

General Properties

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Every RouterBOARD with a miniPCI-e slot which supports LTE modems can also be used as a LoRaWAN gateway by installing **R11e-LoRa8** or **R11e-LoRa9** card. Both UDP and LNS (starting with **v7.12rc1** testing version) protocols are supported.

In order to work with Lora, IoT package should be installed. You can find the package for your device architecture in extra packages archive on the [download](#) page.



Starting with **v7.11** (stable), LoRa functionality is moved into the **IoT package** that is available on the [download](#) page under extra packages. A separate Lora package is still available for download.

When using IoT package, LoRa functionality will move to a `/iot lora` sub-menu. When using LoRa package, LoRa functionality will be possible via `/lora` sub-menu.

LoRa package is not obligatory anymore and is left only for compatibility reasons.



note: RouterOS does not support 3rd party LoRaWAN gateway cards.

Properties

Sub-menu: `/iot lora`

Property	Description
antenna-gain (<i>integer [-128..127]</i> ; Default: 0)	Antenna gain in dBi.
channel-plan (<i>as-923 au-915 custom eu-868 in-865 kr-920 ru-864 ru-864-mid us-915-1 us-915-2</i> ; Default: eu-868)	Frequency plans for various regions.
disabled (<i>yes no</i> ; Default: yes)	Whether LoRaWAN gateway is disabled.
forward (<i>crc-disabled crc-error crc-valid</i> ; Default: crc-valid, crc-error)	Defines what kind of packets should be forwarded to Network server: <ul style="list-style-type: none">• <code>crc-disabled</code> - forward packets which CRC code isn't checked• <code>crc-error</code> - forward packets with incorrect CRC code• <code>crc-valid</code> - forward valid packets with correct CRC.
gateway-id (string)	Gateway ID or Gateway EUI, is used when registering the gateway with the server.
lbt-enabled (<i>yes no</i> ; Default: no)	Whether gateway should use LBT (Listen Before Talk) protocol.
listen-time (<i>integer [0us..4294967295us]</i> ; Default: 5000us)	Time in microseconds to track RSSI before TX (used when lbt-enabled=yes).
name (<i>string</i> ; Default:)	Name of LoRaWAN gateway.
network (<i>private public</i> ; Default: public)	Whether sync word should (network=private) or should not (network=public) be used.
rsqi-threshold (<i>integer [-32,768 .. 32,767]</i> ; Default: -65dB)	RSSI value to determine whether forwarder may use specific channel to talk. If RSSI value is below rsqi-threshold , channel could be used (used when lbt-enabled=yes).
servers (<i>list of string</i> ; Default:)	Name or names of servers from <code>/lora servers</code> .
src-address (<i>IP</i> ; Default:)	Specifies uplink packet source address if necessary (address should match an address configured on the RB).

spoof-gps (<i>string</i> ; Default:)	Set custom GPS location: <ul style="list-style-type: none"> Latitude [-90..90] Longitude [-180..180] Altitude(m) [-2147483648..2147483647]
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Channels

Sub-menu: /iot lora channels

Property	Description
bandwidth (<i>7.8_kHz</i> / <i>15.6_kHz</i> / <i>31.2_kHz</i> / <i>62.5_kHz</i> / <i>125_kHz</i> / <i>250_kHz</i> / <i>500_kHz</i> ; Default: 125_kHz)	Bandwidth of specific channel, predefined when any of channel-plan preset is used, but could be manually changed when channel-plan is set to custom.
disabled (<i>yes</i> / <i>no</i> ; Default: no)	Disable or enable the channel.
freq-off (<i>integer</i> [-400000..400000]; Default:)	Channel frequency offset against radio central frequency, it makes possible to adjust channel frequencies so that channels does not overlap.
radio (<i>radio0</i> / <i>radio1</i> ; Default:)	Defines which radio uses selected channel.
spread-factor (<i>SF7</i> / <i>SF8</i> / <i>SF9</i> / <i>SF10</i> / <i>SF11</i> / <i>SF12</i> ; Default:)	Defines the Spread Factor for a channel with type=LoRa. Lower Spread Factor means higher data rate.

