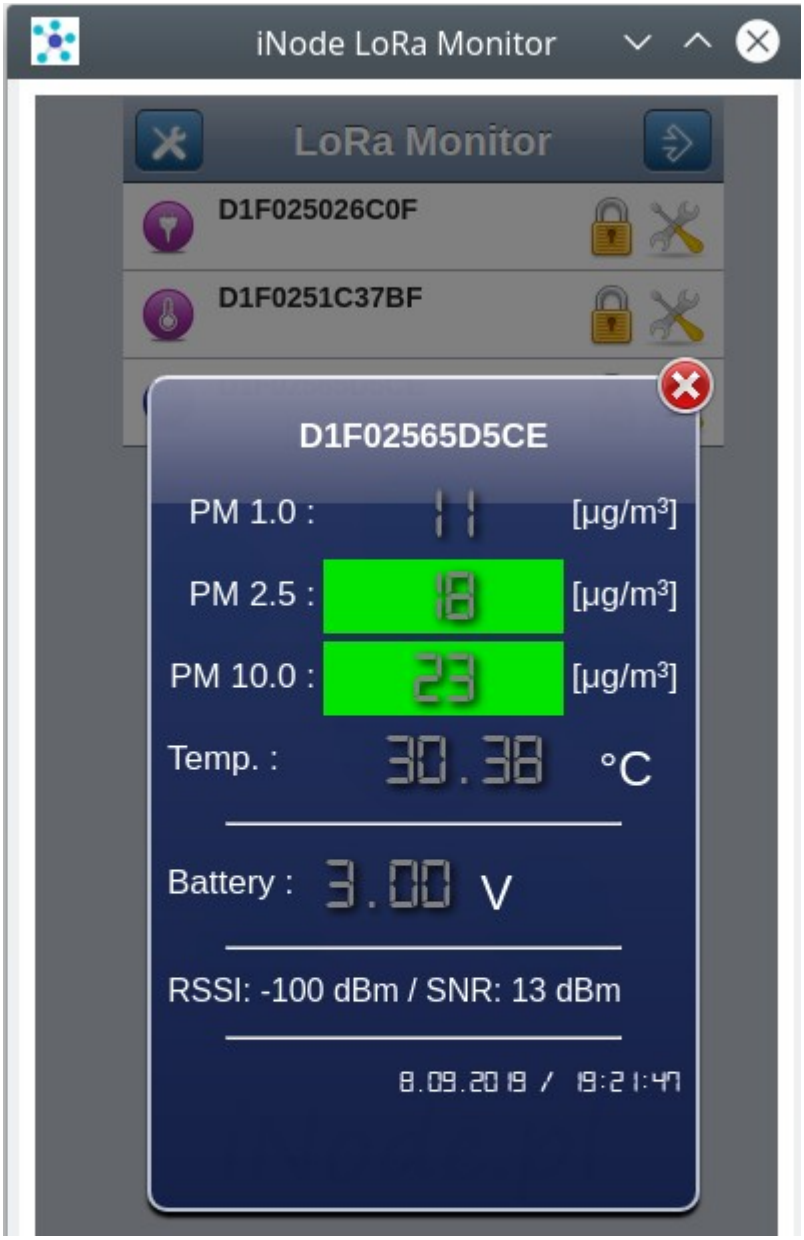
Otherwise, the message *Cannot connect in Lora mode!* will appear.



Based on Wikipedia about GFSK:

GFSK (Gaussian FSK) - a variation of FSK modulation, used for wireless communication within DECT systems, Bluetooth and Z-Wave devices, in which electromagnetic waves in the shape of a Gaussian curve are used. Logical "1" is represented by a positive carrier frequency deviation, and "0" as a negative deviation. In the Bluetooth system, the minimum frequency deviation is 115 kHz. Smoothing of the edges of the impulses is carried out using a Gaussian filter, the effect of which is to reduce the width of the signal spectrum; the next stage is FSK modulation.

iNode LoRa Monitor shows a unique device address on the list of scanned devices. After selecting particular device, a window appears showing the data sent in the broadcast frame received from it.

