

Mikrotik Wireless PTP & PTMP Link Features

By

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About Me

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- MTCNA (MikroTik Certified Network Associate)
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About Company

- Started in 2003
- Top Wireless/Security & Network Equipment Distributor in Pakistan.
- We are Master Distributor for:
 - MIKROTIK, Yeastar, Fanvil, GrandStream, UBNT.....
- We Deals in:
- IT managed services
- Trainings
- Security Solutions
- Electrical & Instrumentation Solutions with SCADA



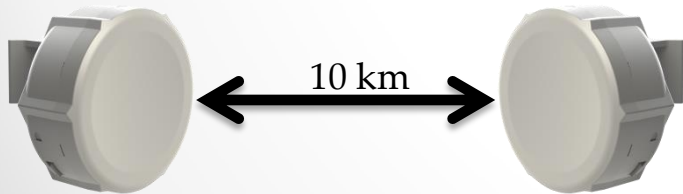
Presentation Objective

- PTP & PTMP Connections
- Access List and Connect List
- Basic Features
- Q & A

Types Of Connections

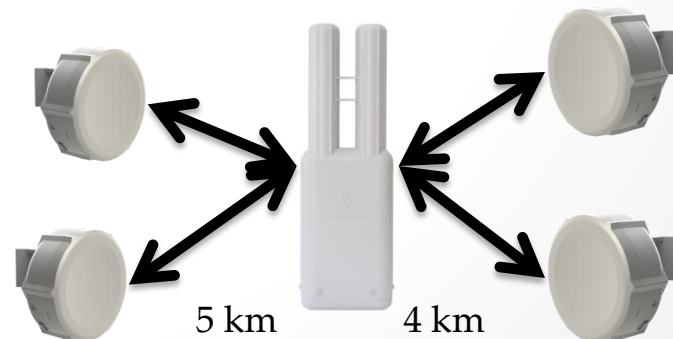
PTP (Point to Point)

- You can establish long distance link.
- Better throughput.



PTMP (Point to Multipoint)

- Mostly use in Wireless ISPs
- Cost effective than PTP



Advantages & Disadvantages Of Wireless Links

Advantages

- Easy to install
- Cost effective
- No cable to pull

Disadvantages

- Country limitation
- Bandwidth limit

Wireless Operation Modes in Mikrotik

- AP-bridge/Bridge <-> Station
- AP-bridge/Bridge <-> Station-wds/Stationbridge
- AP-bridge <-> WDS-slave
- AP-bridge/Bridge <-> Stationpseudobridge

RouterOS License Requirement

- PTP link requires at least Level 3
 - Example: Bridge <-> Station
- PTMP link requires on AP at least Level 4 and on clients at least Level 3
 - Example: AP-bridge <-> Station
- For Non RouterOS AP:
 - Example: Non RouterOS AP <-> pseudobridge

PTP & PTMP link Configuration

- PTP Link Requirements:
 - 1 x Wireless Equipment For Access Point Minimum RouterOS L3
 - 1 x Wireless Equipment For Station Minimum RouterOS L3
- PTMP Link Requirements:
 - 1 x Wireless Equipment For Access Point Minimum RouterOS L4
 - 1 - x Wireless Equipment For Station Minimum RouterOS L3

PTP & PTMP link Configuration

- Access Point WDS Configuration Steps (PTP):

The screenshot displays the RouterOS WinBox interface for configuring WDS on an Access Point. The configuration is performed on the 'wlan1' interface. The following steps are highlighted with red boxes and numbers:

- 1**: Select the 'Wireless' tab in the left sidebar.
- 2**: Select the 'Wireless' tab in the top menu.
- 3**: Configure the 'General' tab with the following settings:
 - Mode: ap bridge
 - Band: 5GHz-A/N/AC
 - Channel Width: 20MHz
 - Frequency: 5765
 - SSID: MUM-PAKISTAN
 - Scan List: default
 - Wireless Protocol: any
 - Security Profile: default
 - Bridge Mode: enabled
 - VLAN Mode: no tag
 - VLAN ID: 1
- 4**: In the 'WDS' tab, check 'Default Authenticate'.
- 5**: In the 'WDS' tab, configure 'Tx Chains' and 'Rx Chains' to include 'chain0' and 'chain1'.
- 6**: In the 'WDS' tab, set 'WDS Mode' to 'dynamic' and 'WDS Default Bridge' to 'bridge1'.
- 7**: Click the 'Apply' button to save the configuration.

