

RB924i-2nD-BT5&BG77



KNOT RB924i-2nD-BT5&BG77



KNOT LR8 kit RB924i-2nD-BT5&BG77&R11e-LR8

KNOT LR9 kit RB924i-2nD-BT5&BG77&R11e-LR9

Safety Warnings

Before you work on any equipment, be aware of the hazards involved with electrical circuitry, and be familiar with standard practices for preventing accidents.

Ultimate disposal of this product should be handled according to all national laws and regulations.

The Installation of the equipment must comply with local and national electrical codes.

This unit is intended to be installed in the rackmount. Please read the mounting instructions carefully before beginning installation. Failure to use the correct hardware or to follow the correct procedures could result in a hazardous situation for people and damage to the system.

This product is intended to be installed indoors. Keep this product away from water, fire, humidity, or hot environments.

Use only the power supply and accessories approved by the manufacturer, and which can be found in the original packaging of this product.

Read the installation instructions before connecting the system to the power source.

We cannot guarantee that no accidents or damage will occur due to the improper use of the device. Please use this product with care and operate at your own risk!

In the case of device failure, please disconnect it from power. The fastest way to do so is by unplugging the power plug from the power outlet.

It is the customer's responsibility to follow local country regulations, including operation within legal frequency channels, output power, cabling requirements, and Dynamic Frequency Selection (DFS) requirements. All Mikrotik radio devices must be professionally installed.

Exposure to Radio Frequency Radiation: This MikroTik equipment complies with the FCC, IC, and European Union radiation exposure limits set forth for an uncontrolled environment. This MikroTik device should be installed and operated no closer than 20 centimeters from your body, occupational user, or the general public.

Connecting

- Make sure your Internet service provider is allowing hardware change and will issue an automatic IP address;
- Connect your ISP cable to the first Ethernet port;
- Connect the device to the power source;

- Open network connections on your computer and search for MikroTik wireless network - connect to it;
- The configuration has to be done through the wireless network using a web browser or mobile app. Alternatively, you can use a WinBox configuration tool <https://mt.lv/winbox>;
- Open <https://192.168.88.1> in your web browser to start configuration, user name: admin and there is no password by default (or, for some models, check user and wireless passwords on the sticker);
- Click the Check for updates button and update your RouterOS software to the latest version, must have an active Internet connection;
- In the Quick Set, WISP AP menu choose your country and apply country regulation and wireless settings;
- Set up your wireless network password;
- Set up your router password.
- The following RouterOS "npk" packages are required for the core functionality of the product: gps, lora, system.

Mounting



1. The device can be mounted using provided DIN rail mount set. Designed to fit standard 35 mm x 7.5 mm DIN rails. Attach it with two provided screws to the device and attach the device to the DIN rail. The DIN rail is not provided in the package.
2. Alternatively, it is possible to attach the device to a wall, using the provided screw holes on the back of the unit. The device should be mounted in a way that the cable openings are pointing downward as shown in the picture.



Warning! This equipment should be installed and operated with a minimum distance of 20 cm between the device and your body. The operation of this equipment in the residential environment could cause radio interference. Mounting and configuration of this device should be done by a qualified person.

Powering

- Direct-input power jack (5.5 mm outside and 2.1 mm inside, female, pin positive plug) accepts 12-57 V DC.
- microUSB port accepts 5 V powering.
- Ethernet port accepts 802.3af/at Power over Ethernet 12-57 V DC.

The power consumption under maximum load with attachments can reach 18 W (for KNOT LR8 kit and KNOT LR9 kit under maximum load with attachments can reach 20 W).

Connecting to a PoE Adapter:

1. Connect the Ethernet cable from the device to the PoE+DATA port of the PoE adapter.
2. Connect an Ethernet cable from your local network (LAN) to the PoE adapter.
3. Connect the power cord to the adapter, and then plug the power cord into a power outlet.

Extension slots and ports



- 2.4 GHz, 802.11b/g/n, antenna gain 1.5 dBi.
- Built-in GPS module (GPS, GLONASS, BeiDou, Galileo).
- Two 10/100 Ethernet ports, supporting automatic cross/straight cable correction (Auto MDI/X). Either straight or crossover cable can be used for connecting to other network devices. The Ethernet port accepts 12-57 V DC power from an 802.3af/at PoE injector.
- One microUSB 2.0 port for powering (for KNOT LR8 and KNOT LR9 kits only the port can be also used for peripherals).
- One nano SIM slot.
- Bluetooth version 5.2, antenna gain 2 dBi.

If it is KNOT LR8 kit:

- LR8 card.

If it is KNOT LR9 kit:

- LR9 card.

Bluetooth antenna

By default, the KNOT has a built-in internal antenna that can be used but it is also possible to connect an external antenna instead to increase Bluetooth operation range. This is relevant for the [KNOT RB924i-2nD-BT5&BG77](#) devices.

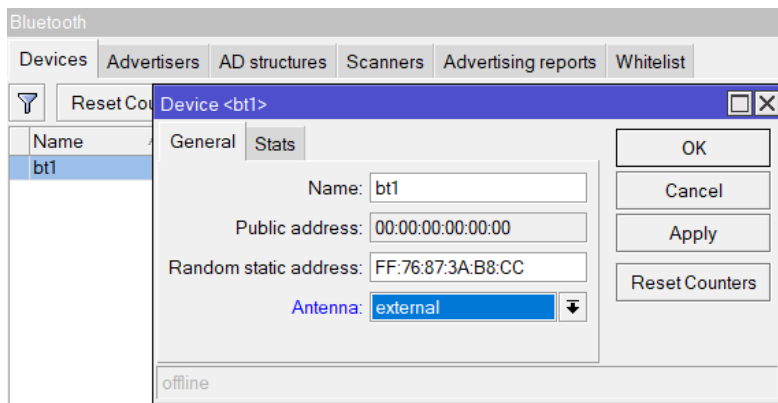
For the [KNOT LR8 kit](#) and [KNOT LR9 kit](#), Bluetooth external antenna pigtail placeholder is **not available** (there is already an SMA slot in place that is used by the LoRa).

To use an external antenna, you will need a U.FL (female) to SMA connector (pigtail) and a Bluetooth antenna (that can be attached to the SMA).



- Unscrew the screw between two SMA slots for CAT-M/NB and GNSS and remove the case.
- Connect U.FL (female) pigtail to the BT slot on the board (as shown in the picture above).
- Drill the hole in the board's case in the specific spot (circular outline from the inside of the case) as per the picture, and attach SMA to the case (where the hole was drilled).
- Connect Bluetooth antenna to the SMA slot.

You will need to change the antenna that you wish to use (newly connected "external" or the build-in "internal") in the RouterOS settings (under IoT→Bluetooth→Devices→double-click on the Bluetooth interface→ in the "Antenna" field):



i U.FL to SMA pigtail and the external Bluetooth antenna are not provided with the package.

GPS and NB/CAT-M

Attach your antennas to the SMA connectors:



i BG77 supports NB and GNSS. Both cannot be used together simultaneously. Please check the guide at - [WWAN and GNSS priority automatization](#).

i External antennas must be connected to use the Narrow Band modem and GPS. Not provided with the package.