To view current channels, issue the command `/iot lora channels print`:

```
/iot lora channels print
Columns: NAME, TYPE, RADIO, FREQ-OFF, BANDWIDTH, FREQ, SPREAD-FACTOR, DATARATE
# NAME      TYPE  RADIO  FREQ-OFF  BANDWIDTH  FREQ  SPREAD-FACTOR  DATARATE
0 gateway-0 MSF    radio1  -400000   125_kHz    868.1
1 gateway-0 MSF    radio1  -200000   125_kHz    868.3
2 gateway-0 MSF    radio1    0         125_kHz    868.5
3 gateway-0 MSF    radio0 -400000   125_kHz    867.1
4 gateway-0 MSF    radio0 -200000   125_kHz    867.3
5 gateway-0 MSF    radio0    0         125_kHz    867.5
6 gateway-0 MSF    radio0 200000    125_kHz    867.7
7 gateway-0 MSF    radio0 400000    125_kHz    867.9
8 gateway-0 LoRa   radio1 -200000   250_kHz    868.3  SF7
9 gateway-0 FSK    radio1 300000    125_kHz    868.8                50000
```

Channels are created using `freq-off` and radio's center-`freq` frequencies. To view **radios** center frequencies use the command `/iot lora radios print`.

To understand how each channel's frequency is calculated, check the example below:

```
# NAME      TYPE  RADIO  FREQ-OFF  BANDWIDTH  FREQ  SPREAD-FACTOR  DATARATE
0 gateway-0 MSF    radio1  -400000   125_kHz    868.1
```

`radio1` is selected to be used for channel #0 and it is configured with `center-freq=868500000` (868500000 Hz or 868.5 MHz).

By using frequency offset, `freq-off=-400000` (-400000 Hz or -0.4 MHz), we define channel #0 to be `868500000-400000=868100000` Hz or 868.1 MHz.



To configure custom channels, select "custom" channel profile with the help of the command:

```
/iot lora set [find] channel-plan=custom
```

