



# User manual

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## FCC Caution

Any Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the 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.

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 Radiation Exposure Statement**

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment.

This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

## IC warning

This device complies with Industry Canada licence-exempt RSS standard(s).

Operation is subject to the following two conditions:

- (1) This device may not cause interference and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie 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, et
- (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication.

This radio transmitter (identify the device by certification number, or model number if Category II) has been approved by Industry Canada to operate with the antenna types listed below with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

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## About this Guide

### Prerequisite Skills and Knowledge

To use this document effectively, you should have a working knowledge of Local Area Networking (LAN) concepts and wireless Internet access infrastructures.

### Conventions Used in this Document

The following typographic conventions and symbols are used throughout this document:



Additional information that may be helpful but which is not required.



Important information that should be observed.

**bold** Menu commands, buttons, input fields, links, and configuration keys are displayed in bold

*italic* References to sections inside the document are displayed in italic.

`code` File names, directory names, form names, system-generated output, and user typed entries are displayed in constant-width type

### Abbreviation List

Abbreviation	Description
<b>ACL</b>	Access Control List
<b>AES</b>	Advanced Encryption Standard
<b>AMSDU</b>	Aggregated Mac Service Data Unit
<b>AP</b>	Access Point
<b>CRC</b>	Cyclic Redundancy Check
<b>DHCP</b>	Dynamic Host Control Protocol
<b>EAP</b>	Extensible Authentication Protocol
<b>GHz</b>	Gigahertz
<b>GMT</b>	Greenwich Mean Time.
<b>GUI</b>	Graphical User Interface
<b>IEEE</b>	Institute of Electrical and Electronics Engineers
<b>IGMP</b>	Internet Group Management Protocol
<b>ISP</b>	Internet Service Provider
<b>IP</b>	Internet Protocol
<b>LAN</b>	Local Area Network
<b>LED</b>	Light-Emitting Diode

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Abbreviation	Description
<b>MAC</b>	Media Access Control
<b>Mbps</b>	Megabits per second
<b>MHz</b>	Megahertz
<b>MIMO</b>	Multiple Input, Multiple Output
<b>MSCHAPv2</b>	Microsoft version of the Challenge-handshake authentication protocol, CHAP.
<b>NAT</b>	Network address translation – translation of IP addresses (and ports)
<b>PC</b>	Personal Computer
<b>PDA</b>	Personal Digital Assistant
<b>PTP</b>	Point To Point
<b>PTMP</b>	Point To Multi Point
<b>PSK</b>	Pre-Shared Key
<b>QoS</b>	Quality of Service
<b>PEAP</b>	Protected Extensible Authentication Protocol
<b>RSSI</b>	Received Signal Strength Indication – received signal strength in mV, measured on BNC outdoor unit connector
<b>RX</b>	Receive
<b>SISO</b>	Simple Input, Simple Output
<b>SNMP</b>	Simple Network Management Protocol
<b>SMTP</b>	Simple Mail Transfer Protocol
<b>SSID</b>	Service Set Identifier
<b>TCP</b>	Transmission Control Protocol
<b>TKIP</b>	Temporal Key Integrity Protocol
<b>TTLS</b>	Tunneled Transport Layer Security (EAP-TTLS) protocol
<b>TX</b>	Transmission
<b>UDP</b>	User Datagram Protocol
<b>UAM</b>	Universal Access Method
<b>VLAN</b>	Virtual Local Area Network
<b>VoIP</b>	Voice over Internet Protocol
<b>WDS</b>	Wireless Distribution System
<b>WEP</b>	Wired Equivalent Privacy
<b>WISPr</b>	Wireless Internet Service Provider roaming
<b>WLAN</b>	Wireless Local Area Network
<b>WPA</b>	Wi-Fi Protected Access
<b>WPA2</b>	Wi-Fi Protected Access 2

## Initial Device Setup

The default product address is 192.168.2.66.

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To access the Web management interface, configure your PC with a static IP address on the 192.168.2.0 subnet with mask 255.255.255.0. Connect the AP device in to the same physical network as your PC. Open the Web browser and type the default IP address of the APC device `https://192.168.2.66/` and the login page will be loaded. Enter default administrator login settings:



Figure 1 – Login Page



The default administrator login settings are:

Login: **admin**

Password: **admin01**

After successful administrator login you will see the main page of the device Web management interface. The device now is ready for configuration.

## Initial AP Setup

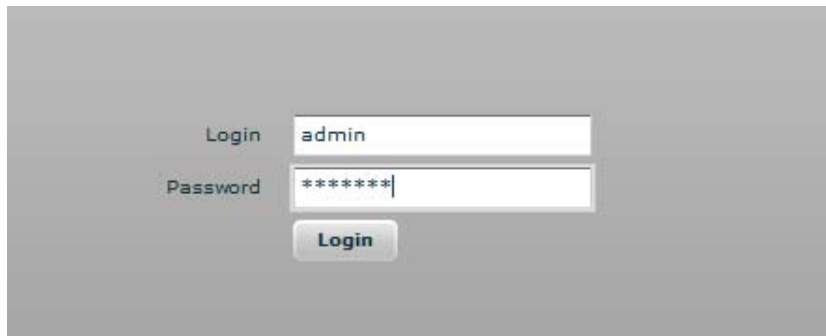
Follow the steps for initial wireless Access Point setup that will be prepared to accept wireless Station connections (refer to the section *Initial Station Setup* for instructions).