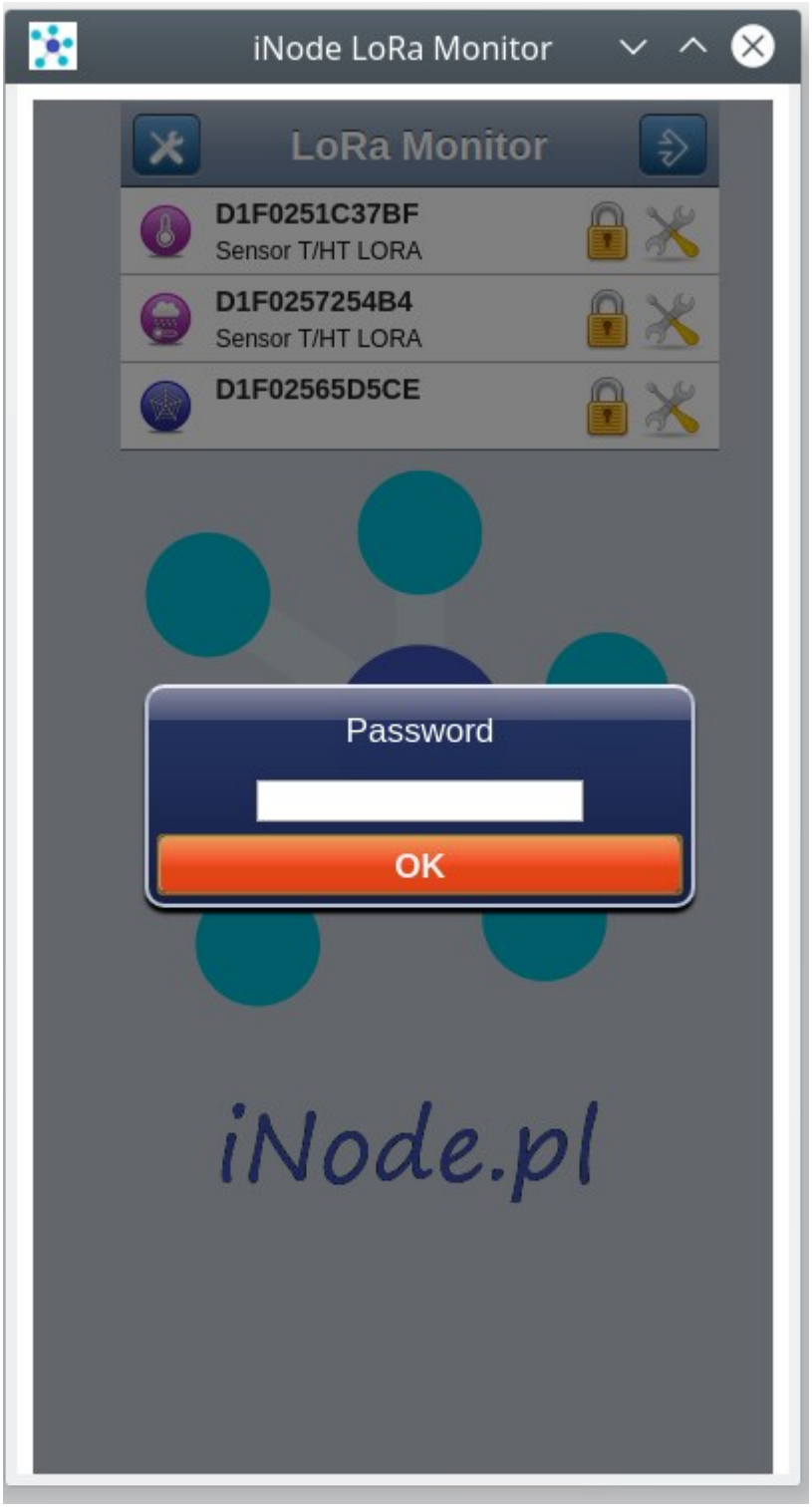


If the **iNode LoRa** device is battery powered, you can see information about the battery voltage. This voltage is measured during transmitting a broadcast frame with LoRa modulation. In idle mode and GFSK one it is higher. The minimum voltage at which **iNode LoRa** devices can work is 1.8V.

In addition, information about the level of the received signal is provided - RSSI and the signal-to-noise ratio - SNR (only in LoRa).

