

MikroTik RouterOS Wireless and LTE features overview

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Overview

- RouterBOARD wAP
- Wireless quick guide
- New Wireless (wireless-rep) package
- LTE Interface and “wAP LTE kit”

wAP



Black and White edition



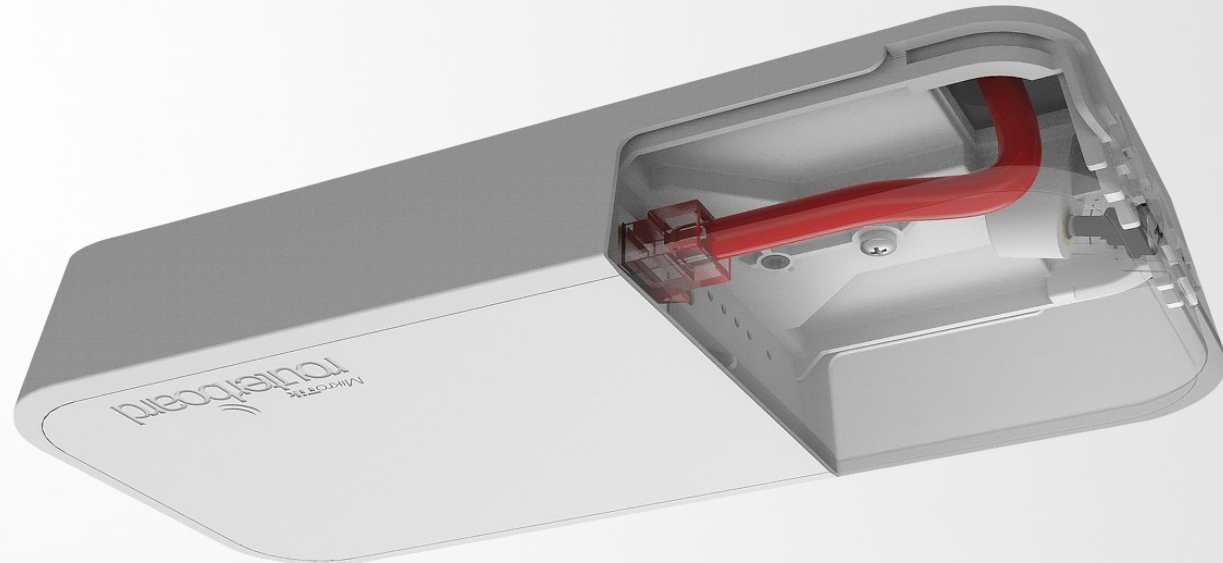
Features

- 2 chain Wireless radio
- Jack and PoE power option
- Wide power input range (11-57V)
- Supports 802.3af/at and Passive PoE
- Low Power Consumption
- High Operating Temperatures
- Suitable for indoor and outdoor
- Waterproof case design

Specification

- CPU 650 MHz
- RAM 64 MB
- Flash 16 MB
- Wireless 802.11b/g/n dual-chain
- Gain 2dBi antennas
- Ethernet 10/100Mbps
- Voltage 11-57V
- Consumption up to 4W
- Operating Temperatures -40C to +70C
- Dimensions 185 x 85 x 30 mm

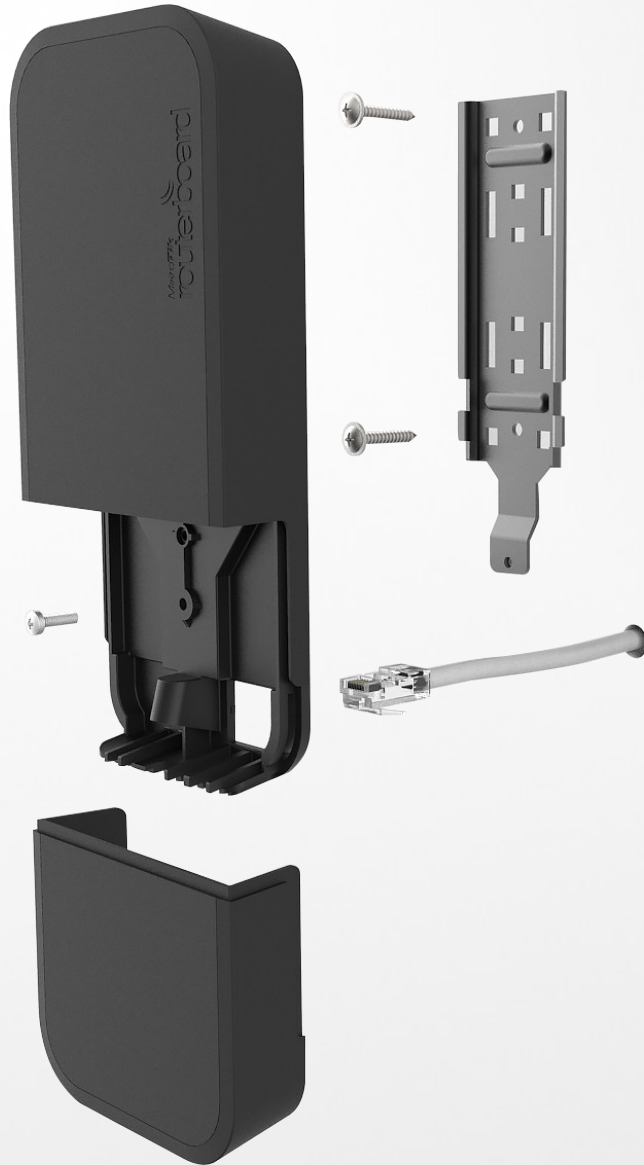
Usage Cases



Use it on the ceiling!

- The wAP comes bundled with all the necessary things to be mounted on ceiling
- Cable breakout provides ability to run cable through the ceiling

Usage Cases



Use it on the wall!

- Wall mounting is easy thanks to the provided drill template and screw anchor. Everything included

New wAP ac

- CPU 720 MHz
- RAM 64 MB
- Flash 16 MB
- Wireless 802.11b/g/n dual-chain
- Wireless 802.11a/n/ac triple-chain
- Gain 2dBi antennas
- Ethernet 10/100/1000Mbps
- Voltage 11-57V
- Consumption up to 12W
- Operating Temperatures -40C to +50C
- Dimensions 185 x 85 x 30 mm

Wireless quick guide

Frequency limitations

regulatory-domain – Limit available channels and maximum transmit power for each channel according to the country limitations

manual-txpower – Use frequency limitations by country, without limiting the maximum transmit power

superchannel – Allow all frequencies supported by the card

lock specific frequencies – Request factory installed lock package, to allow use of only specific wireless frequencies

Wireless usage

PTP (Creates a connection between 2 points)

- PTP devices use **directional** antennas to send signal to narrow beam

PTMP (Allows multiple clients to establish connection)

Sector

- Uses **semi-directional** antenna to cover a specific range with signal, also called sector antenna