Buttons and jumpers

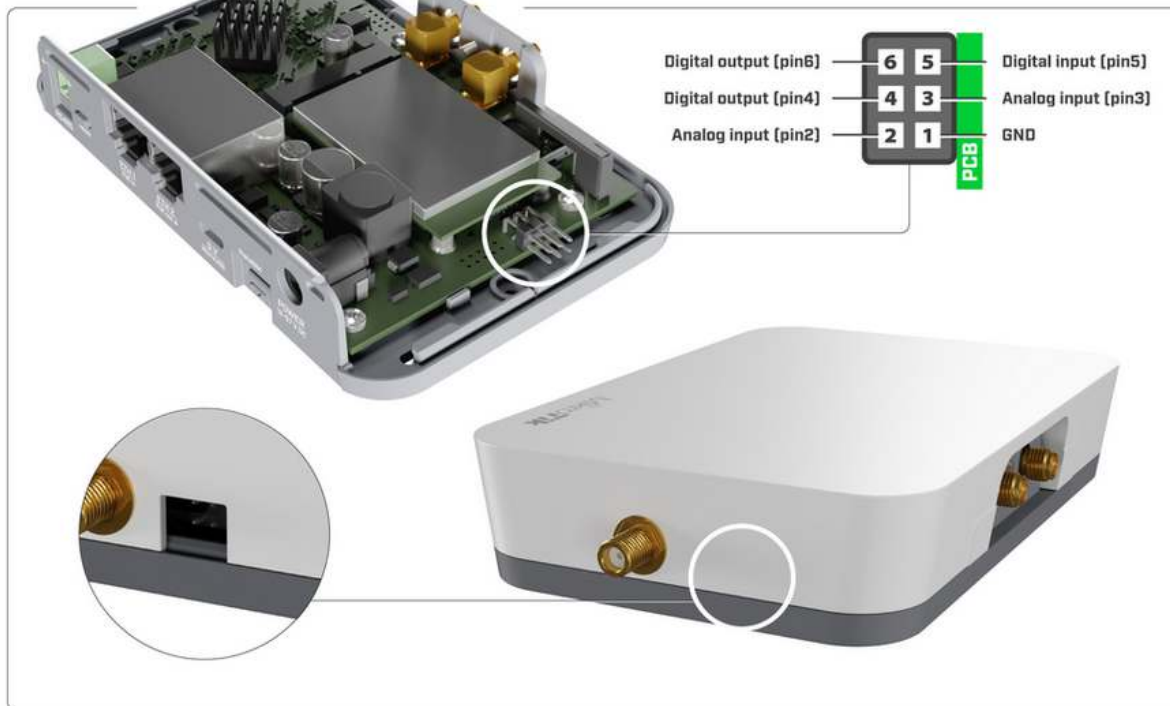
Reset button

- Hold this button during boot time until the LED light starts flashing, release the button to reset RouterOS configuration (total 5 seconds).
- Keep holding for 5 more seconds, LED turns solid, release now to turn on CAP mode. The device will now look for a CAPsMAN server (total 10 seconds).
- Or keep holding the button for 5 more seconds until LED turns off, then release it to make the RouterBOARD look for Netinstall servers (total 15 seconds).

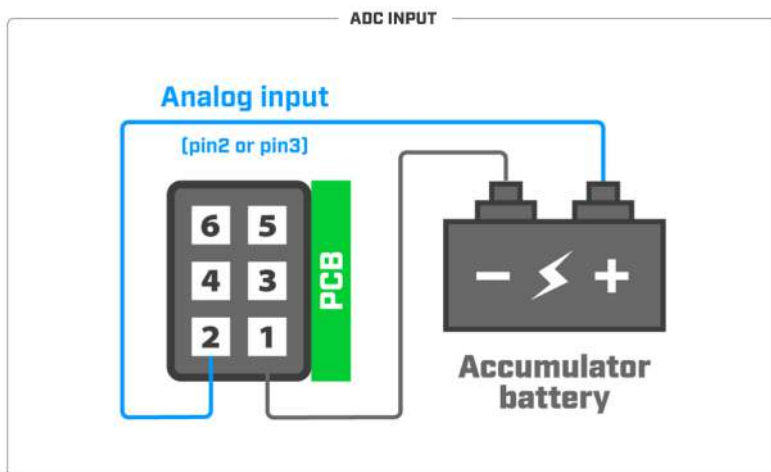
Regardless of the above option used, the system will load the backup RouterBOOT loader if the button is pressed before power is applied to the device. Useful for RouterBOOT debugging and recovery.

GPIO pinout

GPIO pins are located on the board under the case as shown in the picture:



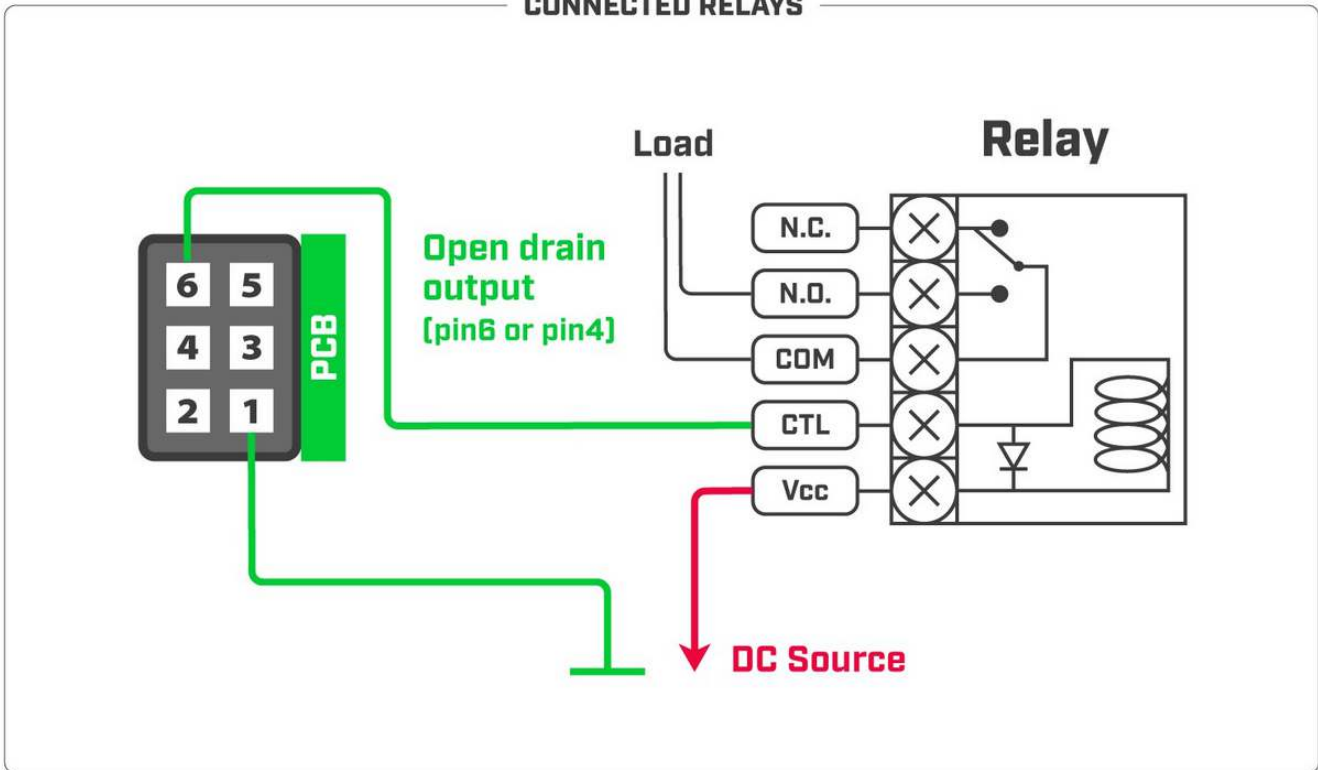
ADC input/analog input (pin2 or pin3):



note: Analog input voltage is 0-60 V. Theoretical resolution is 4 mV (14bit ADC). Analog input impedance is approximately 72K Ohm.