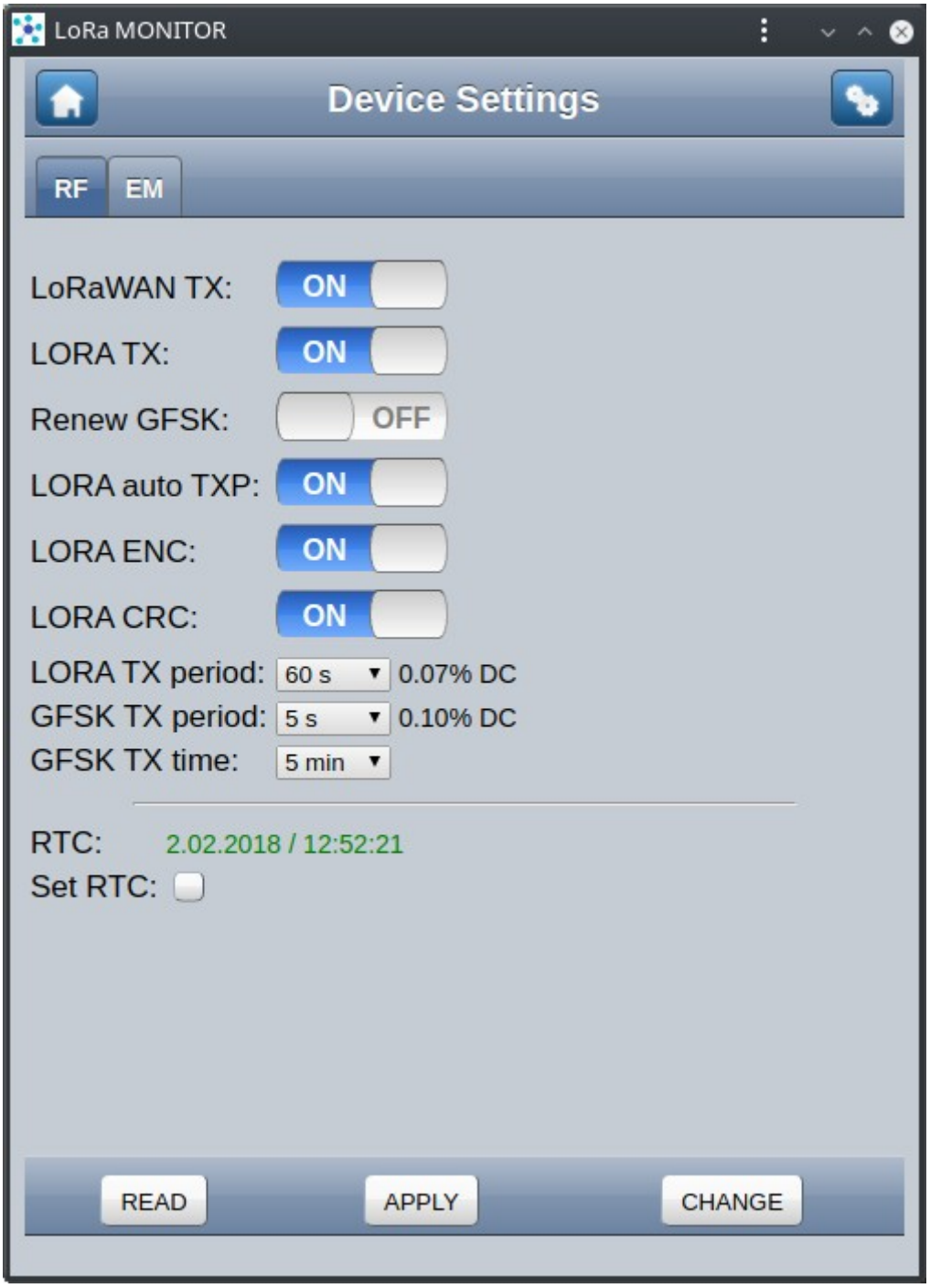
At the very bottom on the right is the date and time of receipt of the last broadcast frame.

The icon  allows you to enter the password necessary to establish a GFSK connection. By default, after the first scan of a device with a given address, it is an empty string. The application remembers entered passwords in the browser database.



5. iNode LoRa device configuration

After selecting the icon  in the list with scanned devices, the **iNode LoRa Monitor** application will try to connect to the given device. When it succeeds, a screen similar to the one below will appear (this one is for **iNode LORA EM**). The ***READ*** button reads data from the device. The ***APPLY*** button changes settings only until the power is turned off or the device is reset. The ***CHANGE*** button changes them permanently and saves them in non-volatile memory. Return to ***MONITOR*** mode is possible after selecting the icon 



5.1 RF

5.1.1 LoRaWAN TX

This switch enables and disables transmission with **LoRa** modulation and with **LoRaWAN** protocol. The device will start working in this mode 5 minutes after turning on the power.

5.1.2 LORA TX

This switch enables and disables transmission with LoRa modulation. If the coverage in GFSK is sufficient for operation, broadcasting in LoRa can be turned off to save battery. The **iNode LoRa Monitor** application will prevent simultaneous disabling of GFSK and LoRa broadcasting. The device must always broadcast to be able to connect to it.

5.1.3 Renew GFSK

This switch allows, if the device only transmits in LoRa, to activate transmission in GFSK for the time specified in ***GFSK TX***. The receiving device (adapter) must then have ***Active Scan*** mode on.

5.1.4 LORA auto TXP

This switch enables the automatic selection of the transmit power level. The receiving device (adapter) must then be in ***Auto TXP*** mode.

5.1.5 LORA ENC

This switch allows the encrypting transmitted data frames. The receiving device (adapter) must then have the password to decryption them entered in the ***PASSWORD*** field.

5.1.6 LORA CRC

This switch allows inclusion of the addition of the checksum to the transmitted data frames. The data frame is longer and it also transmits longer.

5.1.7 LORA TX period

The period of sending broadcast frames by LoRa. On the right, the DC factor is given for the given LoRa TX modulation parameters. It should be remembered that **iNode LoRa** devices are radio and the user must ensure that their operating parameters are compatible with the permissible for a given frequency band. A given device may not transmit too often, because it will prevent transmission to another, especially if its range is large, and so it is when it transmits with high power.