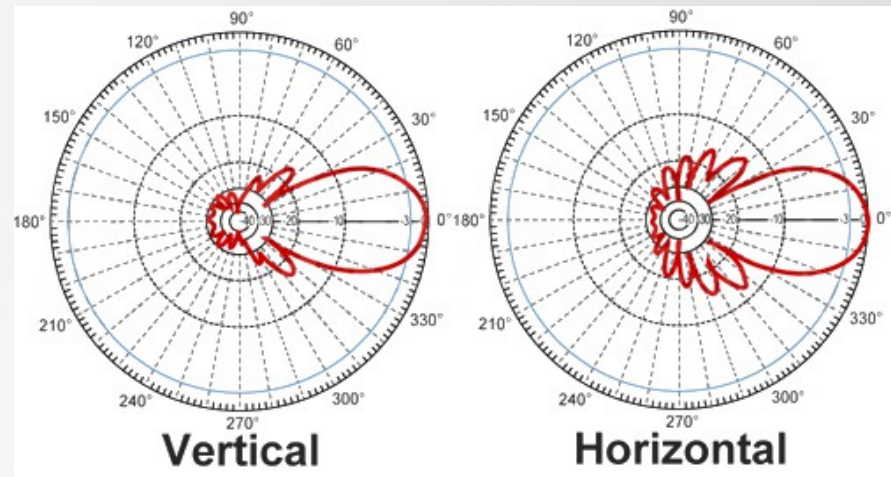
Regular (omni)

- Uses **omni-directional** antenna
- Allows clients to connect from all directions

Directional antenna

Used for PTP links

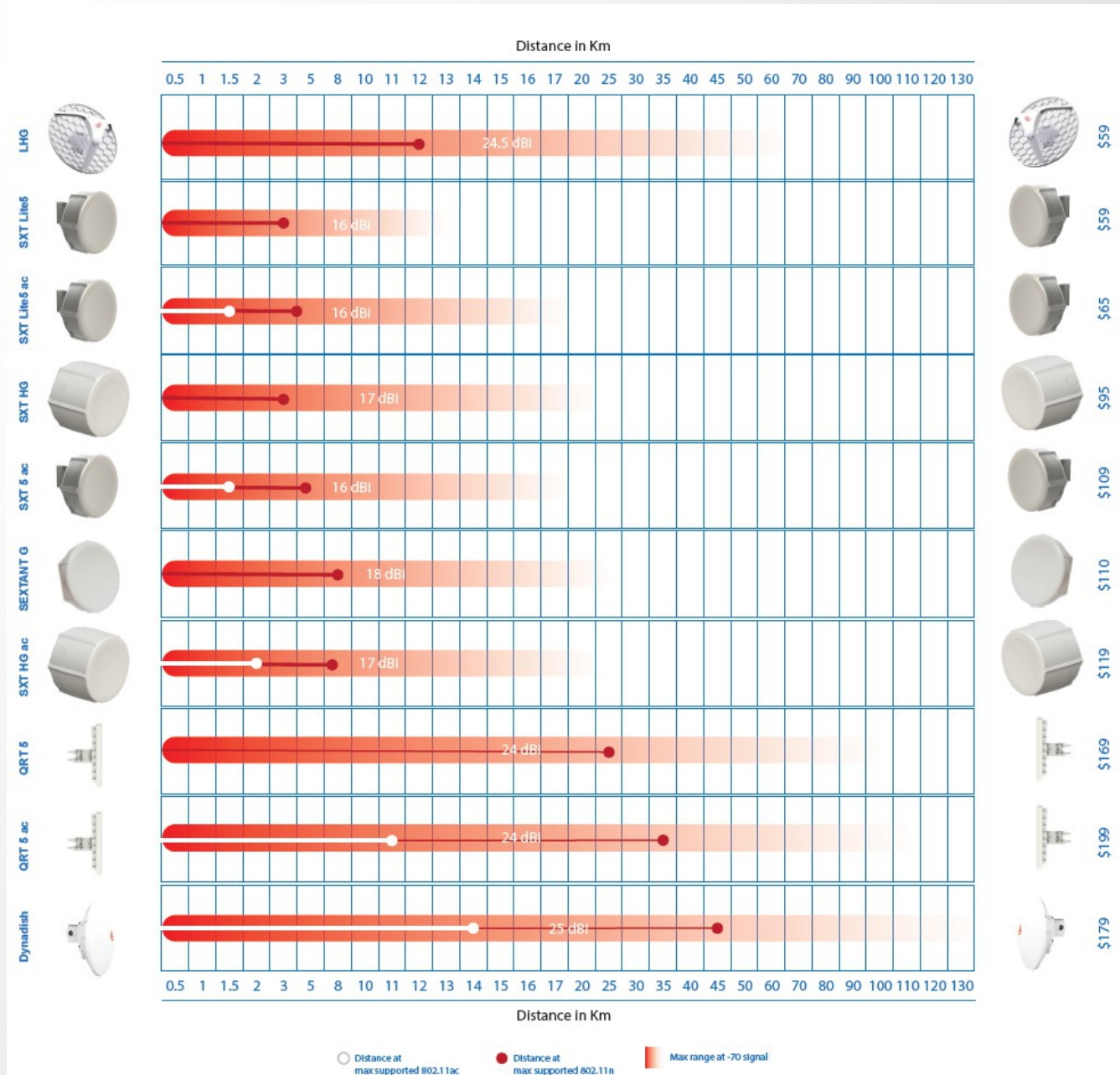
- Focused beam
- Increased antenna gain
- Extended distance
- Reduced interference



MikroTik PTP devices: DynaDish, LHG, SXT, QRT, Sextant

MikroTik PTP antenna: mANT – parabolic dish antenna
mANT can be used with: NetMetal, BaseBox, NetBox
or any other RP-SMA connector compatible device