PTP & PTMP link Configuration

- Station WDS Configuration Steps (PTP) :

The screenshot displays the RouterOS WinBox interface for configuring Station WDS. The interface is annotated with red boxes and numbers 1 through 6, indicating the sequence of steps:

- 1**: The **Bridge** option is selected in the left-hand menu.
- 2**: The **wlan2** interface is selected in the **Wireless Tables** window.
- 3**: The **Mode** is set to **station wds** in the **Interface <wlan2>** configuration window.
- 4**: The **Default Authenticate** checkbox is checked in the **Interface <wlan2>** configuration window.
- 5**: The **WDS** tab is selected in the **Interface <wlan1>** configuration window, and the **Tx Chains** and **Rx Chains** are set to **chain0** and **chain1**.
- 6**: The **Apply** button is clicked in the **Interface <wlan1>** configuration window.

The **RouterOS WinBox** logo is visible in the bottom-left corner.

PTP & PTMP link Configuration

- Result UDP (PTP) :

The screenshot shows the RouterOS WinBox interface. The top status bar displays the session information and a red box highlighting the CPU usage at 41%. The main window is titled "Wireless Tables" and shows a table with one entry for the wlan2 interface. A "Bandwidth Test (Running)" dialog box is open, showing the test configuration and results. The test is configured for UDP, with a test target of 192.168.20.101. The results show a current speed of 75.8 Mbps Tx / 74.0 Mbps Rx, a 10s average of 73.2 Mbps Tx / 72.3 Mbps Rx, and a total average of 67.1 Mbps Tx / 64.5 Mbps Rx. A graph at the bottom shows the test progress.

admin@E4:8D:8C:D6:B1:D3 (CPE) - WinBox v6.35.2 on SXT Lite5 ac (mipsbe)

Session Settings Dashboard

Safe Mode Session: E4:8D:8C:D6:B1:D3 **Always Check CPU Percentages As well** CPU:41%

Wireless Tables

Interfaces Nstreme Dual Access List Registration Connect List Security Profiles Channels

Radio Name	MAC Address	Interface	Uptime	AP	W...	Last Activit...	Tx/Rx Signal ...	Tx Rate	Rx Rate
4C5E0CD...	4C:5E:0C:D4:96:C8	wlan2	00:01:20	yes	yes	0.000	-44/-45	173.3Mbp...	173.3Mbp...

1 - Test UDP

2 Test To: 192.168.20.101 **3** Start

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: 966

Tx/Rx Current: 75.8 Mbps/74.0 Mbps

Tx/Rx 10s Average: 73.2 Mbps/72.3 Mbps

Tx/Rx Total Average: 67.1 Mbps/64.5 Mbps

Tx: 72.9 Mbps

Rx: 72.9 Mbps

running...

Click on Tools and Select BANDWIDTH TEST

PTP & PTMP link Configuration

- Result TCP (PTP) :

The screenshot shows the RouterOS WinBox interface. The main window is titled "Wireless Tables" and displays a table of wireless interfaces. A "Bandwidth Test (Running)" window is open, showing the test configuration and results. The test is configured for TCP with a destination of 192.168.20.101. The results show a Tx/Rx Total Average of 79.3 Mbps/51.0 Mbps. A red box in the top right corner indicates "CPU: 100%".