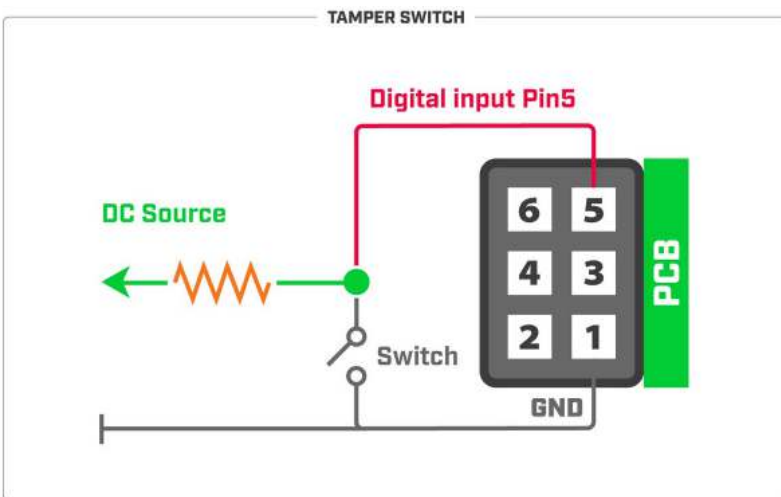
Connected relays (pin4 or pin6):

CONNECTED RELAYS



note: The maximum power dissipation (for digital output open drain transistor) is 0.48 W, and the maximum voltage is 30 V or 2.8 A. For example $0.48W / 1V = 0.48A$, or $0.48W / 2V = 0.24A$ etc.

Tamper switch (pin5):



note: Digital input voltage is 0-2.5 V max.

Without PCB pull-up resistor:

- to receive a logical "0" on the pin, the voltage should be between 0-1.47 V;
- to receive a logical "1" on the pin, the voltage should be between 1.48-2.5 V.

With PCB pull-up resistor:

- to receive a logical "0" on the pin, the voltage should be between 0-1.34 V;
- to receive a logical "1" on the pin, the voltage should be between 1.35-2.5 V.

Newer routerboards will have a pull-up resistor on the PCB (on the board) - 10k ohm. Older boards (the first released batch) may need an external pull-up resistor.

Accessories

The package includes the following accessories that come with the device:

- ADAPT1_ EU/US Switching Power Supply 24V, 1.2A, 28.8W, 86.8%, VI.
- CAB1_ USB A Female to Micro B cable.
- SET1_ K-47 wall mount set, two screws, and dowels.
- SET2_ K-74 Din rail mount set.
- Modbus connector, A+, B-.

HGO-LTE-W antenna can be purchased separately.



Operating system support

The device supports RouterOS software version 6.48.1. The specific factory-installed version number is indicated in the RouterOS menu /system resource. Other operating systems have not been tested.

Configuration

RouterOS includes many configuration options in addition to what is described in this document. We suggest starting here to get yourself accustomed to the possibilities: <https://mt.lv/help>. In case an IP connection is not available, the Winbox tool (<https://mt.lv/winbox>) can be used to connect to the MAC address of the device from the LAN side (all access is blocked from the internet port by default).

For recovery purposes, it is possible to boot the device from the network, see section [Buttons and jumpers](#).

note: make sure that **iot** package is installed beforehand.

Overview

Protocols such as MQTT and HTTP are widely used to push data within M2M networks. M2M topologies can use different technologies, such as Wi-Fi or Bluetooth to send data within networks.

KNOT is a new addition to one of our IoT solutions. KNOT acts as an IoT gateway (that uses Narrow Band and CAT-M technology) and uses Bluetooth to scan broadcasted information. With the Bluetooth interface, you can use the KNOT for asset tracking and telemetry based on Bluetooth advertisement packets. KNOT supports any BLE tag that sends advertisement data. iBeacon, Eddystone, or any other format. It has powerful filters for forwarding only relevant packets and ignoring others. After the gateway processes the data that it receives, it can use an ISP connection to publish the data further to any subscriber or server that is configured accordingly.

All you need to do is to configure a script. The script can filter broadcasted information and push it to the internet.

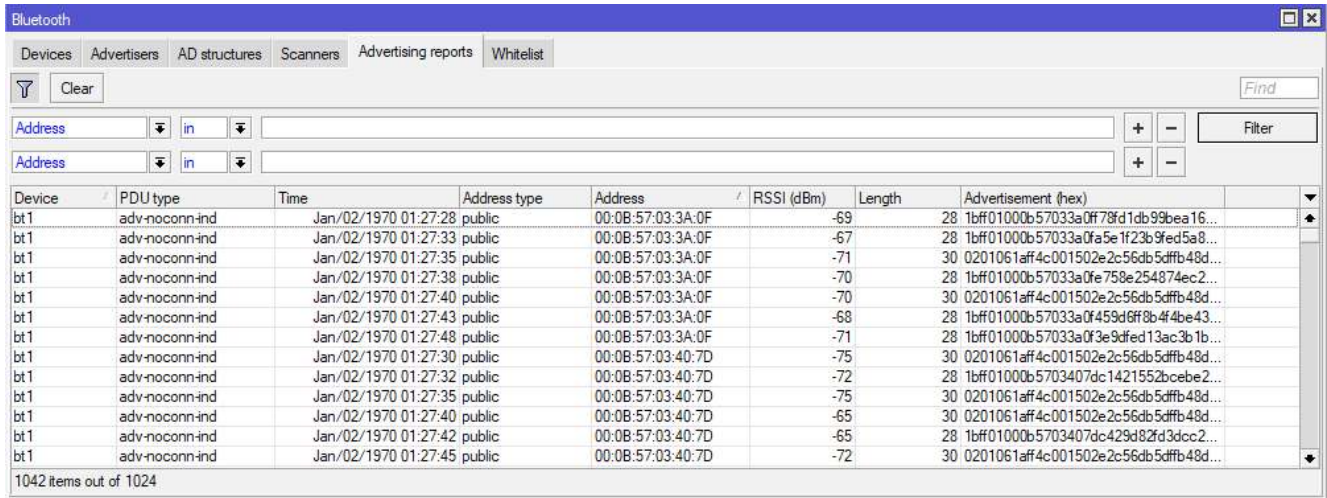
This article explains how to configure KNOT to publish data using MQTT or http protocols.

 External antennas must be connected to use the Narrow Band modem and GPS. Not provided with the package.

Reports

Navigate to IoT>Bluetooth.