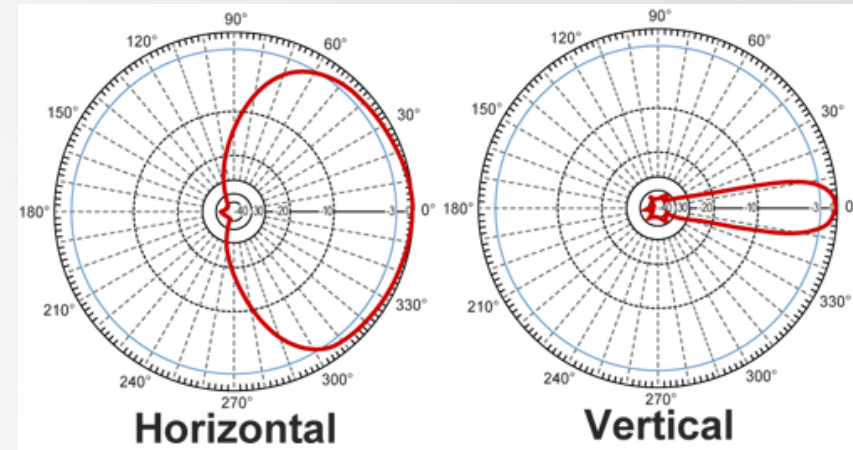
Choose by distance



Sector antenna

Used for PTMP links

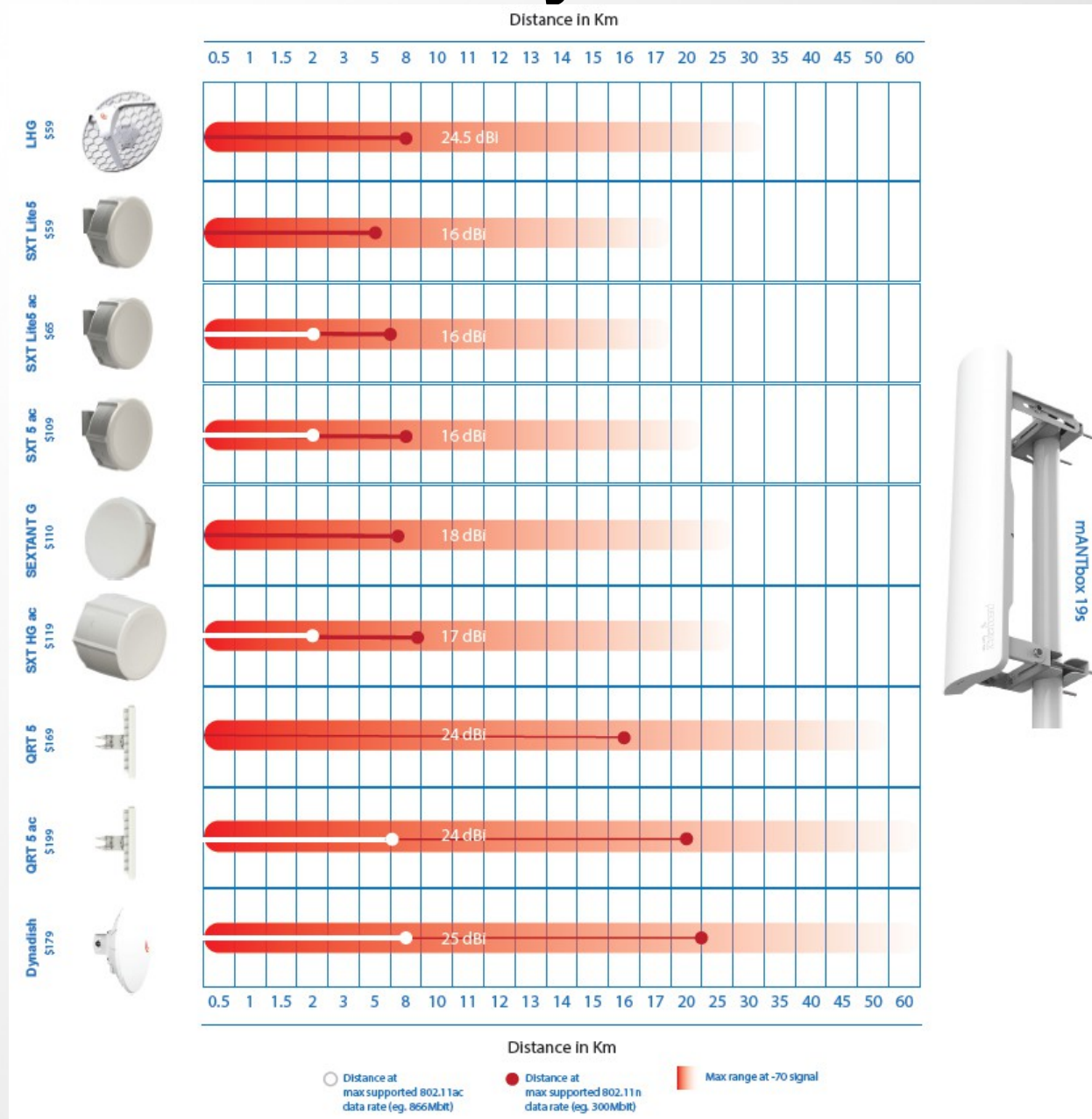
- Specific angle
- Covers large area
- Allows multiple clients
- Lower interference



MikroTik PTMP devices: SXT SA5, SXT SA5 ac, mANTBox 15s/19s

Mikrotik PTMP antenna: mANT 15s/19s – sector antenna
mANT can be used with: NetMetal, BaseBox, NetBox or any other RP-SMA connector compatible device

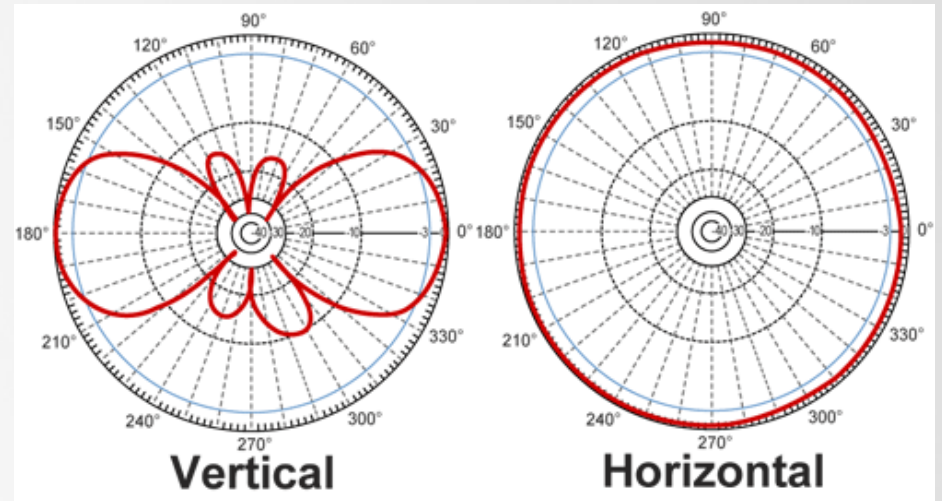
Choose by distance



Omni antenna

Used to cover 360 degrees

- Receives and transmits signals to all directions
- Do not need to be pointed
- Allows multiple clients