2- Test TCP

2 Test To: 192.168.20.101

3 Start

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: 0

Tx/Rx Current: 79.9 Mbps/54.2 Mbps

Tx/Rx 10s Average: 80.9 Mbps/52.8 Mbps

Tx/Rx Total Average: 79.3 Mbps/51.0 Mbps

Tx: 82.1 Mbps

Rx: 55.3 Mbps

running...

Always Check CPU Percentages As well CPU: 100%

Click on Tools and Select BANDWIDTH TEST

PTP & PTMP link Configuration

- Access Point WDS Configuration Steps (PTMP):

The screenshot displays the RouterOS WinBox interface for configuring WDS on the wlan1 interface. The configuration is divided into several panels, with key steps highlighted by red boxes and numbered 1 through 7:

- 1:** The 'Wireless' menu item in the left sidebar is highlighted.
- 2:** The 'WDS' tab is selected in the 'Interface <wlan1>' configuration window.
- 3:** The 'General' tab of the 'Interface <wlan1>' configuration window is shown, with fields for Mode (ap bridge), Band (5GHz-A/N/AC), Channel Width (20MHz), Frequency (5765), SSID (MUM-PAKISTAN), Scan List (default), Wireless Protocol (any), Security Profile (default), Bridge Mode (enabled), VLAN Mode (no tag), and VLAN ID (1).
- 4:** The 'Default Forward' checkbox is checked in the 'Default AP Tx Rate' section.
- 5:** The 'WDS' tab of the 'Interface <wlan1>' configuration window is shown, with 'Tx Chains' and 'Rx Chains' both set to 'chain0' and 'chain1'.
- 6:** The 'WDS Mode' is set to 'dynamic' and the 'WDS Default Bridge' is set to 'bridge1' in the 'WDS' tab.
- 7:** The 'Apply' button is highlighted in the bottom right corner of the configuration window.

PTP & PTMP link Configuration

- StationWDS - 1 Configuration Steps (PTMP):

The screenshot displays the RouterOS WinBox interface for configuring Station WDS. The left sidebar (1) shows the 'Wireless' menu selected. The 'Wireless Tables' window (2) lists the wireless interfaces, with 'wlan2' selected. The 'Interface <wlan2>' window (3) shows the 'Mode' set to 'station wds'. The 'Interface <wlan2>' window (4) shows the 'Default Authenticate' checkbox checked. The 'Interface <wlan1>' window (5) shows the 'Tx Chains' and 'Rx Chains' both set to 'chain0' and 'chain1'. The 'Interface <wlan1>' window (6) shows the 'Apply' button highlighted.

admin@E4:8D:8C:D6:B1:D3 (CPE) - WinBox v6.35.2 on SXT Lite5 ac (mipsbe)

Session Settings Dashboard

Safe Mode Session: E4:8D:8C:D6:B1:D3

Quick Set

CAPsMAN

Interface

Wireless

Bridge

PPP

Switch

Mesh

IP

MPLS

Routing

System

Queues

Files

Log

Radius

Tools

New Terminal

MetaROUTER

Partition

Make Spout.rif

Manual

New WinBox

Exit

RouterOS WinBox

Wireless Tables

Name	Type	Tx	Rx	Tx Packet (p/s)	Rx Packet (p/s)
wlan1	Wireless (Atheros AR9300)	0 bps	0 bps	0	0
wlan2	Wireless (Atheros AR9888)	0 bps	0 bps	0	0

Interface <wlan2>

General Wireless HT WDS Nstreme NV2 Advanced Status ...

Mode: station wds

Band: 5GHz-A/N/AC

Channel Width: 20MHz

Frequency: auto MHz

SSID: MUM-PAKISTAN

Scan List: default

Wireless Protocol: any

Security Profile: default

WPS Mode: push button

Bridge Mode: enabled

VLAN Mode: no tag

VLAN ID: 1

Default AP Tx Rate: bps

Default Client Tx Rate: bps

Default Authenticate

Default Forward

Interface <wlan1>

Wireless HT HT MCS WDS Nstreme NV2 Status Advanced Status ...