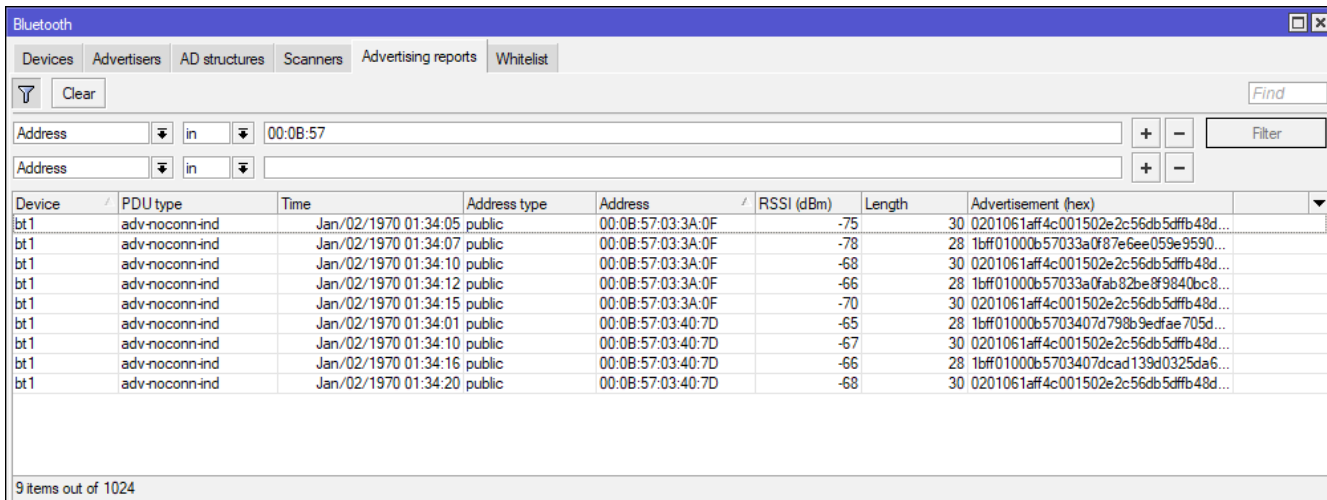
You can find all broadcasting devices in the “Advertising reports” tab.



The screenshot shows the 'Advertising reports' tab in the Bluetooth interface. It features a search bar with a 'Find' button and two filter input fields. Below these is a table with the following columns: Device, PDU type, Time, Address type, Address, RSSI (dBm), Length, and Advertisement (hex). The table contains 14 rows of data, all for device 'bt1' with PDU type 'adv-noconn-ind'. The time entries range from 01:27:28 to 01:27:45. The advertisement hex values are truncated. At the bottom, it indicates '1042 items out of 1024'.

Device	PDU type	Time	Address type	Address	RSSI (dBm)	Length	Advertisement (hex)
bt1	adv-noconn-ind	Jan/02/1970 01:27:28	public	00:0B:57:03:3A:0F	-69	28	1bff01000b57033a0ff78fd1db99bea16...
bt1	adv-noconn-ind	Jan/02/1970 01:27:33	public	00:0B:57:03:3A:0F	-67	28	1bff01000b57033a0fa5e1f23b9fed5a8...
bt1	adv-noconn-ind	Jan/02/1970 01:27:35	public	00:0B:57:03:3A:0F	-71	30	0201061aff4c001502e2c56db5dff48d...
bt1	adv-noconn-ind	Jan/02/1970 01:27:38	public	00:0B:57:03:3A:0F	-70	28	1bff01000b57033a0fe758e254874ec2...
bt1	adv-noconn-ind	Jan/02/1970 01:27:40	public	00:0B:57:03:3A:0F	-70	30	0201061aff4c001502e2c56db5dff48d...
bt1	adv-noconn-ind	Jan/02/1970 01:27:43	public	00:0B:57:03:3A:0F	-68	28	1bff01000b57033a0f459d6ff8b4f4be43...
bt1	adv-noconn-ind	Jan/02/1970 01:27:48	public	00:0B:57:03:3A:0F	-71	28	1bff01000b57033a0f3e9dfed13ac3b1b...
bt1	adv-noconn-ind	Jan/02/1970 01:27:30	public	00:0B:57:03:40:7D	-75	30	0201061aff4c001502e2c56db5dff48d...
bt1	adv-noconn-ind	Jan/02/1970 01:27:32	public	00:0B:57:03:40:7D	-72	28	1bff01000b5703407dc1421552bcebe2...
bt1	adv-noconn-ind	Jan/02/1970 01:27:35	public	00:0B:57:03:40:7D	-75	30	0201061aff4c001502e2c56db5dff48d...
bt1	adv-noconn-ind	Jan/02/1970 01:27:40	public	00:0B:57:03:40:7D	-65	30	0201061aff4c001502e2c56db5dff48d...
bt1	adv-noconn-ind	Jan/02/1970 01:27:42	public	00:0B:57:03:40:7D	-65	28	1bff01000b5703407dc429d82fd3dccc2...
bt1	adv-noconn-ind	Jan/02/1970 01:27:45	public	00:0B:57:03:40:7D	-72	30	0201061aff4c001502e2c56db5dff48d...

In this menu, you can set up a filter by pressing the “Filter” icon. For example, knowing the MAC address of the device, you can set up a filter to only show specific reports.



The screenshot shows the same Bluetooth Advertising reports interface, but with a filter applied. The search bar contains '00:0B:57'. The table now displays only 9 items, all for device 'bt1' with PDU type 'adv-noconn-ind'. The time entries range from 01:34:05 to 01:34:20. The advertisement hex values are truncated. At the bottom, it indicates '9 items out of 1024'.

Device	PDU type	Time	Address type	Address	RSSI (dBm)	Length	Advertisement (hex)
bt1	adv-noconn-ind	Jan/02/1970 01:34:05	public	00:0B:57:03:3A:0F	-75	30	0201061aff4c001502e2c56db5dff48d...
bt1	adv-noconn-ind	Jan/02/1970 01:34:07	public	00:0B:57:03:3A:0F	-78	28	1bff01000b57033a0f87e6ee059e9590...
bt1	adv-noconn-ind	Jan/02/1970 01:34:10	public	00:0B:57:03:3A:0F	-68	30	0201061aff4c001502e2c56db5dff48d...
bt1	adv-noconn-ind	Jan/02/1970 01:34:12	public	00:0B:57:03:3A:0F	-66	28	1bff01000b57033a0fab82be8f9840bc8...
bt1	adv-noconn-ind	Jan/02/1970 01:34:15	public	00:0B:57:03:3A:0F	-70	30	0201061aff4c001502e2c56db5dff48d...
bt1	adv-noconn-ind	Jan/02/1970 01:34:01	public	00:0B:57:03:40:7D	-65	28	1bff01000b5703407d798b9e0fae705d...
bt1	adv-noconn-ind	Jan/02/1970 01:34:10	public	00:0B:57:03:40:7D	-67	30	0201061aff4c001502e2c56db5dff48d...
bt1	adv-noconn-ind	Jan/02/1970 01:34:16	public	00:0B:57:03:40:7D	-66	28	1bff01000b5703407dcad139d0325da6...
bt1	adv-noconn-ind	Jan/02/1970 01:34:20	public	00:0B:57:03:40:7D	-68	30	0201061aff4c001502e2c56db5dff48d...