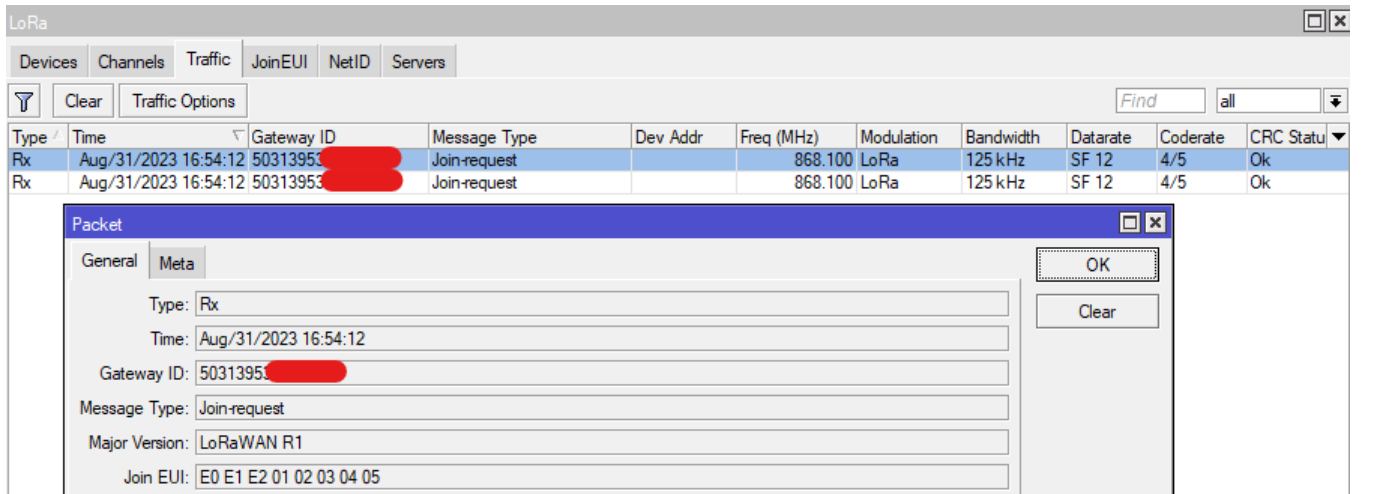
Join EUI

The gateway will forward to the server every single LoRaWAN payload it receives. That includes neighboring LoRaWAN node's payloads as well. It might not be ideal to forward everything, as, for example, it can increase the data amount used (and directly impact ISP plan cost).

The Join EUI menu allows you to specify a range of Join EUI's that the gateway will forward. After adding the range, make sure to apply it to the [server](#) settings.

If the Join EUI of the packet does not match the configuration, the packet is not forwarded to the server.

You can find the Join EUI used by your node with the help of RouterOS GUI. Go to the "LoRa" section and to the "Traffic" sub-menu (which is only available using the graphical interface). After you power your LoRaWAN node, the node should send a "Join-request" packet. Double-click on it to inspect it:



Sub-menu: `/iot lora joineui`

Property	Description
<code>joineui</code> (<i>string</i> ; Default:)	Define a range of Join EUI's.
<code>name</code> (<i>string</i> ; Default:)	Define the name for the range.

An example of Join EUI would look like this **E0 E1 E2 01 02 03 04 05**. It consists of 8 octets in HEX format.

To add a range that allows **every possible** Join EUI, add a filter like this:

```
/iot lora joineui add name=ALL joineuis=0000000000000000-ffffffffffffffff
```

To add a range that allows "nothing" (basically "restrict" all Join EUI's), add a filter like this:

```
/iot lora joineui add name=NONE joineuis=0000000000000000-0000000000000000
```

For a specific single Join EUI, add a filter like this:

```
/iot lora joineui add name=SINGLE joineuis=E0E1E20102030405-E0E1E20102030405
```

Network ID

The gateway will forward to the server every single LoRaWAN payload it receives. That includes neighboring LoRaWAN node's payloads as well. It might not be ideal to forward everything, as, for example, it can increase the data amount used (and directly impact ISP plan cost).

The NetID menu allows you to specify a list of NetIDs that the gateway will forward. After adding the list, make sure to apply it to the [server](#) settings.

If the NetID (DevAddr range) of the packet does not match the configuration, the packet is not forwarded to the server.

NetIDs define the ranges of Device Addresses (DevAddr) that were assigned to different operators/servers by the LoRaWAN Alliance. A list with most ranges can be found in the [TTN guide](#).

DevAddr is assigned to the LoRaWAN node by the LoRaWAN server after the communication with the server takes place. For example, [TTN](#) will assign your node an address from within the range 26000000 - 27FFFFFF. You can find it under the LoRaWAN server dashboard or using RouterOS GUI, under the "Traffic" sub-menu (after "join-request" and "join-accept" communication takes place) in the Dev Addr column/field.

Let's say TTN assigned **26 1B D8 D1** Dev Addr to your node. Based on the [TTN guide](#), it falls under the 26000000 - 27FFFFFF DevAddr range and it belongs to the **000013 NetID**.

Sub-menu: `/iot lora netid`

Property	Description
netids (<i>string</i> ; Default:)	Define the NetIDs
name (<i>string</i> ; Default:)	Define the name for the ID.