Tx Chains: chain0 chain1

Rx Chains: chain0 chain1

AMSDU Limit: 8192

AMSDU Threshold: 8192

Guard Interval: any

AMPDU Priorities: 0 1 2 3 4 5 6 7

PTP & PTMP link Configuration

- Station WDS - 2 Configuration Steps (PTMP):

The screenshot displays the RouterOS WinBox interface for configuring Station WDS. The interface is divided into several panes and windows:

- Left Sidebar:** A vertical menu with various configuration options. The **Wireless** option is highlighted with a red circle **1**.
- Wireless Tables:** A table showing the configuration of wireless interfaces. The **wlan2** interface is highlighted with a red circle **2**.

Name	Type	Tx	Rx	Tx Packet (p/s)	Rx Packet (p/s)	FP T3
wlan1	Wireless (Atheros AR9...	0 bps	0 bps	0	0	0
wlan2	Wireless (Atheros AR9...	5.6 kbps	0 bps	9	0	0
- Interface <wlan2>:** A configuration window for the wlan2 interface. The **WDS** tab is selected. The **Mode** is set to **station wds** (circled in red with **3**). Other settings include **Band: 5GHz-A/N/AC**, **Channel Width: 20MHz**, **Frequency: auto**, **SSID: MUM-PAKISTAN**, **Wireless Protocol: any**, **Security Profile: default**, **WPS Mode: push button**, **Bridge Mode: enabled**, and **VLAN Mode: no tag**. At the bottom, the **Default Authenticate** checkbox is checked (circled in red with **4**).
- Interface <wlan1>:** A configuration window for the wlan1 interface. The **WDS** tab is selected. The **Tx Chains** and **Rx Chains** are both set to **chain0** and **chain1** (circled in red with **5**). The **Apply** button is highlighted with a red circle **6**.

PTP & PTMP link Configuration

- Result UDP (PTMP) Both Stations:

The image shows two side-by-side screenshots of the WinBox interface for configuring and running a bandwidth test on two stations. A red vertical line separates the two screenshots.

Station 1 - Test UDP:

- CPU:** 24%
- Test To:** 192.168.20.101
- Protocol:** udp
- Local UDP Tx Size:** 1500
- Remote UDP Tx Size:** 1500
- Direction:** both
- TCP Connection Count:** 20
- User:** admin
- Lost Packets:** 153
- Tx/Rx Current:** 42.5 Mbps / 21.5 Mbps
- Tx/Rx 10s Average:** 44.8 Mbps / 17.8 Mbps
- Tx/Rx Total Average:** 43.3 Mbps / 17.9 Mbps

Station 2 - Test UDP:

- CPU:** 18%
- Test To:** 192.168.20.101
- Protocol:** udp
- Local UDP Tx Size:** 1500
- Remote UDP Tx Size:** 1500
- Direction:** both
- TCP Connection Count:** 20
- User:** admin
- Lost Packets:** 343
- Tx/Rx Current:** 49.0 Mbps / 18.8 Mbps
- Tx/Rx 10s Average:** 49.7 Mbps / 19.0 Mbps
- Tx/Rx Total Average:** 42.1 Mbps / 19.8 Mbps

Annotations:

- A red box labeled '1' points to the 'Tools' menu item in the left sidebar.
- A red box labeled '2' points to the 'Test To' field in both bandwidth test windows.
- A red box labeled 'Always Check CPU Percentage As Well' spans across the top of both screenshots, pointing to the CPU usage indicators.
- A red box labeled 'Click on Tools and Select BANDWIDTH TEST' is located in the bottom left of the Station 1 screenshot.