MikroTik industrial omni devices: RB Groove, RB Metal, OmniTIK

MikroTik home/office wireless devices are equipped with omni antennas

RouterBOARD: any wireless device with attached omni antenna

Wireless station modes

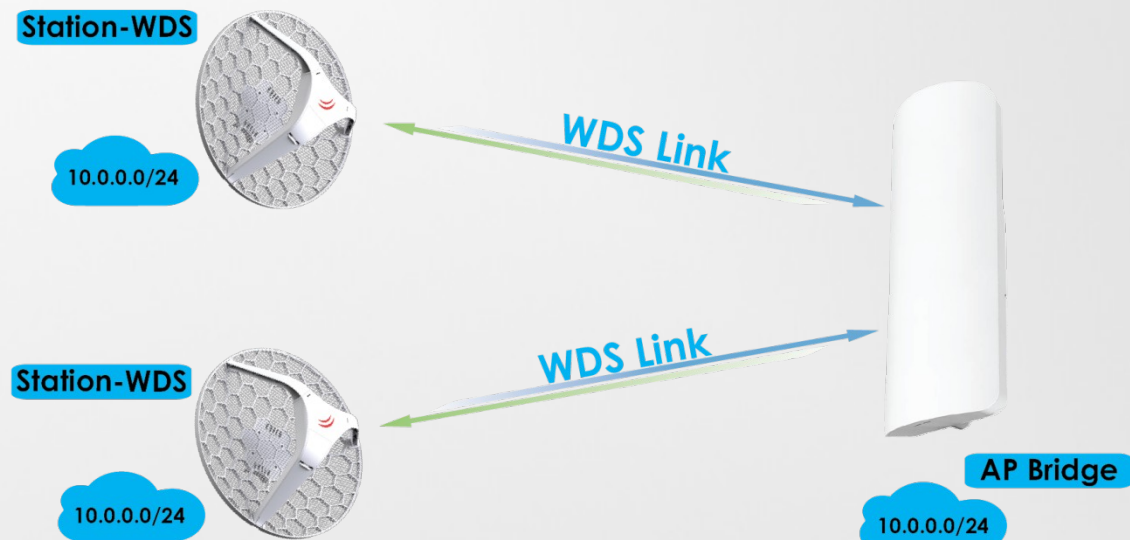
Station



Station-bridge



Station-WDS

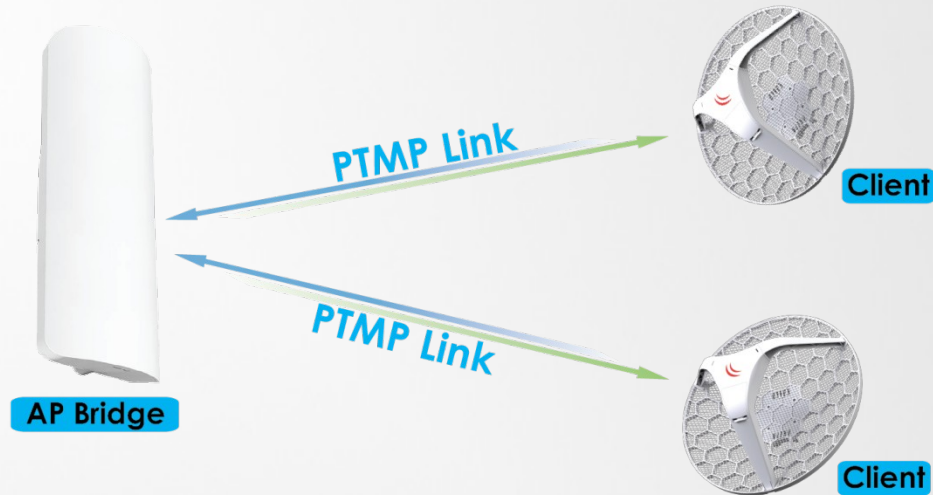


Wireless AP modes

Bridge



AP-Bridge



WDS-Slave



Wireless modes

AP modes:

- AP-bridge (Requires at least level 4 license)
- bridge (Requires at least level 3 license)

Station modes:

- Requires at least level 3 license

Router as station

Configure wireless settings manually to connect to any access point.

- Configure security profiles (authentication-type, mode, key)
- Configure wireless settings (station mode, frequency, band, SSID)

Or use **wireless scan** feature!

Wireless scan

The fastest way to connect to AP

The image shows a screenshot of a wireless management software interface. The top window, titled "Wireless Tables", has a menu bar with "Interfaces", "Nstreme Dual", "Access List", "Registration", "Connect List", "Security Profiles", and "Channels". Below the menu bar is a toolbar with various icons and buttons, including "Scanner" which is highlighted with a red box. The main area of this window contains a table with the following data:

Name	Type	Tx	Rx	Tx Packet (p/s)	Rx Packet (p/s)	FP Tx	FP Rx
wlan1	Wireless (Atheros AR9...	0 bps	1280 bps	0	2	0 bps	1280

Below the table, it says "1 item out of 6 (1 selected)".

The bottom window, titled "Scanner", has a dropdown menu for "Interface:" set to "wlan1" and a "Background Scan" checkbox. On the right side, there are buttons for "Start", "Stop", "Close", "Connect" (highlighted with a red box), and "New Window". Below these buttons is a table of detected APs:

Address	SSID	Channel	Signa...	Noise...	Signa...	Radio Name	RouterO...
30:91:8F:9E:5A:03	TNCAP9...	2437/20-Ce/gn	-77	-108	31		
D4:CA:6D:83:77:03	BackBone	2447/20-eC/gn	-70	-107	37	D4CA6D837703	6.35.1
4E:5E:0C:61:B4:63	testAP	2447/20-eC/gn	-44	-107	63	4C5E0C61B463	6.36rc10

At the bottom of the Scanner window, it says "3 items (1 selected)".

Create AP using Quickset

The screenshot shows the RouterOS WinBox interface with the 'Quick Set' window open for a 'Home AP'. The interface is divided into several sections for configuration:

- Wireless:** Network Name: HomeAP, Frequency: 2447 MHz, Band: 2GHz-B/G/N, Country: no_country_set, MAC Address: 00:0C:42:37:B1:37. Includes a 'WPS Accept' button and a 'Use Access List (ACL)' checkbox.
- Guest Wireless Network:** Guest Network: (empty dropdown).
- Wireless Clients:** A table with columns: MAC Address, In ACL, Last IP, Uptime, Sig. One client is listed: D8:E1:C4:D8:27:08, In ACL: no, Last IP: 192.168.4.203, Uptime: 00:01:47, Sig: -25.
- Internet:** Address Acquisition: Automatic (selected), IP Address, Netmask, Gateway, MAC Address: 00:E1:42:E1:B1:32, Firewall Router checkbox.
- Local Network:** IP Address: 192.168.88.1, Netmask: 255.255.255.0 (/24), DHCP Server (checked), DHCP Server Range: 192.168.88.10-192.168.88.100, NAT (checked), UPnP checkbox.
- VPN:** VPN Access checkbox, VPN Address.
- System:** Check For Updates, Reset Configuration, Password, Confirm Password.

At the bottom, there is a signal strength indicator showing -30 dB and buttons for 'Copy To ACL' and 'Remove From ACL'. The left sidebar contains navigation options like Quick Set, CAPsMAN, Interfaces, Wireless, Bridge, PPP, Switch, Mesh, IP, MPLS, Routing, System, Queues, Files, Log, Radius, Tools, New Terminal, MetaROUTER, Partition, Make Supout.rtf, Manual, New WinBox, and Exit.

Frequency scan

Use scan tool, to find the best frequency

The screenshot displays the MikroTik WinBox interface. At the top, the 'Wireless Tables' window is open, with the 'Freq. Usage' button highlighted in red. Below it, the 'Freq. Usage (Running)' window is active, showing the interface 'wlan1' selected. The main window contains a table with the following data:

Frequency (MHz)	Usage	Noise F...
2412	0.5	-113
2417	2.1	-110
2422	15.3	-109
2427	13.5	-110
2432	17.0	-111
2437	18.2	-111
2442	29.8	-111
2447	17.3	-111
2452	3.7	-110
2457	0.6	-110
2462	0.2	-111