You can add more filter options using “+” icon.

You can remove filter options using “-” icon.

MQTT Broker configuration

Navigate to IoT>MQTT.

You can add a new broker via “+” button.



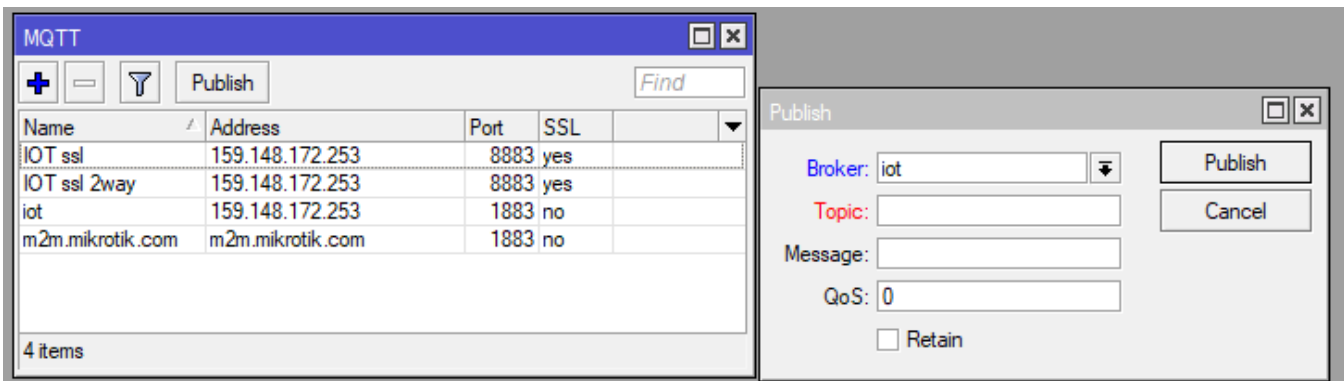
Properties	Description
Name	Identification. Brokers name.
Address	IP address or FQDN name of the MQTT broker without ssl:// or tcp:// prefix.
Port	Network port of the broker. Usually, 1883 or 8883 (for SSL).
SSL	Enable/Disable Secure Socket Layer. If the server uses a self-signed certificate or certificate signed by a non-trusted CA, you have to upload the server's certificates <cr> file to RouterOS. Upload .cer file to the "Files" menu and import the file to certificates in the System>Certificates tab.
Username	Username for MQTT broker.
Password	Password for MQTT broker.
Client Id	A unique ID used for the connection. The broker uses this ID to identify the client.
Certificate	Chose a certificate if required for the two-way authentication.

note: You do not have to specify servers certificate (.cer file) in the MQTT broker settings. The "Certificate" field is used for the client's certificate.

note: "Name", "Address", and "Port" field configuration is required. Other parameters can be optional or required - depends on how the server/broker is set up.

Publish

After you create a broker, click the "Publish" button. This box allows you to choose a broker and specify message information.



Select an already configured broker in the "Broker" field (scroll-down menu).

You can then specify the "Topic" (a string used by a broker to filter messages), "Message" (the message itself), "QoS" (indicates Quality of Service level for the message), and "Retain" (whether to retain the message or discard it) parameters.

note: "Broker" and "Topic" field configuration is required. "Message", "QoS", and "Retain" can be optional or required - depends on how the server/broker is set up.

MQTT with script scenario

MQTT broker can be configured with [scripts](#).

Create a new script, use the template as a reference, change the parameters accordingly and run the script.

Every line that begins with a symbol "#" is instructional and it describes the parameter that is going to be configured below the line. Change the parameters within quotation marks "" that would apply to your specific case.

Script example:

```
# Required packages: iot

##### Configuration #####
# Name of an existing MQTT broker that should be used for publishing
:local broker "Demo Device"

# MQTT topic where the message should be published
:local topic "v1/devices/me/telemetry"

# Interface whose MAC should be used as 'Locator ID'
:local locatorIface "ether1"

# POSIX regex for filtering advertisement Bluetooth addresses. E.g. "ABC:33:AC"
# would only include addresses which start with those 3 octets.
# To disable this filter, set it to ""
:local addressRegex ""

# POSIX regex for filtering Bluetooth advertisements based on their data. Same
# usage as with 'addressRegex'.
:local advertisingDataRegex ""

# Signal strength filter. E.g. -40 would only include Bluetooth advertisements
# whose signal strength is stronger than -40dBm.
# To disable this filter, set it to ""
:local rssiThreshold ""

##### System #####
:put ("[*] Gathering system info...")
:local ifaceMac [/interface get [/interface find name=$locatorIface] mac-address]
:local cpuLoad [/system resource get cpu-load]
:local freeMemory [/system resource get free-memory]
:local usedMemory ([/system resource get total-memory] - $freeMemory)
:local rosVersion [/system package get value-name=version \
[/system package find where name ~ "^routeros"]]
:local model [/system routerboard get value-name=model]
:local serialNumber [/system routerboard get value-name=serial-number]
# Health is a bit iffy since 'system health' does not have 'find' in ROS6
:local health [/system health print as-value]
:local supplyVoltage 0
:local boardTemp 0
:foreach entry in=$health do={
  :if ($entry->"name" = "voltage") do={set $supplyVoltage ($entry->"value")}
  :if ($entry->"name" = "board-temperature1") do={set $boardTemp ($entry->"value")}
}
```

```

##### Bluetooth #####
:put ("[*] Gathering Bluetooth info...")
:global btOldestAdvertisementTimestamp
:if ([:typeof $btOldestAdvertisementTimestamp] = "nothing") do={
  # First time this script has been run since booting, need to initialize
  # persistent variables
  :set $btOldestAdvertisementTimestamp 0
}
:local btProcessingStart [/system clock get time]
:local advertisements [/iot bluetooth scanners advertisements print detail \
  as-value where \
  epoch > $btOldestAdvertisementTimestamp and \
  address ~ $addressRegex and \
  data ~ $advertisingDataRegex and \
  rssi > $rssiThreshold
]
:local advJson ""
:local advCount 0
:local advSeparator ""
:local lastAdvTimestamp 0
# Remove semicolons from MAC/Bluetooth addresses
:local minimizeMac do={
  :local minimized
  :local lastIdx ([:len $address] - 1)
  :for idx from=0 to=$lastIdx step=1 do={
    :local char [:pick $address $idx]
    :if ($char != ".:") do={
      :set $minimized "$minimized$char"
    }
  }
  :return $minimized
}
}

:foreach adv in=$advertisements do={
  :local address ($adv->"address")
  :local ts ($adv->"epoch")
  :local rssi ($adv->"rssi")
  :local ad ($adv->"data")
  :local obj ""
  {
    |"id":1"$[minimizeMac address=$address]|,|
    |"ts":$ts,|
    |"rssi":$rssi,|
    |"ed":{
      |"ad":1"$ad"|
    }|
  }"
  :set $advCount ($advCount + 1)
  :set $lastAdvTimestamp $ts
  # Ensure that the last object is not terminated by a comma
  :set $advJson "$advJson$advSeparator$obj"
  :if ($advSeparator = "") do={
    :set $advSeparator ","
  }
}
}

:if ($advCount > 0) do={
  :set $btOldestAdvertisementTimestamp $lastAdvTimestamp
}

:put ("[*] Found $advCount new advertisements \
  (processing time: $[[/system clock get time] - $btProcessingStart])")