Transmission power should also not be greater than allowed by law. The maximum output power allowed in Europe by ETSI is +14 dBm, except for the G3 band, where it can be up to +27 dBm.

5.1.8 GFSK TX period

The period of sending broadcast frames by GFSK . On the right, the DC factor is given for the given GFSK TX modulation parameters. It should be remembered that **iNode LoRa** devices are radio and the user must ensure that their operating parameters are compatible with the permissible for a given frequency band. A given device may not transmit too often, because it will prevent transmission to another, especially if its range is large, and so it is when it transmits with high power. Transmission power should also not be greater than allowed by law. The maximum output power allowed in Europe by ETSI is +14 dBm, except for the G3 band, where it can be up to +27 dBm.

5.1.9 GFSK TX time

Here you can set how long the device will transmit via GFSK after power up or reset. The **iNode LoRa Monitor** application will prevent simultaneous disabling of GFSK and LoRa broadcasting. The device must always broadcast to be able to connect to it.

5.1.10 RTC

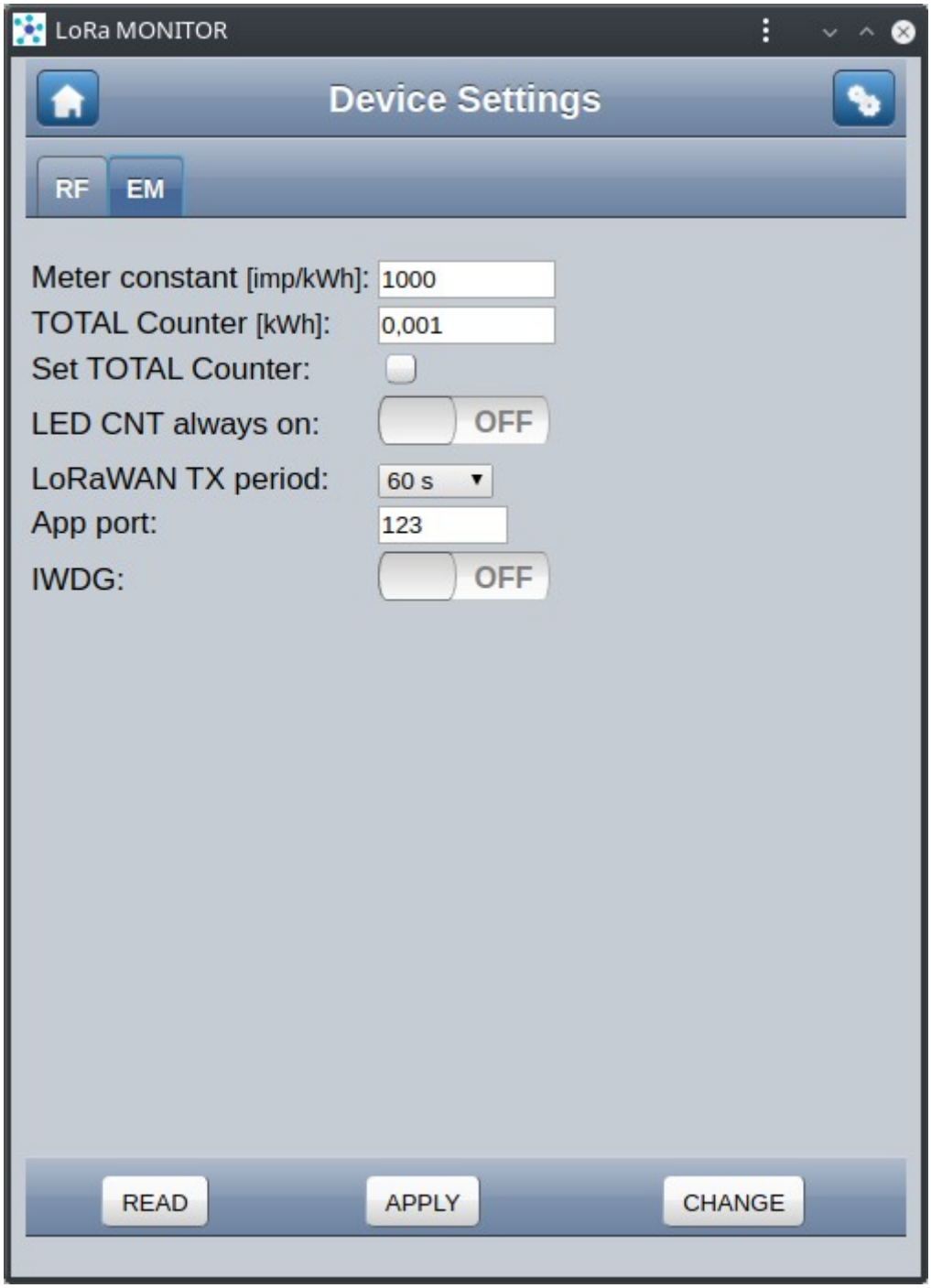
Shows the date and time read from the device.