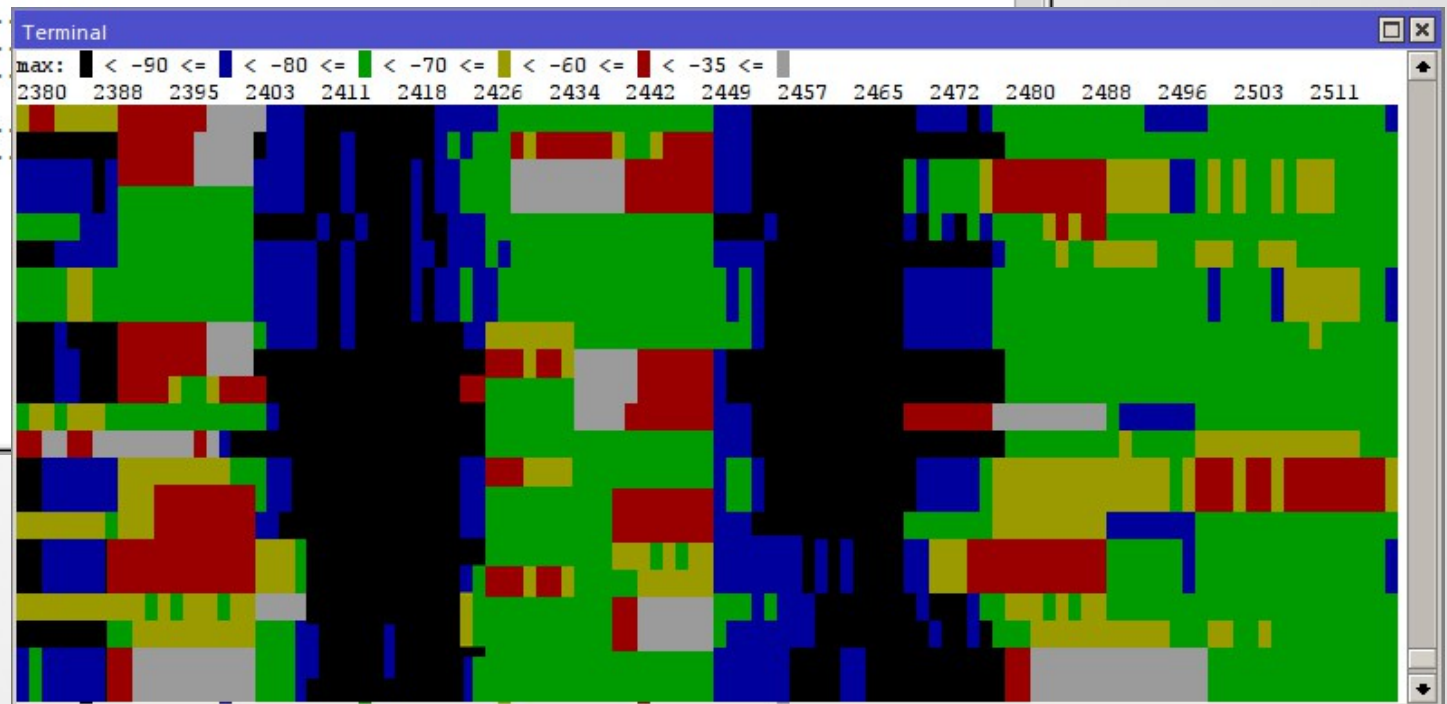
11 items

CLI wireless spectral scan

Use terminal to check used frequencies

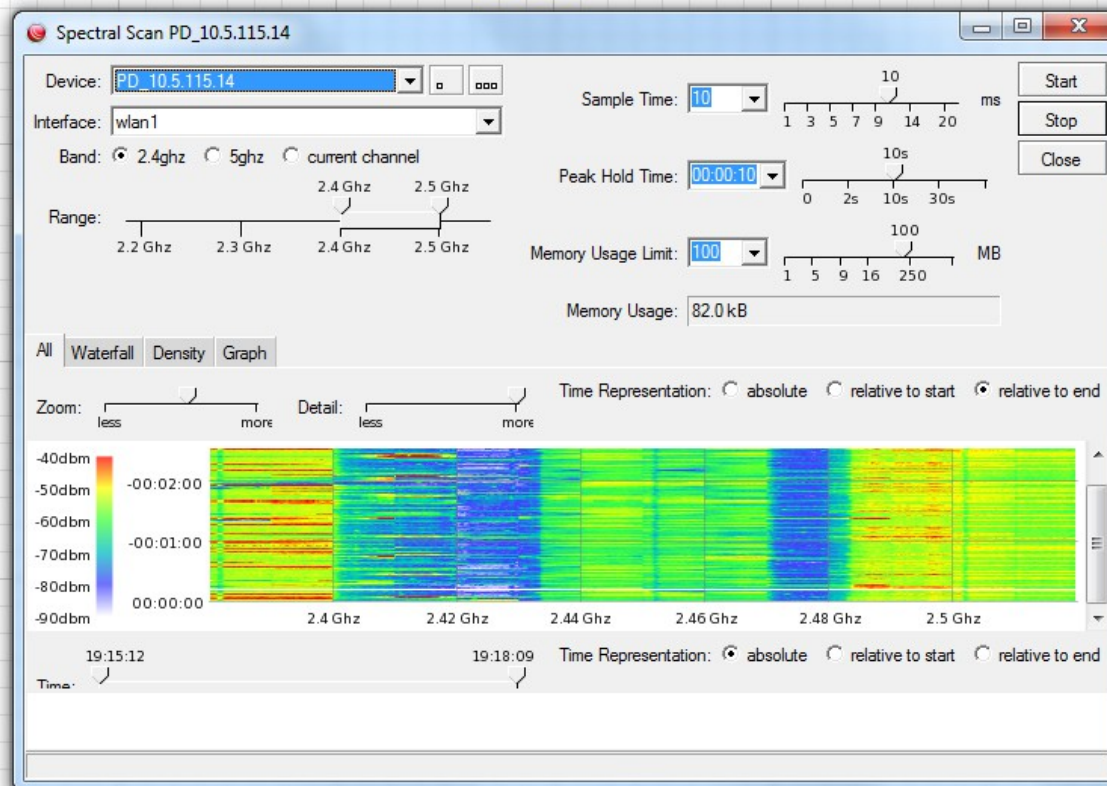
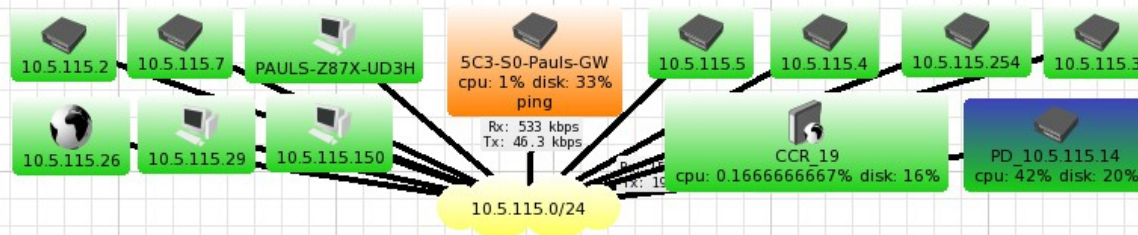
```
Terminal
2383 -97 .....
2389 -92 .....
2395 -90 .....
2401 -91 .....
2407 -90 .....
2413 -91 .....
2419 -92 .....
2425 -93 .....
2431 -94 .....
2437 -94 .....
2443 -95 .....
2449 -95 .....
2455 -94 .....
2461 -94 .....
2468 -96 .....
2474 -101 .....
2480 -103 .....
2486 -104 .....
2492 -104 .....
2498 -105 ....
2504 -105 .
2510 -107 .
2516 -107 .

[pauls@mAP] >
```