- Step 1.** Connect an Ethernet cable between your computer and the AP.
- Step 2.** Make sure your computer is set to the same subnet as the AP, i.e. 192.168.2.150
- Step 3.** Start your Web browser.
- Step 4.** Each devices uses following default settings:
- WAN IP: **192.168.2.66**
  - Subnet mask: **255.255.255.0**
  - Username: **admin**
  - Password: **admin01**



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The initial login screen looks as follow:



The image shows a login interface with a grey background. On the left, the labels "Login" and "Password" are displayed. To the right of "Login" is a text input field containing the text "admin". To the right of "Password" is a text input field containing seven asterisks "\*\*\*\*\*". Below the password field is a button labeled "Login".

**Step 5. Confirm the disclaimer of the APC.** According to the chosen country the regulatory domain settings may differ. You are not allowed to select radio channels and RF output power values other the permitted values for your country and regulatory domain.



The image shows a dialog box with a white background and a grey border. The text inside reads: "The correct country code must be selected before using the equipment to meet the regulatory requirements of authorized channels, channel width, output power, Dynamic Frequency Selection (DFS) and Automatic Transmit Power Control (ATPC). Installer or equipment owner takes all responsibility for proper product usage according to the regulatory rules. Vendor or distributor/reseller is not responsible for illegal wireless equipment operation." Below the text is a checkbox labeled "I Agree" which is checked. Below the checkbox is a dropdown menu labeled "Operating country" with "UNITED STATES" selected. At the bottom are two buttons: "OK" and "Cancel". In the background, a web interface is visible with fields for "Uptime: 3 mins 6 secs", "Country code: US", "Channel: 132 (5660 MHz)", and "IP address: 192.168.2.1".

**Step 6.** Enter the default password, and then press the Login button to enter the AP web management page.

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- Step 7.** Navigate to the **Configuration | Network** tab and choose the Router network mode with NAT enabled, Static IP enabled on WAN side, LAN settings with DHCP server enabled (to loan an IP addresses for connected clients) on LAN side and click **Save&Apply**:

The screenshot shows the Mikrotik WinBox Configuration | Network tab. The top navigation bar includes Status, Configuration, Services, System, and Tools. The Configuration tab is active, and the Network sub-tab is selected. The Network mode is set to Router, and Ethernet speed is set to auto. NAT is enabled. The WAN, wired section shows MAC address 00:19:3B:FF:1C:5F, VLAN ID 2, WAN mode Static IP, IP address 192.168.3.153, Subnet mask 255.255.255.0, Default gateway 192.168.3.1, DNS server 1 195.14.76.1, and DNS server 2. The LAN, wireless section shows IP address 192.168.15.15, Subnet mask 255.255.255.0, DHCP mode server, IP address from 192.168.15.1, IP address to 192.168.15.254, Subnet mask 255.255.255.0, Default gateway 192.168.15.15, Lease time 86400, DNS server 1 192.168.15.15, and DNS server 2.

Field	Value
Network mode	Router
Ethernet speed	auto
NAT	<input checked="" type="checkbox"/>
<b>WAN, wired</b>	
MAC address	00:19:3B:FF:1C:5F
VLAN ID	2
WAN mode	Static IP
IP address	192.168.3.153
Subnet mask	255.255.255.0
Default gateway	192.168.3.1
DNS server 1	195.14.76.1
DNS server 2	
Enable secondary IP	<input type="checkbox"/>
IP address	192.168.2.66
Subnet mask	255.255.255.0
<b>LAN, wireless</b>	
IP address	192.168.15.15
Subnet mask	255.255.255.0
DHCP mode	server
IP address from	192.168.15.1
IP address to	192.168.15.254
Subnet mask	255.255.255.0
Default gateway	192.168.15.15
Lease time, s	86400
DNS server 1	192.168.15.15
DNS server 2	

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**Step 8.** Navigate to the **Configuration | Wireless** tab, choose Access Point wireless mode with WDS enabled, specify the SSID with Broadcast enabled, Security parameters and IEEE mode and click **Save&Apply**:

The screenshot shows the 'Wireless' configuration page. At the top, there are tabs for 'Status', 'Configuration', 'Services', 'System', and 'Tools'. Under 'Configuration', there are sub-tabs: 'Network', 'Wireless', 'Virtual AP', 'Wireless ACL', 'Traffic shaping', 'Port forwarding', and 'Static routes'. The 'Wireless' sub-tab is selected. The page has a top bar with buttons: 'Apply', 'Discard', 'Save & Apply', and 'Logout'. The main content area is divided into sections: 'Wireless mode' (set to 'Access Point (auto WDS)') and 'Country' (set to 'UNITED STATES'). Below this is the 'Basic' section with 'SSID' (my AP), 'Broadcast SSID' (checked), 'IEEE mode' (A/N mixed), 'Channel width' (20/40 MHz), and 'Channel' (Auto). The 'Security' section shows 'Security' (Personal WPA2), 'Encryption' (AES), and 'Passphrase' (\*\*\*\*\*). The 'Advanced' section includes 'Tx power (dBm)' (12), 'Enable ATPC' (checked), 'Fragmentation' (256), 'RTS' (1), 'Quality of service (WMM)' (checked), 'Client isolation' (unchecked), 'Enable DFS' (checked), 'Enable AMSDU' (unchecked), 'Mode' (MIMO 2x2), 'Max data rate' (Auto), 'Max data rate N' (Auto), 'Disable data rate fallback' (unchecked), 'Short GI' (checked), 'MPDU density' (4), 'ACK timeout' (Distance), 'Kilometers' (selected), 'Miles' (unchecked), and 'BA window size' (64).

**Step 9.** Verify connection. Navigate to **Status | Information** menu to check if the Station are successfully connected to the APC device:

#### Initial Station Setup

Follow the steps for initial wireless client setup that will be connected to the previously configured AP (refer to the section *Initial AP Setup*).

- Step 1.** Connect an Ethernet cable between your computer and the DLB APC device.
- Step 2.** Make sure your computer is set to the same subnet as the APC, i.e. 192.168.2.150
- Step 3.** Start your Web browser.
- Step 4.** Each APC devices uses following default settings:
- WAN IP: **192.168.2.66**
  - Subnet mask: **255.255.255.0**
  - Username: **admin**
  - Password: **admin01**

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The initial login screen looks as follow:



The image shows a login interface with a grey background. It features two input fields: 'Login' with the text 'admin' and 'Password' with masked characters '\*\*\*\*\*'. Below the password field is a 'Login' button.

**Step 5. Confirm the disclaimer of the APC.** According to the chosen country the regulatory domain settings may differ. You are not allowed to select radio channels and RF output power values other the permitted values for your country and regulatory domain.



The image shows a disclaimer dialog box overlaid on a background interface. The dialog box contains the following text: 'The correct country code must be selected before using the equipment to meet the regulatory requirements of authorized channels, channel width, output power, Dynamic Frequency Selection (DFS) and Automatic Transmit Power Control (ATPC). Installer or equipment owner takes all responsibility for proper product usage according to the regulatory rules. Vendor or distributor/reseller is not responsible for illegal wireless equipment operation.' Below the text is a checkbox labeled 'I Agree' which is checked. At the bottom, there is a dropdown menu for 'Operating country' with 'UNITED STATES' selected, and 'OK' and 'Cancel' buttons.

**Step 6.** Enter the default password, and then press the Login button to enter the APC web management page.

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- Step 7.** Navigate to the **Configuration | Network** tab and choose the bridge network mode with, Dynamic IP enabled (be sure that AP to which the device will be associated has a DHCP server running ((refer to the section *Initial AP Setup* for instructions)), specify the DHCP fallback settings in case the DHCP server will be unreachable and click **Save&Apply** button:

The screenshot displays the Mikrotik WinBox interface for the **Configuration | Network** tab. The **Network** sub-tab is selected, showing the **Bridge** network mode. The **Ethernet speed** is set to **auto**. The **IP settings** section shows the **Method** set to **Dynamic IP**. Under **DHCP fallback settings**, the **IP address** is **192.168.3.151**, **Subnet mask** is **255.255.255.0**, **Default gateway** is **192.168.3.1**, **DNS server 1** is **195.14.162.78**, and **DNS server 2** is empty. The **Enable IP alias** checkbox is unchecked. Below this, the **IP address** is **192.168.2.66** and the **Subnet mask** is **255.255.255.0**. The **VLAN to SSID mapping** section shows a mapping for **2** to **ra0 (SSID)**. The **Management VLAN** section shows the **Enable** checkbox checked, **Management VLAN ID** set to **2**, and **Restrict management to** checked for **eth0** and **ra0 (SSID)**. At the top right, there are buttons for **Apply**, **Discard**, **Save & Apply**, and **Logout**.

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- Step 8.** Navigate to the **Configuration | Wireless** tab, choose Station WDS wireless mode, click **Scan** button near the SSID entry field to choose the SSID of the AP where the station will be associated to. Specify the Security parameters for the AP, check IEEE mode (these settings must conform with AP wireless settings) and click **Save&Apply**:

The screenshot shows the 'Wireless' configuration tab in a network management interface. The 'Wireless mode' is set to 'Station WDS' and the 'Country' is 'UNITED STATES'. The 'Basic' section shows the SSID 'my AP' with a 'Scan' button and a 'Scanned SSID' dropdown. The 'IEEE mode' is 'A/N mixed' and the 'Channel width' is '20/40 MHz'. The 'Security' section shows 'Security' as 'Personal WPA2', 'Encryption' as 'AES', and a 'Passphrase' field with asterisks. The 'Advanced' section includes 'Tx power (dBm)' set to 12, 'Enable ATPC' checked, 'Fragmentation' set to 256, 'RTS' set to 1, 'Quality of service (WMM)' checked, 'Enable DFS' checked, 'Enable AMSDU' unchecked, 'Mode' set to 'MIMO 2x2', 'Max data rate' set to 'Auto', 'Max data rate N' set to 'Auto', 'Disable data rate fallback' unchecked, 'Short GI' checked, 'MPDU density' set to 4, 'ACK timeout' set to 'Distance', 'Kilometers' selected for distance units, and 'BA window size' set to 64.