5.1.11 Set RTC

After selecting and selecting the ***APPLY*** or ***CHANGE*** button, the date and time on the device will be set.

5.2 EM

This tab allows you to modify the operating parameters of **iNode LORA EM**.



5.2.1 Meter constant

Here we can provide a constant of electric meter with which **iNode LORA EM** works. It must be expressed in impulses / kWh and must not be greater than 16383.

5.2.2 TOTAL Counter

The pulse counter value read from **iNode LORA EM** is displayed here . User can now enter new value. However, it will be saved into the device only when ***Set TOTAL Counter*** is selected.

5.2.3 Set TOTAL Counter

Selecting this option and selecting the ***APPLY*** or ***CHANGE*** button will save the value from the ***TOTAL Counter*** to ***iNode LORA EM***.

5.2.4 LED CNT always on

After selecting this option, the LED repeating the LED indicator on the meter will be lit all the time. Otherwise it is always off.

5.2.5 LoRaWAN TX period

Here we can choose how often data from the device will be sent in **LoRaWAN** mode.

5.2.6 App port

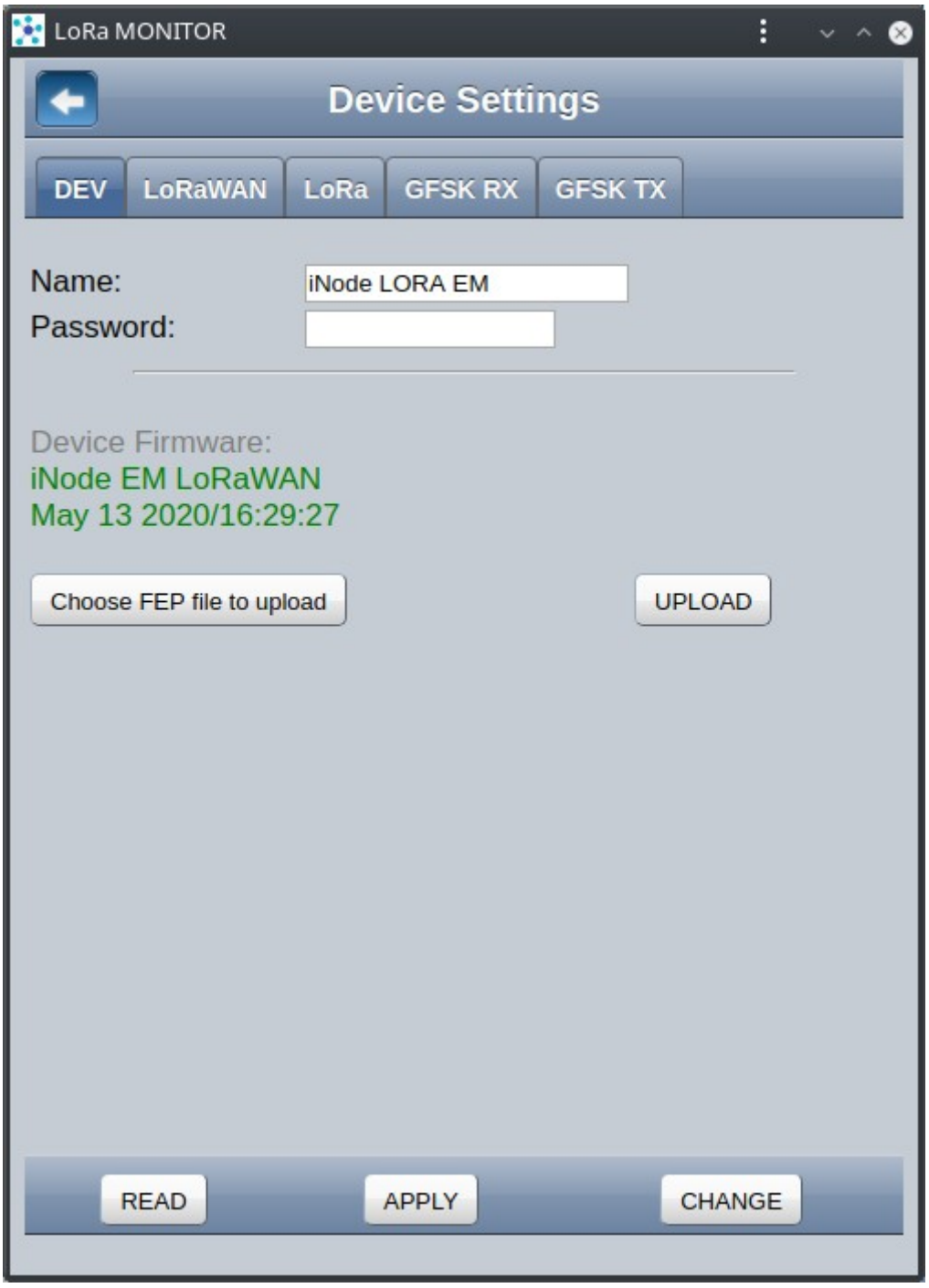
The port number to which data is sent in **LoRaWAN** mode.