Dude

Wireless Spectral Scan from Dude



- Settings
- Appearance
- Tools
 - Reprobe
 - Ack
 - Unack
 - Upgrade
 - Force Upgrade
 - Notes
 - Remove
 - Select Adjacent
- Ping
- Traceroute
- Snmpwalk
- Winbox
- Terminal
- Remote Connection
- Torch
- Bandwidth Test
- Spectral Scan
- Telnet
- Web
- Ftp
- Dude

Test throughput

Measure throughput between wireless devices

The screenshot shows the BTest Server application interface. On the left is a menu with options like 'Tools', 'New Terminal', 'Partition', 'Make Supout.rif', 'Manual', 'New WinBox', and 'Exit'. The main window is titled 'Bandwidth Test (Running)'. It displays the following configuration and results:

- Test To:** 192.168.1.1
- Protocol:** udp tcp
- Local UDP Tx Size:** 1500
- Remote UDP Tx Size:** 1500
- Direction:** both
- TCP Connection Count:** 20
- Local Tx Speed:** [] bps
- Remote Tx Speed:** [] bps
- Random Data
- User:** admin
- Password:** []
- Lost Packets:** 947
- Tx/Rx Current:** 182.8 Mbps/179.9 Mbps
- Tx/Rx 10s Average:** 183.8 Mbps/177.0 Mbps
- Tx/Rx Total Average:** 172.0 Mbps/166.9 Mbps

At the bottom, a bar chart shows the current Tx (blue) and Rx (red) rates. A legend indicates: Tx: 182.8 Mbps, Rx: 179.9 Mbps. The status 'running...' is shown at the bottom left of the window.

Results

Compare throughput in different frequencies

Frequency	Rx Mbps	Tx Mbps	Rx CCQ	Tx CCQ
2407	46.8	46	42	37
2417	74.7	70.3	66	76
2427	88.8	90.2	84	88
2437	98.1	97.3	89	86
2447	77.4	70.7	75	77
2457	63.3	65.4	62	65
2467	85.8	86.8	87	84
2477	95.8	93.3	62	92
2487	66	59.1	57	55

Wireless Snooper

Monitor wireless devices

The screenshot displays the 'Wireless Tables' application window with the 'Wireless Snooper' tab selected. Below it, the 'Wireless Snooper (Running)' window is open, showing the interface for monitoring wireless devices on the 'wlan1' interface. The main window contains a table with the following columns: Channel, Address, SSID, Signal, Of Freq. (%), Of Traf. (%), Bandwidth, Net..., and Stati... The table lists 20 items, including various channels and their associated addresses and SSIDs.

Channel	Address	SSID	Signal	Of Freq. (%)	Of Traf. (%)	Bandwidth	Net...	Stati...
2412/2...				13.1		107.0 kbps	0	0
2417/2...				0.0		0 bps	0	0
2422/2...				10.0		81.7 kbps	0	0
2427/2...	4C:5E:0C:61:B4:63	BackBone	-36	12.6	95.8	102.7 kbps		
2427/2...				13.1		102.7 kbps	0	1
2432/2...				2.2		20.6 kbps	0	0
2437/2...	30:91:8F:9E:5A:03	TNCAP9E...		2.2	100.0	20.5 kbps		1
2437/2...	30:91:8F:9E:5A:03	TNCAP9E...	-77	2.2	100.0	20.5 kbps		1
2437/2...				2.2		20.5 kbps	1	1
2442/2...				3.8		34.4 kbps	0	0
2447/2...	4E:5E:0C:61:B4:63	testAP		2.3	63.6	21.7 kbps		1
2447/2...	D4:CA:6D:83:77:03	BackBone		1.3	36.3	12.5 kbps		2
2447/2...	4E:5E:0C:61:B4:63	testAP	-45	2.3	63.6	21.7 kbps		
2447/2...	D4:CA:6D:83:77:03	BackBone	-78	1.3	36.3	12.5 kbps		
2447/2...	54:35:30:60:51:F3		-41	0.0	0.0	0 bps		
2447/2...	B4:E1:C4:D8:27:08	BackBone	-30	0.0	0.0	0 bps		
2447/2...				3.7		34.3 kbps	2	4
2452/2...				4.9		46.0 kbps	0	0
2457/2...				0.0		0 bps	0	0
2462/2...				0.0		0 bps	0	0

Wireless Sniffer

Capture frames & packets

The screenshot displays the 'Wireless Tables' application interface. The main window has a menu bar with 'Interfaces', 'Nstreme Dual', 'Access List', 'Registration', 'Connect List', 'Security Profiles', and 'Channels'. Below the menu bar is a toolbar with various icons and buttons, including 'CAP', 'WPS Client', 'Setup Repeater', 'Scanner', 'Freq. Usage', 'Alignment', 'Wireless Sniffer', and 'Wireless Snooper'. The 'Wireless Sniffer' button is highlighted in red.

The 'Wireless Sniffer' window is open, showing the following settings:

- Interface: wlan1
- Processed Packets: 384
- Memory Size: 9.9 KiB
- Memory Saved Packets: 32
- Memory Over Limit Packets: 352
- File Size: 0 B
- File Saved Packets: 0
- File Overlimit Packets: 0
- Stream Dropped Packets: 0
- Stream Sent Packets: 0
- File Limit: 10 KiB
- Memory Limit: 10 KiB

The 'Wireless Sniffed Packets' window is also open, displaying a table of captured packets. The table has the following columns: Time (s), Interface, Channel, Signal, Rate, Dst., Src., and Type. The table contains 32 items, with the first item selected.

Time (s)	Interface	Channel	Signal	Rate	Dst.	Src.	Type
0.069	wlan1	2447/20-eC/gn	-42	1Mbps	FF:FF:FF:FF:FF:FF	4E:5E:0C:61:B4:63	beacon
0.073	wlan1	2447/20-eC/gn	-70	1Mbps	FF:FF:FF:FF:FF:FF	D4:CA:6D:83:77:03	beacon
0.172	wlan1	2447/20-eC/gn	-42	1Mbps	FF:FF:FF:FF:FF:FF	4E:5E:0C:61:B4:63	beacon
0.176	wlan1	2447/20-eC/gn	-68	1Mbps	FF:FF:FF:FF:FF:FF	D4:CA:6D:83:77:03	beacon
0.227	wlan1	2447/20-eC/gn	-41	1Mbps	D4:CA:6D:83:77:03	4C:5E:0C:61:B4:63	unknown
0.229	wlan1	2447/20-eC/gn	-69	1Mbps	4C:5E:0C:61:B4:63	D4:CA:6D:83:77:03	unknown
0.274	wlan1	2447/20-eC/gn	-41	1Mbps	FF:FF:FF:FF:FF:FF	4E:5E:0C:61:B4:63	beacon

New Wireless (wireless-rep) package

New Wireless package

- Repeater setup
- Background scan
- Virtual Wireless Interfaces
- WPS client
- New Wireless Scan features
- Scan-list Step support
- Station Roaming support
- G/N band support
- CAPsMAN additional settings enabled
- CAPsMAN Rates support