```

```
##### MQTT #####
:local message \
  "{
    "clientid":!"$[/iot mqtt brokers get value-name=client-id \
      [/iot mqtt brokers find name=$broker]]",\
    "t":0,\
    "v":1,\
    "OldestAdvertisementTimestamp":.$btOldestAdvertisementTimestamp,\
    "locs":{\
      "id":!"$[$minimizeMac address=$ifaceMac]",\
      "tags":![$advJson],\
      "ed":{\
        "model":!"$model",\
        "sn":!"$serialNumber",\
        "ros":!"$rosVersion",\
        "cpu":!$cpuLoad,\
        "umem":!$usedMemory,\
        "fmem":!$freeMemory,\
        "psu":!$supplyVoltage,\
        "temp":!$boardTemp
      }
    }
  }"
:log info "$message";
:put ("[*] Total message size: $[:len $message] bytes")
:put ("[*] Sending message to MQTT broker...")
/iot mqtt publish broker=$broker topic=$topic message=$message
:put ("[*] Done")
```

To run this script, the Broker should be pre-configured:

For example, [thingsboard](https://thingsboard.io) only requires settings that are shown in the screenshot above. When you successfully configure the broker, the only thing that needs to be changed in the script is:

```
:local broker "Demo Device"
```

line, where you should specify the broker's name within the quotation marks "".

Another line that should be taken into account is:

```
:local topic "v1/devices/me/telemetry"
```

, where you should specify the topic.

The rest of the script configuration depends on the overall requirements. The script explains which exact parameters are configured to be published.

Navigate to System>Scripts and add a new script there (name it, for example, script1).

To run the script, you can use the command line:

```
/system script run script1
```

HTTP fetch with script scenario

Another way to publish data is to use HTTP (instead of MQTT). This can be achieved using [fetch tool](#).

The same principles apply:

Create a new script, use the template as a reference, change the parameters accordingly and run the script.

Every line that begins with a symbol `"#"` is instructional and it describes the parameter that is going to be configured below the line. Change the parameters within quotation marks `""` that would apply to your specific case.

Script example:

```
# Required packages: iot

##### Configuration #####
# Interface whose MAC should be used as 'Locator ID'
:local locatorIface "ether1"

# POSIX regex for filtering advertisement Bluetooth addresses. E.g. "ABC:33:AC"
# would only include addresses which start with those 3 octets.
# To disable this filter, set it to ""
:local addressRegex ""

# POSIX regex for filtering Bluetooth advertisements based on their data. Same
# usage as with 'addressRegex'.
:local advertisingDataRegex ""

# Signal strength filter. E.g. -40 would only include Bluetooth advertisements
# whose signal strength is stronger than -40dBm.
# To disable this filter, set it to ""
:local rssiThreshold ""

##### System #####
:put ("[*] Gathering system info...")
:local ifaceMac [/interface get [/interface find name=$locatorIface] mac-address]
:local cpuLoad [/system resource get cpu-load]
:local freeMemory [/system resource get free-memory]
:local usedMemory ([/system resource get total-memory] - $freeMemory)
:local rosVersion [/system package get value-name=version \
[/system package find where name ~ "routers"]]
:local model [/system routerboard get value-name=model]
:local serialNumber [/system routerboard get value-name=serial-number]
# Health is a bit iffy since 'system health' does not have 'find' in ROS6
:local health [/system health print as-value]
:local supplyVoltage 0
:local boardTemp 0
:foreach entry in=$health do={
  :if ($entry->"name" = "voltage") do={set $supplyVoltage ($entry->"value")}
  :if ($entry->"name" = "board-temperature1") do={set $boardTemp ($entry->"value")}
}
```

```

##### Bluetooth #####
:put ("[*] Gathering Bluetooth info...")
:global btOldestAdvertisementTimestamp
:if ([typeof $btOldestAdvertisementTimestamp] = "nothing") do={
  # First time this script has been run since booting, need to initialize
  # persistent variables
  :set $btOldestAdvertisementTimestamp 0
}
:local btProcessingStart [/system clock get time]
:local advertisements [/iot bluetooth scanners advertisements print detail \
  as-value where \
  epoch > $btOldestAdvertisementTimestamp and \
  address ~ $addressRegex and \
  data ~ $advertisingDataRegex and \
  rssi > $rssiThreshold
]
:local advJson ""
:local advCount 0
:local advSeparator ""
:local lastAdvTimestamp 0
# Remove semicolons from MAC/Bluetooth addresses
:local minimizeMac do={
  :local minimized
  :local lastIdx ([len $address] - 1)
  :for idx from=0 to=$lastIdx step=1 do={
    :local char [:pick $address $idx]
    :if ($char != ".:") do={
      :set $minimized "$minimized$char"
    }
  }
  :return $minimized
}
:foreach adv in=$advertisements do={
  :local address ($adv->"address")
  :local ts ($adv->"epoch")
  :local rssi ($adv->"rssi")
  :local ad ($adv->"data")
  :local obj ""
  {
    |"id":1"$[minimizeMac address=$address]|,|
    |"ts":$ts,|
    |"rssi":$rssi,|
    |"ed":{
      |"ad":1"$ad"|
    }|
  }"
  :set $advCount ($advCount + 1)
  :set $lastAdvTimestamp $ts
  # Ensure that the last object is not terminated by a comma
  :set $advJson "$advJson$advSeparator$obj"
  :if ($advSeparator = "") do={
    :set $advSeparator ","
  }
}
:if ($advCount > 0) do={
  :set $btOldestAdvertisementTimestamp $lastAdvTimestamp
}

:put ("[*] Found $advCount new advertisements \
  (processing time: $[/system clock get time] - $btProcessingStart)")

```

```
##### MQTT #####
:local message \
  "{
    "t":0,
    "v":1,
    "OldestAdvertisementTimestamp":$btOldestAdvertisementTimestamp,
    "locs":{"
      "id":"[$$minimizeMac address=$ifaceMac]",
      "tags":[$advJson],
      "ed":{"
        "model":"$model",
        "sn":"$serialNumber",
        "ros":"$rosVersion",
        "cpu":$cpuLoad,
        "umem":$usedMemory,
        "fmem":$freeMemory,
        "psu":$supplyVoltage,
        "temp":$boardTemp
      }
    }
  }"
:log info "$message";
:put ("[*] Total message size: $[:len $message] bytes")
/tool fetch http-method=post http-header-field="Content-Type:application/json" http-data=$message url="https://demo.thingsboard.io/api/v1/Q99YIBqv59NdzOel6tyP/telemetry"
:put ("[*] Done")
```

Change the URL accordingly (depends on the server configuration).

```
/tool fetch http-method=post http-header-field="Content-Type:application/json" http-data=$message url="https://demo.thingsboard.io/api/v1/Q99YIBqv59NdzOel6tyP/telemetry"
```

Navigate to System>Scripts and add a new script there (name it, for example, script1).

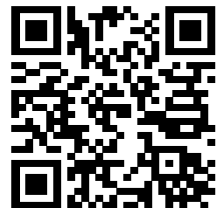
To run the script, you can use the command line:

```
/system script run script1
```

MikroTik mobile app

Use the MikroTik smartphone app to configure your router in the field, or to apply the most basic initial settings for your MikroTik home access point.