Station	CPU	Tx/Rx Current	Tx/Rx 10s Average	Tx/Rx Total Average
Station 1	24%	42.5 Mbps / 21.5 Mbps	44.8 Mbps / 17.8 Mbps	43.3 Mbps / 17.9 Mbps
Station 2	18%	49.0 Mbps / 18.8 Mbps	49.7 Mbps / 19.0 Mbps	42.1 Mbps / 19.8 Mbps

PTP & PTMP link Configuration

- Result TCP (PTMP) Both Stations:

Always Check CPU Percentage As Well

Station 1 - Test TCP

Station 2 - Test TCP

1 Click on Tools and Select BANDWIDTH TEST

2 Test To: 192.168.20.101

Protocol: 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: 0

Tx/Rx Current: 28.4 Mbps/20.1 Mbps

Tx/Rx 10s Average: 28.3 Mbps/22.4 Mbps

Tx/Rx Total Average: 21.4 Mbps/20.4 Mbps

Tx: 20.1 Mbps

Tx/Rx Current: 30.1 Mbps/21.5 Mbps

Tx/Rx 10s Average: 28.9 Mbps/17.4 Mbps

Tx/Rx Total Average: 23.2 Mbps/15.2 Mbps

Tx: 21.5 Mbps

Access List & Connect List

Access List

- Access list is used by access point to restrict allowed connections from other devices, and to control connection parameters.
- Access List is use in Access Point

Connect List

- Connect List is used to assign priority and security settings to connections with remote access points and to restrict allowed connections.
- Connect List is use in Station

Access List

- How to Enable Access List on Mikrotik Wireless Access Point

The screenshot displays the Mikrotik WinBox interface for configuring an Access List on a wireless interface. The interface is divided into several panes:

- Left Pane:** A sidebar menu with the "Wireless" option highlighted (1).
- Top Pane:** A table of wireless interfaces. The "wlan1" interface is selected (2).
- Right Pane:** The "Access List" configuration window for the selected interface. The "Access List" tab is active (3). The "AP Access Rule" configuration is shown with the following settings:
 - Address: E4:8D:8C:D6:B1:D4 (5)
 - Interface: all
 - Signal Strength Range: -120..120
 - Authentication: (6)
 - Forwarding:
 - VLAN Mode: no tag
 - VLAN ID: 1
 - Private Key: none
 - Private Pre Shared Key: *****
 - Management Protection Key: *****
- Bottom Pane:** The "Wireless" configuration window for the "wlan1" interface. The "Default Authentication" checkbox is checked (3).

Access List

- Result:
 - Now Check on Wireless Registration Table, You will Find your Station Device

The screenshot shows the RouterOS WinBox interface. The 'Wireless Tables' window is open, displaying the 'Registration' tab. A table lists wireless stations with columns for Radio Name, MAC Address, Interface, Uptime, AP, WDS, Last Activity, Tx/Rx Signal, Tx Rate, and Rx Rate. One entry is highlighted with a red box. A dialog box for 'AP Access Rule' is also visible, showing configuration options for the selected MAC address.

Radio Name	MAC Address	Interface	Uptime	AP	WDS	Last Activity	Tx/Rx Signal	Tx Rate	Rx Rate
E48D8CD6B1D4	E4:8D:8C:D6:B1:D4	wlan1	00:04:20	no	yes	0.000	-40/-38	173.3Mbps...	6Mbps

AP Access Rule <E4:8D:8C:D6:B1:D4>

MAC Address: E4:8D:8C:D6:B1:D4

Interface: all

Signal Strength Range: -120..120

AP Tx Limit: []

Client Tx Limit: []

Authentication

Forwarding

VLAN Mode: no tag

VLAN ID: 1

Private Key: none

Private Pre Shared Key: []

Management Protection Key: []

Time: []

enabled

Connect List

- How to Enable Connect List on MikroTik Wireless Station

The screenshot displays the MikroTik WinBox interface with several windows open to configure a wireless station's connect list. Red circles 1 through 10 indicate the following steps:

1. Selecting the **Wireless** menu item in the left sidebar.
2. Selecting the **wlan2** interface in the **Wireless Tables** list.
3. Setting the **Mode** to **station wds** in the **Interface <wlan2>** configuration window.
4. Switching to the **Connect List** tab in the **Wireless Tables** window.
5. Clicking the **+** button to add a new rule.
6. Setting the **MAC Address** to **E4:8D:8C:D6:B1:D4** in the **Station Connect Rule <E4:8D:8C:D6:B1:D4>** dialog.
7. Clicking the **Copy** button.
8. Clicking the **OK** button to save the rule.
9. Setting the **MAC Address** to **4C:5E:0C:D4:96:C8** in the second **Station Connect Rule <4C:5E:0C:D4:96:C8>** dialog.
10. Clicking the **OK** button to save the second rule.

Connect List

- Result:
 - Now Check on Wireless Registration Table, You will Find your Access Point Device. So which Access Point is Showing there switch off that one. Your Station Will Connect from Other AP.

The image displays two screenshots of the Mikrotik WinBox interface, showing the 'Wireless Tables' window with the 'Registration' tab selected. The first screenshot shows a table with one entry for radio E48D8CD6B1D4. The second screenshot shows a table with one entry for radio 4C5E0CD496C8.

Screenshot 1: The 'Registration' tab is selected. The table contains one entry:

Radio Name	MAC Address	Interface	Uptime	AP	W...	Last Activ...	Tx/Rx Signal ...	Tx Rate	Rx Rate
E48D8CD6B1D4	E4:8D:8C:D6:B1:D4	wlan2	00:05:20	yes	yes	0.000	-47/-49	173.3Mbp...	173.3Mbp...

Screenshot 2: The 'Registration' tab is selected. The table contains one entry:

Radio Name	MAC Address	Interface	Uptime	AP	W...	Last Activ...	Tx/Rx Signal ...	Tx Rate	Rx Rate
4C5E0CD496C8	4C:5E:0C:D4:96:C8	wlan2	00:00:02	yes	yes	0.000	-60	6Mbps	144.4Mbp...

Basic Features

- Scan
- Frequency Usage
- Snooper

Basic Feature

- Scan
 - Scan command allows to see available AP in the frequency range defined in the scan-list.

The screenshot shows the Mikrotik WinBox interface. The main window is titled 'Interface <wan1>' and is in the 'Wireless' tab. The configuration for the 'wan1' interface is as follows:

- Mode: station
- Band: 2GHz-B/G
- Channel Width: 20MHz
- Frequency: 2412 MHz
- SSID: MikroTik
- Scan List: default
- Wireless Protocol: any
- Security Profile: default
- WPS Mode: push button
- Bridge Mode: enabled
- VLAN Mode: no tag
- VLAN ID: 1
- Default AP Tx Rate: [] bps
- Default Client Tx Rate: [] bps
- Default Authenticate
- Default Forward

Overlaid on the interface configuration is a 'Scanner (Running)' window. It shows the interface 'wan1' selected and a list of 17 detected wireless networks. The scanner window includes buttons for Start, Stop, Close, Connect, and New Window.

	Address	SSID	Channel	Signa...	Noise...	Signa...	Radio Name	RouterO...
ARB	4C:5E:0C:0B:36:3D	Mikro Tik...	2412/2...	-24	-115	91	4C5E0C0B363D	6.30.4
A	A0:F3:C1:81:F2:D6	Mamiott...	2412/2...	-88	-115	27		
A	E8:94:F6:29:48:9A	Mamiott...	2412/2...	-86	-115	29		
A	9C:AD:97:2B:A6:FE	HP-Print-f...	2412/2...	-79	-115	36		
ARB	E4:8D:8C:B3:06:19	Mikro Tik...	2422/2...	-42	-115	73	E48D8C830619	6.30.4
APRB	E4:8D:8C:53:78:87	Mamiott...	2422/2...	-72	-115	43	E48D8C537887	6.33.5
A	64:70:02:F9:34:B4	Mamiott...	2427/2...	-88	-115	27		
A	64:70:02:6C:37:E0	Mamiott...	2437/2...	-79	-114	35		
A	90:F6:52:2A:0A:26	Mamiott...	2442/2...	-91	-114	23		
A	54:E6:FC:9A:41:80	Mamiott...	2452/2...	-71	-114	43		
AP	50:68:0A:E6:3A:85	Khattak ...	2462/2...	-82	-114	32		
A	A0:F3:C1:D4:0D:A6	Mamiott...	2462/2...	-89	-114	25		
A	E8:DE:27:25:3A:A6	Mamiott...	2447/2...	-93	-114	21		
A	64:70:02:6C:49:A8	Board Ro...	2412/2...	-90	-115	25		
	00:18:F8:4A:E3:74	Mamiott...	2442/2...	-91	-114	23		