Repeater Setup

- Allow to receive signal from the AP and repeat the signal using the same physical interface locally for connecting other clients
- Allows to extend wireless service for the wireless clients
- Steps that this setup command does:
 - Configure wireless interface to connect to the AP
 - Create a Virtual AP interface
 - Create Bridge interface
 - Adds both (main and virtual) interfaces to bridge ports

Background Scan

- Supported for 802.11 protocol only
- Working conditions
 - Wireless interface should be enabled
 - For AP mode – when operating on fixed channel
 - For Station mode – when connected to AP
- Supported also on Virtual interfaces
 - Scan is only performed in channel where master interface is running

Virtual Wireless Interfaces

- Supported for 802.11 protocol only
- Virtual AP and Client interface can be added on the same physical interface
- Multiple Virtual Wireless interfaces can be added
- Background scan is supported on Virtual Wireless Interfaces and is only performed in channel where master interface is running

WPS Client Support

- Allows wireless client to get Pre-Shared Key configuration of the AP that has WPS Server enabled
- Gets information from any WPS Server running or can be specified to get only with specific SSID or MAC address
- Received configuration is shown on the screen and can be also saved to a new wireless security profile

Wireless Scan features

- Scan to file
 - Allows to save the scan results in a CSV format file
 - Supported with background scan
- Scan Round setting
 - Allows to do full scan of the scan-list and then stop scanning
 - Useful for remote scans on the clients
 - Supported with background scan as well

Scan-list Step feature

- Scan-list Step feature allows to make compact scan-list entries
- To make scan-list from 5500-5700 with 20mhz step now you need just one entry:
 - Scan-list=5500-5700:20
 - In system it will create scan-list with such frequencies:
5500,5520,5540,5560,5580,5600,5620,5640,5660,5680,5700

Station Roaming support

- Supported for 802.11 protocol only
- While connected to AP station does periodic background scans to look for a better AP
- When a better AP is found station roams to the new AP
- Time intervals between scans becomes shorter when signal becomes worse
- Time intervals between scans becomes longer when signal becomes better

G/N Band Setting

- Regular Wireless Interface and CAPsMAN supports '2ghz-g/n' band setting
 - basic-rates – 6-54Mbps
 - supported – 6-54Mbps
 - ht-basic-mcs – None
 - ht-supported-mcs – 0-23

CAPsMAN Settings

- CAPsMAN now supports the following settings:
 - distance – default value is 'indoors'
 - hw-retries
 - hw-protection-mode
 - frame-lifetime
 - disconnect-timeout

CAPsMAN Rates support

- CAPsMAN supports Rates configuration tab:
 - Basic – B and A/G basic-rates
 - supported – B and A/G supported data-rates
 - ht-basic-mcs – N basic-rates
 - ht-supported-mcs – N supported data-rates
 - vht-basic-mcs – AC basic rates
 - vht-supported-mcs – AC supported data-rates

DFS mode setting changes in v6.37

- In RouterOS v6.37 DFS configuration is redesigned making the DFS mode setting unnecessary
- By default now the DFS mode setting is set to radar-detect
 - If you select a frequency that is a DFS frequency range then before beginning of transmission on that channel it will do a DFS radar detect
 - If you select a frequency that is not in a DFS frequency range then it will begin the transmission on that channel

Wireless packages in v6.37

- In RouterOS v6.37 there is only one wireless package - “wireless”
- “wireless” is the same wireless-rep package in older versions
- Upgrading from older RouterOS versions that had bundle package will automatically upgrade to new bundle package with new wireless package
- If you have multiple individual wireless packages installed, please leave only one wireless package installed before doing upgrade to v6.37

LTE interface

- RouterOS supports PPP emulation and Ethernet emulation driver:
 - PPP emulation has speed limit of approx 25Mbps
 - Ethernet emulation doesn't have such limitation
- Shows supported 2G/3G/4G interfaces that uses ethernet emulation driver under '/interface lte' section

LTE configuration

WEB or Direct

- LTE modem configuration might have two options:
 - WEB interface on the modem IP address where APN, PIN, modem specific configuration and status is located
 - Direct configuration in the RouterOS lte interface menu

LTE interface IP address

- LTE interface IP address, default-gateway is added depending on the LTE modem:
 - On most of the LTE modems IP address, default-gateway is configured by adding DHCP-Client on LTE interface
 - On few LTE modems like SXT LTE the IP address, default-gateway is configured directly on the LTE interface without DHCP-Client
- SXT LTE also support IPv6 on the LTE interface

SMS on LTE interface

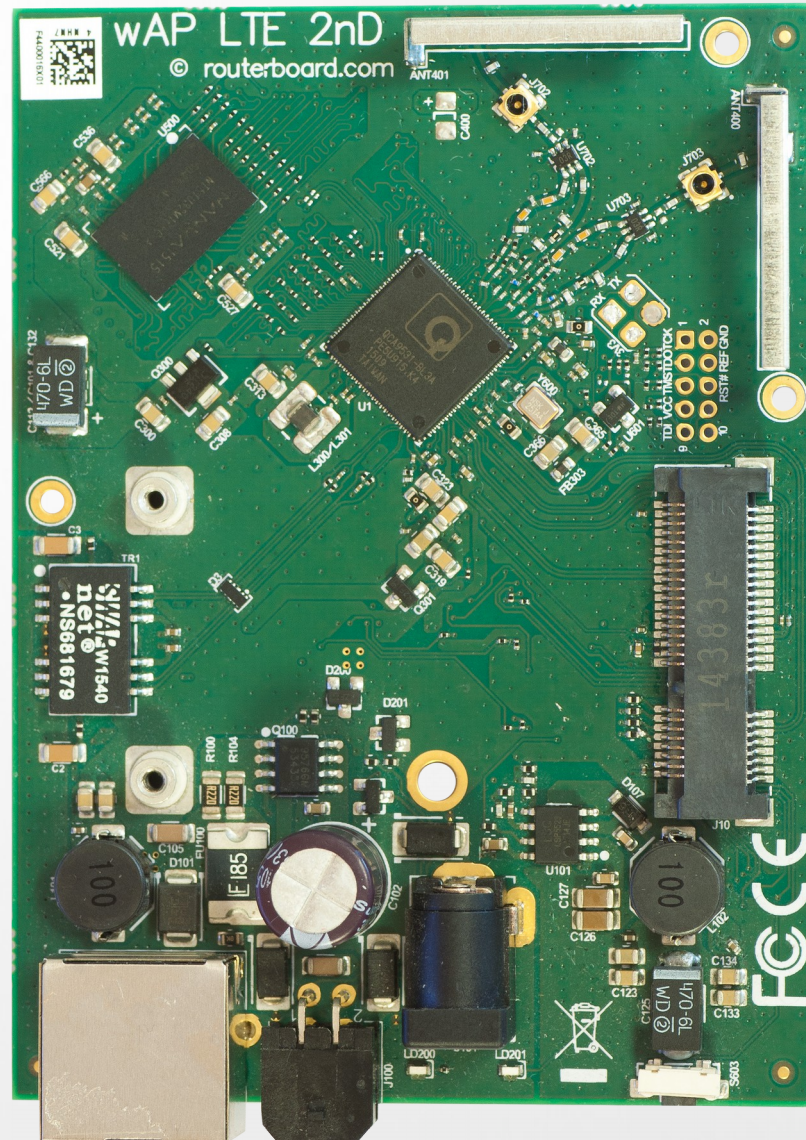
- Starting from RouterOS v6.37 you can Send and Receive SMS on LTE modems
- Allows to send custom status messages and execute scripts by receiving SMS messages
- Some limitations/requirements applies:
 - Sending and Receiving SMS will only work when the LTE interface is Running (Connected)
 - SMS tool supports only “GSM 7” encoding for SMS messages