- Step 9.** Verify connection. Navigate to the **Status | Information** page. The **Information** page will display wireless information of the link with AP. The connection status must be displayed as Connected and progress bars indicating the quality of the connection must be displayed:

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## Network Operation Modes

The device can operate as transparent Bridge or Router.

### Bridge Mode

The device can act as a wireless network bridge and establish wireless links with other APs. In this mode all LAN port and Wireless interface will be a part of the Bridge.

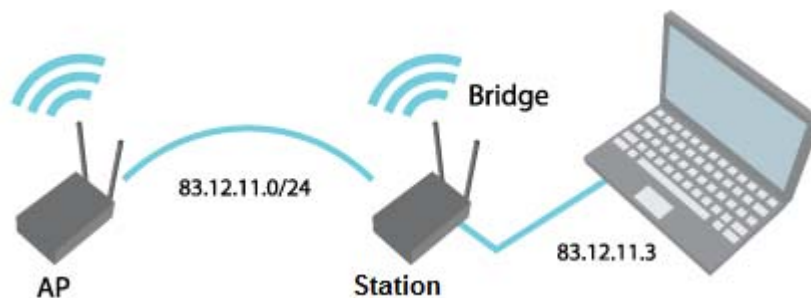


Figure 2 – Bridge Mode

With a Bridge, all connected computers are in the same network subnet. The only data that is allowed to cross the bridge is data that is being sent to a valid address on the other side of the bridge.

### Router Mode

In router mode the device will receive internet through WAN port and will share it to the LAN ports that will be separated with a different IP range. The type of connection to the WAN interface can be made by Static IP, DHCP client or PPPoE client.

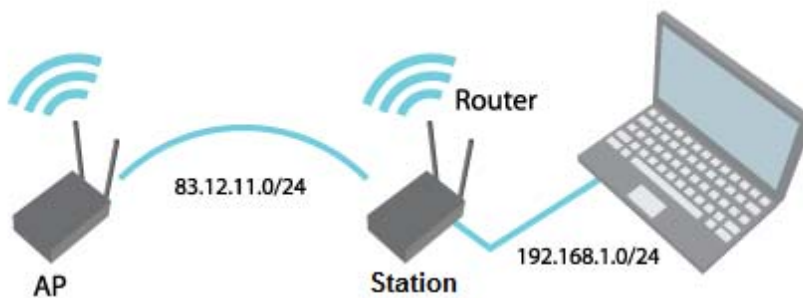


Figure 3 – Router Mode

When device operates in Router mode, the traffic coming on wired interface and going out on wireless interface can be masqueraded by enabling NAT. NAT allows a set of station's clients to invisibly access the Internet via the wireless station. To other clients on the Internet, all this outgoing traffic will appear to be from the APC device itself.

## General Device Operation

### Web Management Structure

The main web management menu is displayed after successfully login into the system (see the figure below). From this menu all essential configuration pages are accessed. The active menu tab is displayed in a different color:

By default the **Status | Information** menu is activated where the main device information is displayed. The APC web management menu has the following structure:

#### Status

**Information** – displays general information and of the device.

**Network** – displays network statistics of the device.

**Wireless** – displays information about connected stations on each wireless interface (only on AP wireless mode).

**Routes** – displays unit's route table.

**ARP** – displays ARP table.

#### Configuration

**Network** – to configure network mode, Ethernet speed, IP settings, management and data VLANs, DHCP, PPPoE.

**Wireless** – specify wireless mode (AP, Station, Station WDS, iPoll AP, iPoll Station), country, SSID, IEEE mode, channel configuration, security and advanced radio settings.

**Virtual AP** – create and setup virtual AP (only in AP wireless mode).

**Wireless ACL** – access control by MAC address (only in AP and iPoll AP wireless modes).

**Traffic shaping** – download and upload traffic control.

**Port forwarding** – port forwarding rules (only in router network mode for AP and iPoll AP).

**Static routes** – static route rules (only in router network mode for AP and iPoll AP).

#### Services

**WNMS** – set WNMS server/collector URL allowing remote device configuration and monitoring.

**System Alerts** – set alerts which can be sent via SNMP Traps or/and SMTP notifications.

**SNMP** – SNMP service settings allowing remote device monitoring.

**Clock/NTP** – set device date manually or enable and configure NTP service.

**SSH** – control SSH connection.

**HTTP** – control HTTP connection.

**Autodiscovery** – control device autodiscovery function (only on Station, Station WDS and iPoll Station wireless modes).

#### System

**Administration** – change password, reboot, restore factory default settings, backup/restore configuration, troubleshooting file support.