1. Scan QR code and choose your preferred OS.
2. Install and open the application.
3. By default, the IP address and user name will be already entered.
4. Click Connect to establish a connection to your device through a wireless network.
5. Choose Quick setup and the application will guide you through all basic configuration settings in a couple of easy steps.
6. An advanced menu is available to fully configure all necessary settings.



To avoid pollution of the environment, please separate the device from household waste and dispose of it in a safe manner, such as in designated waste disposal sites. Familiarize yourself with the procedures for the proper transportation of the equipment to the designated disposal sites in your area.

Model: RB924i-2nD-BT5&BG77 (KNOT)

Federal Communication Commission Interference Statement

Model	FCC ID	Contains FCC ID
RB924i-2nD-BT5&BG77	TV7924BT5BG77	XMR201912BG77

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation.



This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

FCC Caution: Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Note: This unit was tested with shielded cables on the peripheral devices. Shielded cables must be used with the unit to ensure compliance.

Innovation, Science and Economic Development Canada

Model	IC	Contains IC
RB924i-2nD-BT5&BG77	7442A-924BT5BG77	10224A-201912BG77

This device contains license-exempt transmitter(s)/receiver(s) that comply with Innovation, Science, and Economic Development Canada's license-exempt RSS(s). Operation is subject to the following two conditions: (1) This device may not cause interference. (2) This device must accept any interference, including interference that may cause undesired operation of the device.

L'émetteur/récepteur exempt de licence contenu dans le présent appareil est conforme aux CNR d'Innovation, Sciences et Développement économique Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes: 1) L'appareil ne doit pas produire de brouillage; 2) L'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

This Class B digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe [B] est conforme à la norme NMB-003 du Canada.

CAN ICES-003 (B) / NMB-003 (B)

UKCA marking



Eurasian Conformity Mark

Частотний діапазон	Мощність передатчика
2400-2483.5 МГц	≤100 мВт

*Доступные частотные каналы могут различаться в зависимости от модели продукта и сертификации.

Информация о дате изготовления устройства указана в конце серийного номера на его наклейке через дробь. Первая цифра означает номер года (последняя цифра года), две последующие означают номер недели.

Изготовитель: Mikrotikls SIA, Aizkraukles iela 23, Rīga, LV-1006, Латвия, support@mikrotik.com. Сделано в Китае, Латвии или Литве. См. на упаковке.

Для получения подробных сведений о гарантийном обслуживании обратитесь к продавцу. Информация об импортерах продукции MikroTik в Российскую Федерацию: <https://mikrotik.com/buy/europe/russia>

Продукты MikroTik, которые поставляются в Евразийский таможенный союз, оцениваются с учетом соответствующих требований и помечены знаком ЕАС, как показано ниже:



Norma Oficial Mexicana

Rango de frecuencia (potencia de salida máxima): 2400-2483.5 MHz (30 dBm). Los canales de frecuencia disponibles pueden variar según el modelo y la certificación del producto.

EFICIENCIA ENERGETICA CUMPLE CON LA NOM-029-ENER-2017.

La operacion de este equipo esta sujeta a las siguientes dos condiciones:

- Es posible que este equipo o dispositivo no cause interferencia perjudicial y.
- Este equipo debe aceptar cualquier interferencia, incluyendo la que pueda causar su operacion no deseada.

Fabricante: Mikrotikls SIA, Brivibas gatve 214i, Rīga, LV-1039, Latvia.

País De Origen: Letonia; Lituania; China (Republica Popular); Estados Unidos De America; Mexico.

Por favor contacte a su distribuidor local para preguntas regionales específicas. La lista de importadores se puede encontrar en nuestra página de inicio – <https://mikrotik.com/buy/latinamerica/mexico>.

The National Commission for the State Regulation of Communications and Informatization by Ukraine

Виробник: Mikrotikls SIA, Brivibas gatve 214i Rīga, Латвія, LV1039.

Робоча частота (Максимальна вихідна потужність): 2480-2483.5 МГц (20 дБм).



Справжнім Mikrotikls SIA заявляє, що маршрутизатор відповідає основним вимогам та іншим відповідним положенням директиви 2014/53/ЕС, а також суттєвим вимогам Технічного регламенту радіообладнання, затвердженого постановою Кабінету Міністрів України від 24 травня 2017 року № 355.

Для експлуатації в Україні необхідно отримати дозвіл на експлуатацію у порядку, затвердженому рішенням НКРЗІ від 01.11.2012 № 559, зареєстрованому в Міністерстві юстиції України 03.01.2013 за № 57/22589.

CE Declaration of Conformity

Manufacturer: Mikrotikls SIA, Brivibas gatve 214i Rīga, Latvia, LV1039.

Hereby, Mikrotikls SIA declares that the radio equipment type RB924i-2nD-BT5&BG77 is in compliance with Directive 2014/53/EU. The full text of the EU declaration of conformity is available at the following internet address: <https://mikrotik.com/products>


WLAN / Bluetooth / LTE

(EN) Operating Frequency / Maximum output power	WLAN	2400-2483.5 MHz / 20 dBm
(DE) Betriebsfrequenz / maximale Ausgangsleistung	Bluetooth	2400-2483.5 MHz / 20 dBm
(FR) Fréquence de fonctionnement / puissance de sortie maximale	LTE FDD Band 1	2100 MHz / 21 dBm ± 2.7 dB
(IT) Frequenza operativa / massima potenza di uscita	LTE FDD Band 3	1800 MHz / 21 dBm ± 2.7 dB
(ES) Frecuencia de funcionamiento / potencia de salida máxima	LTE FDD Band 8	900 MHz / 21 dBm ± 2.7 dB
(RU) Рабочая частота / максимальная выходная мощность	LTE FDD Band 20	800 MHz / 21 dBm ± 2.7 dB
	LTE FDD Band 28	700 MHz / 21 dBm ± 2.7 dB

Bluetooth Qualified Product



This product has successfully completed Bluetooth Qualification Process. For more information on Bluetooth Qualified products please use the following link: <https://launchstudio.bluetooth.com/Listings/Search>

 (EN) This MikroTik device meets Maximum WLAN and LTE transmit power limits per ETSI regulations. For more detailed information see Declaration of Conformity above / (DE) Dieses MikroTik-Gerät erfüllt die maximalen WLAN- und LTE-Sendeleistung Grenzwerte gemäß ETSI-Bestimmungen. Weitere Informationen finden Sie oben unter Konformitätserklärung / (FR) Cet appareil MikroTik respecte les limites maximales de puissance de transmission WLAN et LTE conformément aux réglementations ETSI. Pour plus d'informations, voir la déclaration de conformité ci-dessus / (IT) Questo dispositivo MikroTik è conforme ai limiti massimi di potenza di trasmissione WLAN e LTE in conformità con le normative ETSI. Per ulteriori informazioni, consultare la dichiarazione di conformità sopra / (ES) Este dispositivo MikroTik cumple con los límites máximos de potencia de transmisión WLAN y LTE de acuerdo con las regulaciones ETSI. Para obtener más información, consulte la declaración de conformidad anterior / (RU) Это устройство MikroTik соответствует максимальным пределам мощности передачи WLAN и LTE в соответствии с правилами ETSI. Для получения дополнительной информации см. Декларацию соответствия выше.