To add a filter for a specific NetId, use the command (you can add more than one using a "comma" separator):

```
/iot lora netids add name=TTN netids=000013
```

Servers

Sub-menu: `/iot lora servers`

There are a few predefined servers that can be used (it requires to make an [The Things Network](#) account to use them):

```
[admin@MikroTik] /iot/lora/servers> print
Columns: NAME, UP-PORT, DOWN-PORT, ADDRESS
#  NAME                UP-PORT  DOWN-PORT  ADDRESS
0  TTN-EU                1700      1700      eu.mikrotik.thethings.industries
1  TTN-US                1700      1700      us.mikrotik.thethings.industries
2  TTS Cloud (eul)       1700      1700      eul.cloud.thethings.industries
3  TTS Cloud (nam1)      1700      1700      nam1.cloud.thethings.industries
4  TTS Cloud (aul)       1700      1700      aul.cloud.thethings.industries
5  TTN V3 (eul)          1700      1700      eul.cloud.thethings.network
6  TTN V3 (nam1)         1700      1700      nam1.cloud.thethings.network
7  TTN V3 (aul)          1700      1700      aul.cloud.thethings.network
```

Custom servers can be added as well. Data forwarding to multiple servers can work simultaneously if the first server does not change "DevAddress" part of the packet and under the condition that all servers are able to decode the packet.

Property	Description
address (<i>domain name or IP address</i> ; Default:)	Defines LoRaWAN Network server address.
name (<i>string</i> ; Default:)	Defines server name.
protocol (<i>UDP / LNS / CUPS</i> ; Default: UDP)	Specify whether to use UDP, LNS or CUPS protocol for the communication with the LoRaWAN server.

down-port (<i>integer [0..65535]; Default: 1700</i>)	Parameter that is used when UDP protocol is selected. Defines port for down-link communication (from server to node) with LoRaWAN Network server. Most of known open source servers uses port 1700 as default, but it can change if multiple servers are configured on the same machine.
up-port (<i>integer [0..65535]; Default: 1700</i>)	Parameter that is used when UDP protocol is selected. Defines port for up-link communication (from node to server) with LoRaWAN Network server. Most of known open source servers uses port 1700 as default, but it can change if multiple servers are configured on the same machine.
netid (<i>list of string; Default: </i>)	Parameter that is used when UDP protocol is selected. Applies a filter to only send LoRaWAN payloads that match the Network ID (Net ID) filter configured.
joinnei (<i>list of string; Default: </i>)	Parameter that is used when UDP protocol is selected. Applies a filter to only send LoRaWAN payloads that match the Join EUI filter configured.
port (<i>integer [0..65535]; Default: 8887</i>)	Parameter that is used when LNS or CUPS protocol is selected. For LNS, defines the WSS (WebSocket) port and, for CUPS, defines HTTPS port.
key (<i>string; Default: </i>)	Parameter that is used when LNS or CUPS protocol is selected. Specify the LoRa Basics Station LNS Authentication Key or CUPS API KEY (both generated on the server).
ssl (<i>yes or no; Default: no</i>)	Parameter that is used when LNS or CUPS protocol is selected. Specify whether to use or not to use SSL (if the server supports TLS server authentication). When this option is choosen, root SSL certificate(s) must be uploaded under the certificates menu.
certificate (<i>list of string; Default: none</i>)	Parameter that is used when LNS or CUPS protocol is selected. Select an uploaded client certificate (if the server awaits TLS client authentication). If TLS client authentication is not required by the server, use the default " none " setting.
interval (<i>integer [0..65535]; Default: </i>)	Parameter that is used when CUPS protocol is selected. Specify the interval with which the LoRa Basics Station will query CUPS server for configuration updates/changes.

Debugging

If you have issues with the connection, make sure to enable logs:

```
/system/logging/add topics=debug,lora
```

This will enable debug logging and help you pin point where the potential issue could be. Logs can be viewed using:

```
/log/print
```

A successful connection would look like this:

```
13:50:33 lora,info gateway-0 forwarder started
13:50:38 lora,info [LNS] connecting to wss://eul.cloud.thethings.network:8887/router-info
13:50:39 lora,info [LNS] eul.cloud.thethings.network discovered
13:50:39 lora,info [LNS] eul.cloud.thethings.network disconnected
13:50:39 lora,info [LNS] connecting to wss://eul.cloud.thethings.network:8887/traffic/eui-xxxx
13:50:39 lora,info [LNS] eul.cloud.thethings.network configured
13:50:52 lora,info gateway-0 forwarder is ready
```

More logging information can be found in our [Log](#) guide.