Basic Feature

- Frequency Usage
 - This tool shows you that usage of frequency.

The screenshot displays the Mikrotik WinBox interface. The main window is titled 'Interface <wlan1>' and shows the 'Wireless' tab. The configuration includes:

- Mode: station
- Band: 2GHz-B/G
- Channel Width: 20MHz
- Frequency: 2412 MHz
- SSID: MikroTik
- Scan List: default
- Wireless Protocol: any
- Security Profile: default
- WPS Mode: push button
- Bridge Mode: enabled
- VLAN Mode: no tag
- VLAN ID: 1
- Default AP Tx Rate: [] bps
- Default Client Tx Rate: [] bps
- Default Authenticate
- Default Forward

On the right side, the 'Freq. Usage (Running)' tool window is open, showing a table of frequency usage for the 'wlan1' interface. The table has columns for Frequency (MHz), Usage, and Noise Floor (dBm). The data is as follows:

Frequency (MHz)	Usage	Noise F...
2412	15.2	-114
2417	9.8	-114
2422	12.2	-115
2427	15.6	-115
2432	14.9	-115
2437	21.5	-115
2442	13.0	-114
2447	9.8	-114
2452	7.6	-114
2457	3.7	-114
2462	18.9	-115

Basic Feature

- Snooper
 - This tool monitors surrounding frequency usage, and displays which devices occupy each frequency. It's available both in console, and also in Winbox.

The screenshot shows the Mikrotik WinBox interface with the Wireless Snooper tool running on interface wlan1. The tool displays a table of detected wireless networks. The table has the following columns: Channel, Address, SSID, Signal, Of Freq. (%), Of Traf. (%), Bandwidth, Networks, and Stations. The data is as follows:

Channel	Address	SSID	Signal	Of Freq. (%)	Of Traf. (%)	Bandwidth	Networks	Stations
2427/2...				30.2		251.4 kbps	1	5
2452/2...				18.0		249.7 kbps	1	5
2452/2...	54:E6:FC:9A:41:80	Mamott_B...		5.7	31.6	222.2 kbps		3
2452/2...	54:E6:FC:9A:41:80	Mamott_B...	-70	5.7	31.6	222.2 kbps		
2412/2...				21.1		195.6 kbps	6	17
2437/2...	64:70:02:6C:37:E0	Mamott_G...		1.3		101.9 kbps		4
2437/2...				5.7	22.7	123.3 kbps	1	5
2437/2...	64:70:02:6C:37:E0	Mamott_G...	-71	1.1	19.8	101.3 kbps		
2417/2...				11.0		83.2 kbps	1	2
2457/2...				12.1		81.5 kbps	0	1
2412/2...	A0:F3:C1:81:F2:D6	Mamott_G...		2.4	11.6	79.5 kbps		2
2412/2...	A0:F3:C1:81:F2:D6	Mamott_G...	-87	2.4	11.6	79.5 kbps		
2412/2...	E8:94:F6:29:48:9A	Mamott_P...		1.3	6.3	66.1 kbps		7
2412/2...	E8:94:F6:29:48:9A	Mamott_P...	-87	1.3	6.3	66.1 kbps		
2462/2...				9.3		59.0 kbps	2	12

Q&A