Model: RB924i-2nD-BT5&BG77&R11e-LR8 (**KNOT LR8 kit**)

UKCA marking



Eurasian Conformity Mark

Частотный диапазон	Мощность передатчика
2400-2483.5 МГц	≤100 мВт

*Доступные частотные каналы могут различаться в зависимости от модели продукта и сертификации.

Информация о дате изготовления устройства указана в конце серийного номера на его наклейке через дробь. Первая цифра означает номер года (последняя цифра года), две последующие означают номер недели.

Изготовитель: Mikrotikls SIA, Aizkraukles iela 23, Riga, LV-1006, Латвия, support@mikrotik.com. Сделано в Китае, Латвии или Литве. См. на упаковке.

Для получения подробных сведений о гарантийном обслуживании обратитесь к продавцу. Информация об импортерах продукции MikroTik в Российскую Федерацию: <https://mikrotik.com/buy/europe/russia>

Продукты MikroTik, которые поставляются в Евразийский таможенный союз, оцениваются с учетом соответствующих требований и помечены знаком ЕАС, как показано ниже:



Norma Oficial Mexicana

Rango de frecuencia (potencia de salida máxima): 2400-2483.5 MHz (30 dBm). Los canales de frecuencia disponibles pueden variar según el modelo y la certificación del producto.

EFICIENCIA ENERGETICA CUMPLE CON LA NOM-029-ENER-2017.

La operacion de este equipo esta sujeta a las siguientes dos condiciones:

- Es posible que este equipo o dispositivo no cause interferencia perjudicial y.
- Este equipo debe aceptar cualquier interferencia, incluyendo la que pueda causar su operacion no deseada.

Fabricante: Mikrotikls SIA, Brivibas gatve 214i, Riga, LV-1039, Latvia.

País De Origen: Letonia; Lituania; China (Republica Popular); Estados Unidos De America; Mexico.

Por favor contacte a su distribuidor local para preguntas regionales específicas. La lista de importadores se puede encontrar en nuestra página de inicio – <https://mikrotik.com/buy/latinamerica/mexico>.

The National Commission for the State Regulation of Communications and Informatization by Ukraine

Виробник: Mikrotikls SIA, Brivibas gatve 214i Riga, Латвія, LV1039.

Робоча частота (Максимальна вихідна потужність): 2480-2483.5 МГц (20 дБм).



Справжнім Mikrotikls SIA заявляє, що маршрутизатор відповідає основним вимогам та іншим відповідним положенням директиви 2014 /53/ЕС, а також суттєвим вимогам Технічного регламенту радіообладнання, затвердженого постановою Кабінету Міністрів України від 24 травня 2017 року № 355.

Для експлуатації в Україні необхідно отримати дозвіл на експлуатацію у порядку, затвердженому рішенням НКРЗІ від 01.11.2012 № 559, зареєстрованому в Міністерстві юстиції України 03.01.2013 за № 57/22589.

CE Declaration of Conformity


Manufacturer: Mikrotikls SIA, Brivibas gatve 214i Riga, Latvia, LV1039.

Hereby, Mikrotikls SIA declares that the radio equipment type RB924iR-2nD-BT5&BG77&R11e-LR8 is in compliance with Directive 2014/53/EU. The full text of the EU declaration of conformity is available at the following internet address: <https://mikrotik.com/products>

WLAN / BLUETOOTH / LTE

(EN) Operating Frequency / Maximum output power	WLAN	2400-2483.5 MHz / 20 dBm
(DE) Betriebsfrequenz / maximale Ausgangsleistung	Bluetooth	2400-2483.5 MHz / 10 dBm
(FR) Fréquence de fonctionnement / puissance de sortie maximale	LR (SRD)	863-870 MHz / 14 dBm
(IT) Frequenza operativa / massima potenza di uscita	LTE FDD Band 1	2100 MHz / 21 dBm
	LTE FDD Band 3	1800 MHz / 21 dBm

(ES) Frecuencia de funcionamiento / potencia de salida máxima	LTE FDD Band 8	900 MHz / 21 dBm
(RU) Рабочая частота / максимальная выходная мощность	LTE FDD Band 20	800 MHz / 21 dBm
	LTE FDD Band 28	700 MHz / 21 dBm

 (EN) This MikroTik device meets Maximum WLAN and LTE transmit power limits per ETSI regulations. For more detailed information see Declaration of Conformity above / (DE) Dieses MikroTik-Gerät erfüllt die maximalen WLAN- und LTE-Sendeleistung Grenzwerte gemäß ETSI-Bestimmungen. Weitere Informationen finden Sie oben unter Konformitätserklärung / (FR) Cet appareil MikroTik respecte les limites maximales de puissance de transmission WLAN et LTE conformément aux réglementations ETSI. Pour plus d'informations, voir la déclaration de conformité ci-dessus / (IT) Questo dispositivo MikroTik è conforme ai limiti massimi di potenza di trasmissione WLAN e LTE in conformità con le normative ETSI. Per ulteriori informazioni, consultare la dichiarazione di conformità sopra / (ES) Este dispositivo MikroTik cumple con los límites máximos de potencia de transmisión WLAN y LTE de acuerdo con las regulaciones ETSI. Para obtener más información, consulte la declaración de conformidad anterior / (RU) Это устройство MikroTik соответствует максимальным пределам мощности передачи WLAN и LTE в соответствии с правилами ETSI. Для получения дополнительной информации см. Декларацию соответствия выше.

Bluetooth Qualified Product



This product has successfully completed Bluetooth Qualification Process. For more information on Bluetooth Qualified products please use the following link: <https://launchstudio.bluetooth.com/Listings/Search>

Model: RB924i-2nD-BT5&BG77&R11e-LR9 (**KNOT LR9 kit**)

Federal Communication Commission Interference Statement

Model	FCC ID	Contains FCC ID
RB924iR-2nD-BT5&BG77&R11e-LR9	TV7924BT5LR9	XMR201912BG77

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation.

This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:



- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

FCC Caution: Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Note: This unit was tested with shielded cables on the peripheral devices. Shielded cables must be used with the unit to ensure compliance.

Innovation, Science and Economic Development Canada

Model	IC	Contains IC
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RB924iR-2nD-BT5&BG77&R11e-LR9	7442A-924BT5LR9	10224A-201912BG77
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This device contains license-exempt transmitter(s)/receiver(s) that comply with Innovation, Science, and Economic Development Canada's license-exempt RSS(s). Operation is subject to the following two conditions: (1) This device may not cause interference. (2) This device must accept any interference, including interference that may cause undesired operation of the device.

L'émetteur/récepteur exempt de licence contenu dans le présent appareil est conforme aux CNR d'Innovation, Sciences et Développement économique Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes: 1) L'appareil ne doit pas produire de brouillage; 2) L'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

This Class B digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe [B] est conforme à la norme NMB-003 du Canada.

CAN ICES-003 (B) / NMB-003 (B)

Bluetooth Qualified Product



This product has successfully completed Bluetooth Qualification Process. For more information on Bluetooth Qualified products please use the following link: <https://launchstudio.bluetooth.com/Listings/Search>