wAP LTE kit



- wAPR-2nD board with case
- mini-PCle LTE modem card
- Two LTE antennas built-in the case for LTE modem

wAPR-2nD board picture



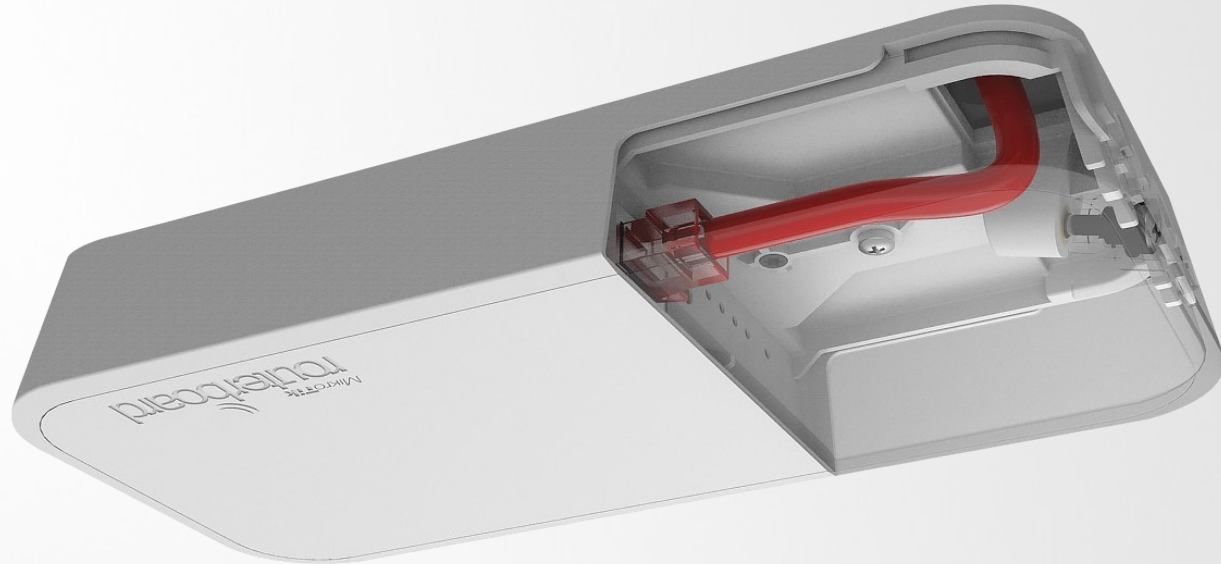
Features

- 2 chain Wireless radio
- Mini-PCIe slot for wireless radio or LTE modem
- SIM slot for LTE modem
- Integrated antennas for LTE interface
- Jack, PoE, 4-pin Automotive power option
- Supports Passive PoE
- Low Power Consumption
- High Operating Temperatures
- Suitable for indoor, outdoor and mobile operation
- Waterproof case design

Specification

- CPU 650 MHz
- RAM 64 MB
- Flash 16 MB
- Wireless 802.11b/g/n dual-chain
- One Mini-PCle slot for wireless or LTE modem
- Gain 2dBi antennas for 802.11b/g/n
- Gain 2-4.5dbi antennas LTE modem
- Ethernet 10/100Mbps
- Voltage 11-30V
- Consumption up to 7W
- Operating Temperatures -40C to +60C
- Dimensions 185 x 85 x 30 mm

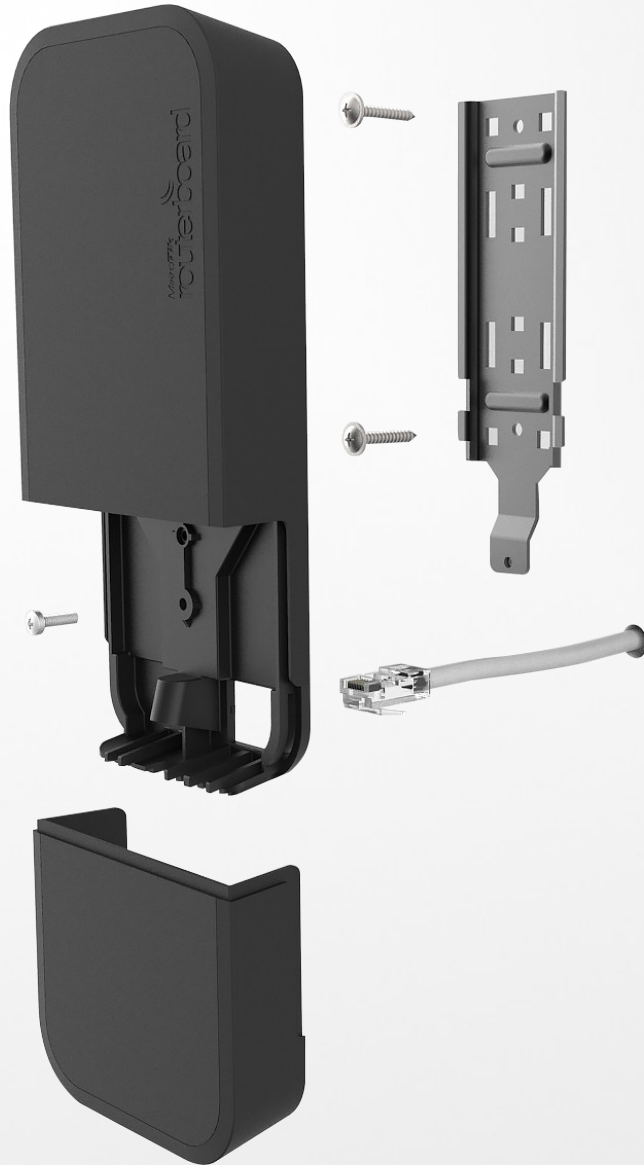
Usage Cases - Mobile



Use it on the ceiling inside a car, bus or train

- The wAP comes bundled with all the necessary things to be mounted on ceiling
- Cable breakout provides ability to run cable through the ceiling

Usage Cases - Wall



Use it on the wall!

- Wall mounting is easy thanks to the provided drill template and screw anchor. Everything included

Usage Cases – Table



Use it on the table!

- Use special plastic stand to place it on the table at home or office

Supported LTE modules

- RouterOS supported Mini-PCIe LTE modules can be found in this Wiki page:

http://wiki.mikrotik.com/wiki/Supported_Hardware

- MikroTik will provide bundle “WAP LTE kit” with a Mini-PCIe LTE module and antenna inside
 - LTE module will be different depending on the Region as LTE supported bands are not the same everywhere

Suggestions?
Feature requests?

Information on “WAP LTE kit”
please talk to MikroTik staff at the
registration table

Thank you!