5.2.7 IWDG

We can enable and disable the hardware watchdog. In **LoRaWAN** mode it is always turned off to save energy.

5.3 RF Settings

After selecting the button  the **iNode LoRa Monitor** application will allow you to configure the RF (radio) parameters of the device. They are similar to those for the **iNode LoRa** adapter.



5.3.1 DEV

5.3.1.1 Name

Here you can change the device name sent by GFSK in the frame with the answer to the active query.

5.3.1.2 Password

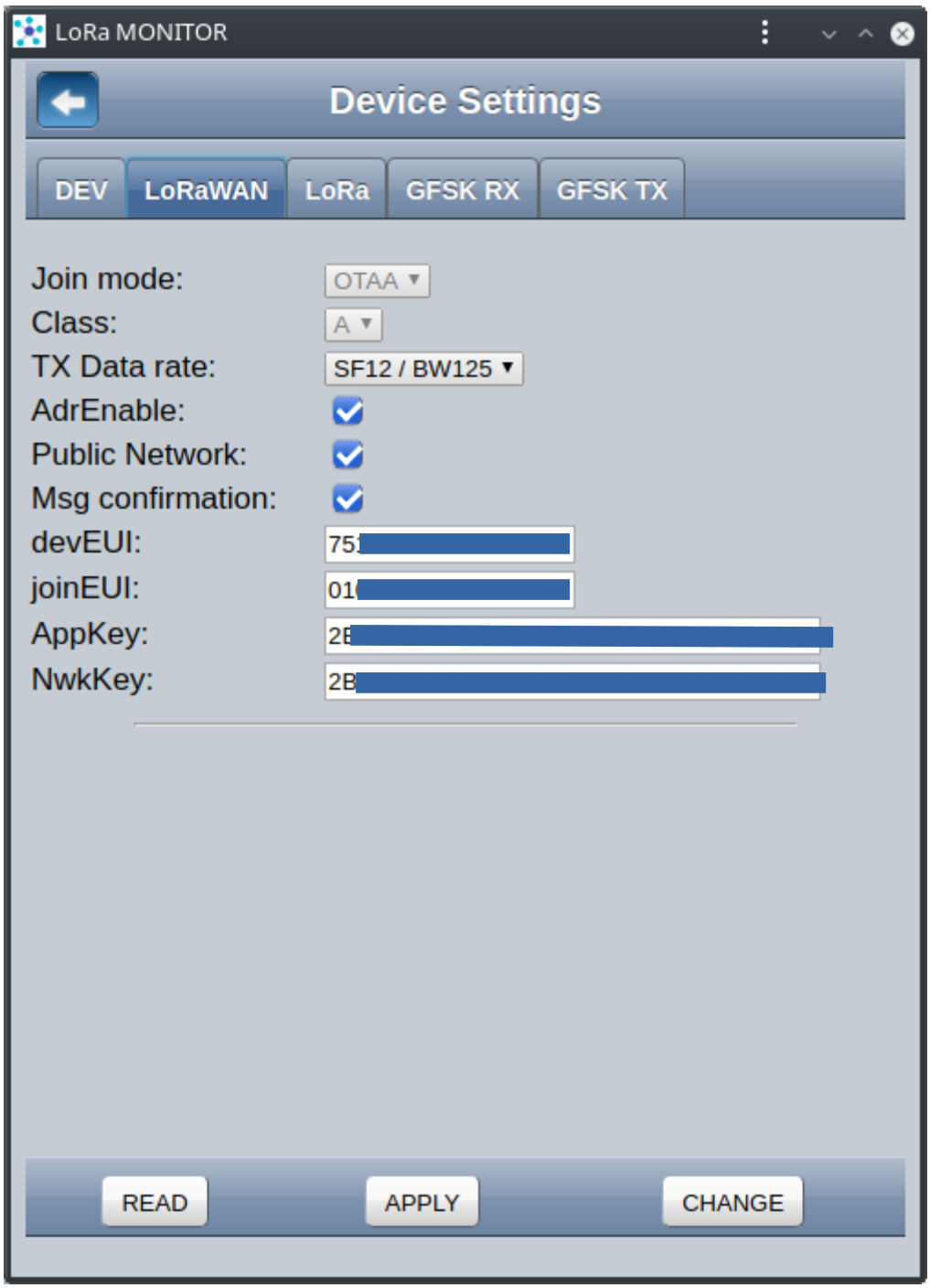
Here you can enter the password for access to the device via GFSK. The default is an empty string.