**Log** – view device log, set system log forwarding settings.

**LED** – control operation of LEDs.

**Firmware upgrade** – upgrade device firmware.

#### Tools

**Antenna alignment** – measure received signal quality of the wireless link to align antenna in the best direction.



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**Site Survey** – information about other wireless networks in the local area.

**Delayed reboot** – setup delayed reboot for APC unit.

**Ping** – perform ping command.

**Traceroute** – perform graphical traceroute command.

**Spectrum analyzer** – check the signal strength on available channels.

## Applying and Saving Configuration Changes

There are three general buttons located on the right top corner of the WEB GUI allowing managing device configuration:

**Apply** – if pressed new configuration settings are applied instantly. It will take few seconds and the device will be running with new settings. It should be noted that pressing Apply button settings are not written to the permanent memory. Therefore, if the device is rebooted it will start with old configuration settings.

**Discard** – if pressed parameter changes are discarded. It should be noted that if Apply or Save&Apply is pressed it is not possible to discard changes.

**Save&Apply** – if pressed new configuration settings are applied instantly and written to the permanent memory.



It is not required to press **Apply** or **Save&Apply** in every Web GUI tab. The device remembers all changes made in every tab and after action button is used, all changes will be applied.

## Configuration Guide

This document contains product's powerful web management interface configuration description allowing setups ranging from very simple to very complex.

## Status

### Information

The Information page displays a summary of status information of your device. It shows important information for the APC operating mode, network settings.

**System information** – displays general information about the device.

**Wireless information** – displays general information about the wireless connection. The wireless information will differ on Access Point, Station, iPoll wireless modes:

- **AP mode** – displays access point operating information, number of connected clients and SSID details (including VAPs).
- **Station mode** – displays settings at which the station is connected to the access point.
- **iPoll AP** – displays iPoll access point operating information, number of connected wireless stations.
- **iPoll Station** – displays settings at which the iPoll wireless station is connected to the iPoll AP.

**Network mode** – displays short summary about current network configuration (bridge or router).

### Network

The **Network** sections displays statistics of the network interfaces and DHCP leases (depending on network mode):

Interface	IP address	MAC address	RX packets	RX errors	TX packets	TX errors
eth0	192.168.3.151	00:19:3B:FF:1C:5F	62238585	0	8509	0

Interface	IP address	MAC address	RX packets	RX errors	TX packets	TX errors
br0	192.168.4.66	00:19:3B:FB:71:7C	21012	0	61	0
ra0 (my AP)	0.0.0.0	00:19:3B:FB:71:7C	30117	0	18153	372

brX: bridge  
eth0: ethernet  
raX: wireless  
raX.Y, eth0.Y: Y stands for VLAN ID

MAC address	IP address	Expires in
00:19:3B:FB:71:80	192.168.4.1	22 hours, 48 minutes, 44 seconds

Figure 4 – Network Statistics

**Interface** – displays the interface name. The SSID name is displayed in the brackets near the radio interface (and VAPs).

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**IP address** – displays the IP address of the particular interface.

**MAC** – displays the MAC address of the particular interface.

**Received** – displays the number of received packets.

**RX errors** – displays the number of the RX errors.

**Transmitted** – displays the number of transmitted packets.

**TX errors** – displays the number of the TX errors.

**DHCP leases** – table displays information about leased DHCP addresses. This table appears only on AP which acts as Router and have DHCP server enabled.

## Wireless



**Status Wireless** section is not available if APC is operating in Station wireless mode. In this case all necessary information about wireless connection with AP unit will be under *Information* section.

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The Wireless statistics displays the receive/transmit statistics between AP and successfully associated wireless clients:

Peer MAC	Signal, dBm	Noise, dBm	IEEE mode	Data rate, Mbps	Connection time
00:19:3B:FB:71:80	-26/-26	-95	N	144	0:23:54

Figure 5 – Access Point's Wireless Statistics

In case the access point has more than one wireless interface (VAPs), the appropriate number of tables with information about connected wireless clients will be displayed.

**Peer MAC** – displays MAC address of the successfully connected wireless client.

**Signal** – indicates the signal strength of the access point main and auxiliary antennas that the station communicates with displayed dBm.

**Noise** – displays the noise level in dBm.

**IEEE mode** – displays the IEEE mode at which the access point communicates with the particular station.

**Data rate** – displays the data rate at which the access point communicates with the particular station.

**Connection time** – displays the duration of the session.

## Routes

The **Routes** page displays the routing table for each interface:

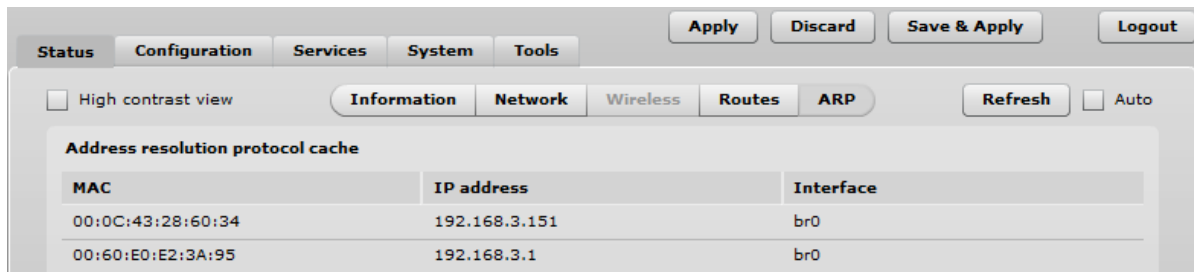
Network	Netmask	Gateway	Interface
192.168.4.0	255.255.255.0	*	br0
192.168.3.0	255.255.255.0	*	eth0
default	0.0.0.0	192.168.3.1	eth0

Figure 6 – Routes Table

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## ARP

The **ARP** page displays the ARP (Address Resolution Protocol) table currently recorded on the device. Use **Refresh** button to reload ARP table results.



MAC	IP address	Interface
00:0C:43:28:60:34	192.168.3.151	br0
00:60:E0:E2:3A:95	192.168.3.1	br0

Figure 7 – ARP Table Records

## Configuration

### Network

The **Configuration | Network** page allows you to control the network configuration and settings of the device. First, the device operation mode must be defined to work as a bridge or router. The content of the window varies depending on your selection:



Network mode: **Router** Ethernet speed: **auto**

NAT: ☒

Figure 8 – Network Mode Options

**Network mode** – choose the device operating mode [bridge/router]

- **Bridge** – in this mode the device works as transparent bridge interconnecting wireless network and LAN port.
- **Router** – in this mode the device works as router between wireless network and all LAN ports.

Network settings will vary according to the selected Network mode. The Bridge mode allows configuring device LAN IP settings, while the Router mode requires more parameters such as LAN network settings, WAN network settings, LAN DHCP settings.

### Bridge Mode



**Port forwarding** and **Static routes** are not available on Bridge mode.

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When device is configured to operate in Bridge mode, only device LAN settings should be configured on the **Network** page:

The screenshot shows the Network configuration page in Bridge mode. The top navigation bar includes tabs for Status, Configuration, Services, System, and Tools. The Configuration tab is active, and the Network sub-tab is selected. The page contains several sections: Network mode (Bridge), Ethernet speed (auto), Enable IGMP snooping (checkbox), IP settings (Method: Static IP, IP address, Subnet mask, Default gateway, DNS server 1, DNS server 2, Enable secondary IP, IP address, Subnet mask), VLAN to SSID mapping (2, ra0 (my AP)), and Management VLAN (Enable, Management VLAN ID, Restrict management to, Untagged radio).

Figure 9 – Bridge Mode Settings

**IGMP snooping** (only on AP or iPoll Bridge modes) – when enabled AP will passively snoop on IGMP Report and Leave packets transferred between it's clients and IP Multicast hosts. It checks IGMP packets passing through it, picks out the group registration information and generates internal L2 MAC forwarding table. Then it forwards multicast traffic using unicast packets directed according to forwarding table.

**Ethernet speed** – configures the Ethernet link speed and the duplex mode of the Ethernet port. Choose "auto" for automatic detection of link speed and duplex mode.

## IP Settings



When assigning IP address make sure that the chosen IP address is unused and belongs to the same IP subnet as your wired LAN, otherwise you will lose the connection to the device from your current PC. If you enable the DHCP client, the browser will lose the connection after saving, because the IP address assigned by the DHCP server is not predictable.

**Method** – specify IP reception method: IP addresses can either be retrieved from a DHCP server or configured manually:

- **Static IP** – the IP address must be specified manually.
- **Dynamic IP** – the IP address for this device will be assigned from the DHCP server. If DHCP server is not available, the device will try to get an IP. If has no success, it will use pre-configured fallback IP address. The fallback IP settings can be changed to custom values.

**IP Address** – specify IP address for device

**Subnet mask** – specify a subnet mask for device.

**Default gateway** – specify a gateway IP address for device.

**DNS server** – specify the Domain Naming Server.

**Enable IP alias** – specify the alternative IP address and the netmask for APC unit management.

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## VLAN to SSID Mapping

Virtual Local Area Networks (VLANs) are logical groupings of network resources.



Figure 10 - VLAN to SSID Mapping

**VLAN to SSID mapping** – specify the VLAN ID for traffic tagging on required radio interface [2-4095]. The Station devices that associate using the particular SSID will be grouped into this VLAN.

## Management VLAN



Available only on Bridge network mode.

Access to the AP for management purposes can further be limited using VLAN tagging. By defining Management VLAN, the device will only accept management frames that have the appropriate Management VLAN ID. All other frames using any management protocol will be rejected.



When you specify a new management VLAN, your HTTP connection to the device will be lost. For this reason, you should have a connection between your management station and a port in the new management VLAN or connect to the new management VLAN through a multi-VLAN router.