5.3.1.3 Device Firmware

This part of the tab displays information about the firmware in the device. After pressing the ***Choose FEP file to upload*** button, the system browser window will appear for choosing a firmware file. Files with firmware for ***iNode LoRa*** devices have the extension *.fep* and contain information for which device they are intended. Therefore, it is not possible to upload to the device firmware intended for another.

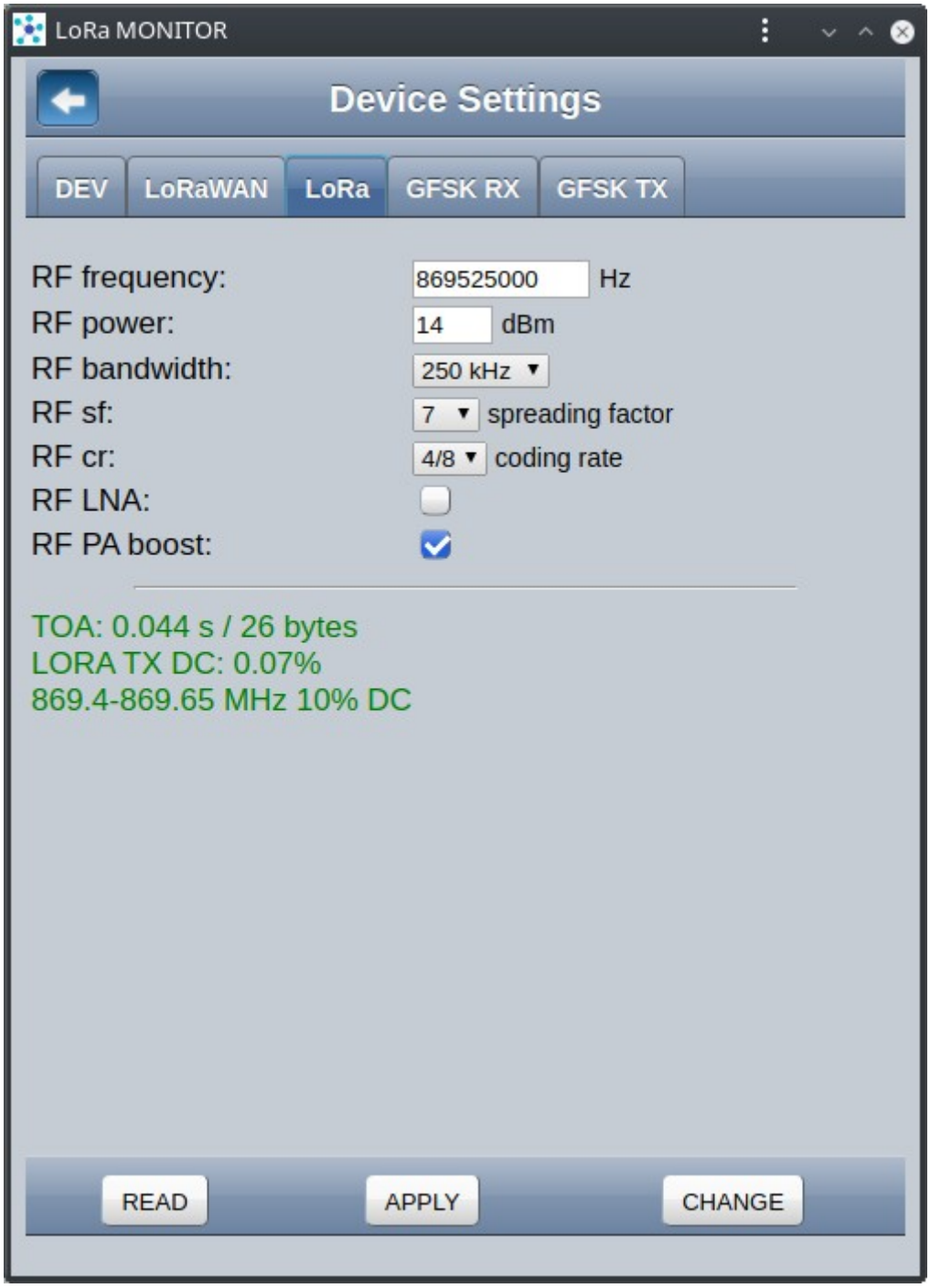
5.3.2 LoRaWAN

This tab allows you to change the **LoRaWAN** operating parameters. It may only be available if the device's firmware enables operation in this mode.