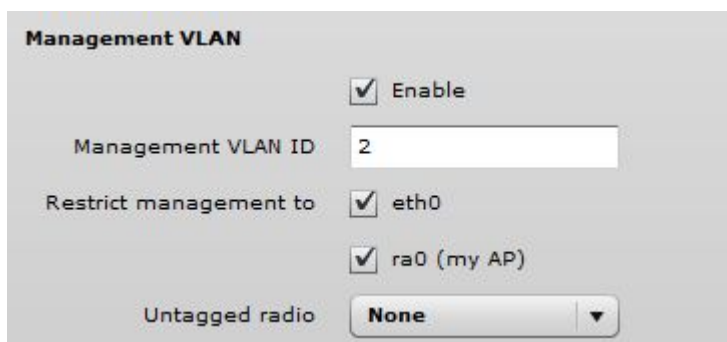


Figure 11 – Management VLAN Settings

**Enable** – select to enable a VLAN tagging for management traffic.

**Management VLAN ID** – specify the VLAN ID [2-4095]. When device interfaces are configured with a specific VLAN ID value, only management frames that matching configured VLAN ID will be accepted by device.

**Restrict management to** – select interfaces that will be restricted with management VLAN.

**Untagged radio** – select the interface for untagged traffic.

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## Router Mode

This section allows customizing parameters of the Router to suit the needs of network, including ability to use the built-in DHCP server. When device is configured to operate as Router, the following sections should be specified: WAN network settings, LAN network settings and LAN DHCP settings.

The screenshot shows the 'Configuration' tab of a router's web interface. The 'Network' sub-tab is selected. At the top, there are buttons for 'Apply', 'Discard', 'Save & Apply', and 'Logout'. Below these are tabs for 'Network', 'Wireless', 'Virtual AP', 'Wireless ACL', 'Traffic shaping', 'Port forwarding', and 'Static routes'. The 'Network' section contains a 'Network mode' dropdown set to 'Router' and an 'Ethernet speed' dropdown set to 'auto'. A 'NAT' checkbox is checked. Below this, there are two main sections: 'WAN, wired' and 'LAN, wireless'. The 'WAN, wired' section includes fields for MAC address (00:19:3B:FF:1C:5F), VLAN ID (2), WAN mode (Static IP), IP address (192.168.3.151), Subnet mask (255.255.255.0), Default gateway (192.168.3.1), DNS server 1 (195.14.162.78), DNS server 2, and an 'Enable secondary IP' checkbox. The 'LAN, wireless' section includes fields for IP address (192.168.4.66), Subnet mask (255.255.255.0), and a DHCP mode dropdown set to 'disabled'.

Figure 12 – Router Settings

**Enable NAT** – select to enable NAT (Network Address Translation), that functions by transforming the private IP address of packets originating from hosts on your network so that they appear to be coming from a single public IP address and by restoring the destination public IP address to the appropriate private IP address for packets entering the private network, the multiple PCs on your network would then appear as a single client to the WAN interface.

**Ethernet speed** – configures the Ethernet link speed and the duplex mode of the Ethernet port. Choose "auto" for automatic detection of link speed and duplex mode.

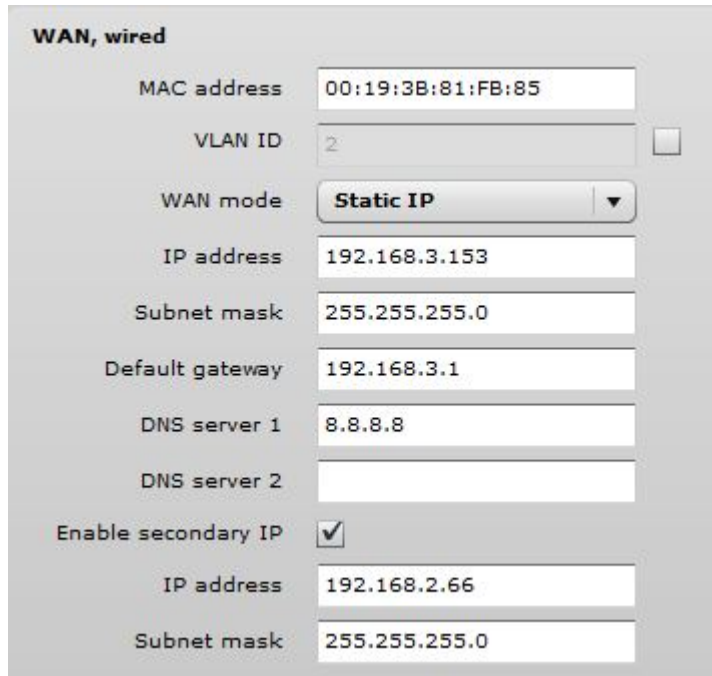


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## WAN Settings

WAN network settings include settings related to the WAN interface. The access type of the WAN interface can be configured as: Static IP, Dynamic IP, PPPoE client.

**WAN mode** – choose **Static IP** to specify IP settings for device WAN interface:



The screenshot shows the 'WAN, wired' configuration page for a router. It includes the following fields and settings:

- MAC address:** 00:19:3B:81:FB:85
- VLAN ID:** 2
- WAN mode:** Static IP (selected from a dropdown menu)
- IP address:** 192.168.3.153
- Subnet mask:** 255.255.255.0
- Default gateway:** 192.168.3.1
- DNS server 1:** 8.8.8.8
- DNS server 2:** (empty field)
- Enable secondary IP:** ☒
- IP address (secondary):** 192.168.2.66
- Subnet mask (secondary):** 255.255.255.0

Figure 13 – Router WAN Settings: Static IP

**MAC address** – specify the clone MAC address if required. The ISPs registers the MAC address of the router, and allows only that MAC address to connect to their network. In such case if there is need to change hardware (router), you need to notify your ISP about MAC address change, or simply set the router's MAC address to the MAC address of the previously router/computer.