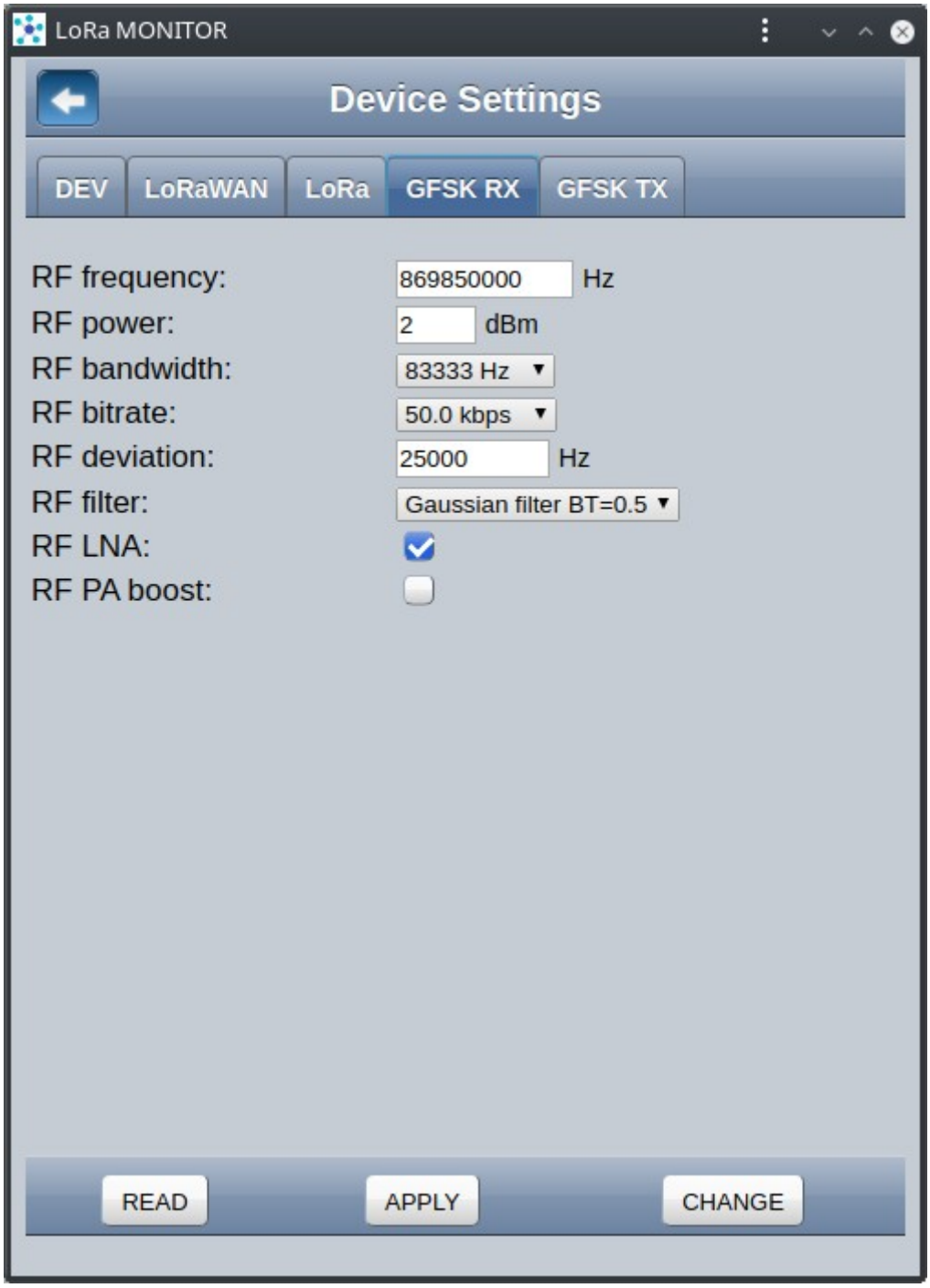
5.3.3 LoRa

This tab allows you to change LoRa modulation parameters of the device. Please note that these parameters must be the same in the **iNode LoRa** adapter, otherwise it will not receive any data from device. Below all parameters information is displayed, what is the maximum allowable value of DC coefficient in a given frequency band, and what is obtained by the device - LORA TX DC. This information is only helpful and the user should confirm it with the regulator. The maximum output power allowed in Europe by ETSI is +14 dBm.



5.3.4 GFSK RX

This tab allows you to change the GFSK modulation parameters of the device in RX mode, i.e. receiving data. Please note that these parameters must be the same (GFSK TX) in the adapter, otherwise it will not send any data to the device. Devices **iNode Lora** have a so-called emergency mode, which is activated for 5 minutes after the power is turned on. They transmit over GFSK for 5 minutes with the parameters as in the window below.



5.3.5 GFSK TX

This tab allows you to change the GFSK modulation parameters of the device in TX mode, i.e. sending data. Please note that these parameters must be the same (GFSK RX) in the **iNode LoRa** adapter, otherwise it will not receive any data from the device. Below all parameters information is displayed, what is the maximum permissible value of DC coefficient in a given frequency band, and what is obtained by the device - GFSK TX DC. This information is only helpful and the user should confirm it with the regulator. The maximum output power allowed in Europe by ETSI is +14 dBm.