**VLAN ID** – specify the VLAN ID for traffic tagging on required radio interface [2-4095]. The Station devices that associate using the particular SSID will be grouped into this VLAN.

**WAN mode** – choose Static IP to specify IP settings manually. This option needs parameters listed below:

**IP address** – specify static IP address.

**Subnet mask** – specify a subnet mask.

**Default gateway** – specify a gateway.

**DNS server** – specify primary and/or secondary DNS server

**Enable secondary IP** – specify the alternative IP address and the netmask for APC unit management.

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**WAN mode** – choose **Dynamic IP** to enable DHCP client on the WAN side. This option does not need any parameters:

The screenshot shows the 'WAN, wired' configuration page. It includes fields for MAC address (00:19:3B:81:FB:85), VLAN ID (2), and WAN mode (Dynamic IP). Below this is the 'DHCP fallback settings' section with fields for IP address (192.168.3.153), Subnet mask (255.255.255.0), Default gateway (192.168.3.1), DNS server 1 (8.8.8.8), and DNS server 2. There is also an 'Enable secondary IP' checkbox which is checked, with its own IP address (192.168.2.66) and Subnet mask (255.255.255.0) fields.

WAN, wired	
MAC address	00:19:3B:81:FB:85
VLAN ID	2
WAN mode	Dynamic IP
DHCP fallback settings:	
IP address	192.168.3.153
Subnet mask	255.255.255.0
Default gateway	192.168.3.1
DNS server 1	8.8.8.8
DNS server 2	
Enable secondary IP	<input checked="" type="checkbox"/>
IP address	192.168.2.66
Subnet mask	255.255.255.0

Figure 14 – Routers WAN Settings: Dynamic IP

**MAC address** – specify the clone MAC address if required. The ISPs registers the MAC address of the router, and allows only that MAC address to connect to their network. In such case if there is need to change hardware (router), you need to notify your ISP about MAC address change, or simply set the router's MAC address to the MAC address of the previously router/computer.

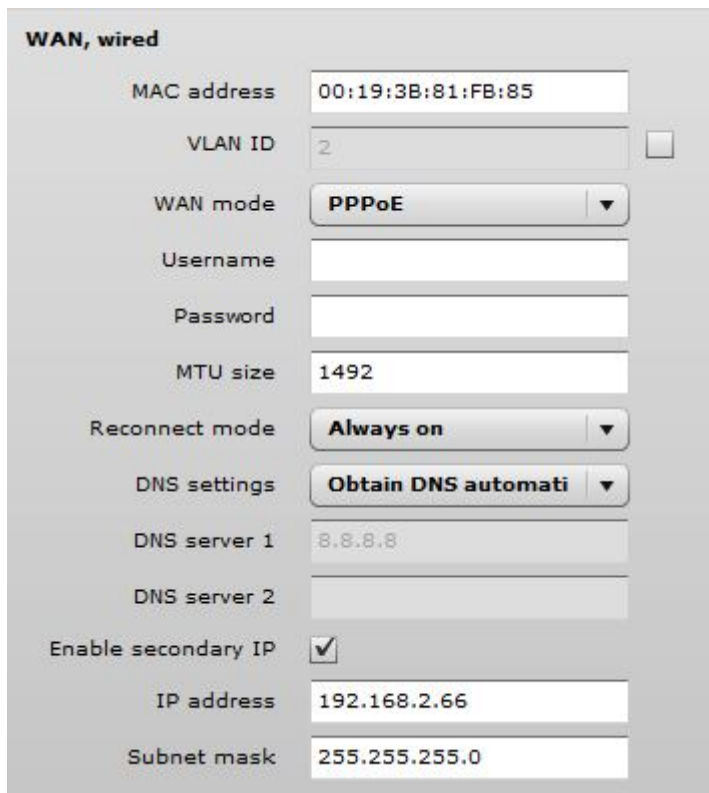
**VLAN ID** – specify the VLAN ID for traffic tagging on required radio interface [2-4095]. The Station devices that associate using the particular SSID will be grouped into this VLAN.

**DHCP fallback setting** – specify IP address, Subnet mask, Default gateway and optionally DNS server for DHCP fallback. In case the APC unit will not get the IP address from the DHCP, the specified fallback IP settings will be used.

**Enable secondary IP** – specify the alternative IP address and the netmask for APC unit management.

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**WAN mode** – choose PPPoE to configure WAN interface to connect to an ISP via a PPPoE:



**WAN, wired**

MAC address	00:19:3B:81:FB:85
VLAN ID	2
WAN mode	PPPoE
Username	
Password	
MTU size	1492
Reconnect mode	Always on
DNS settings	Obtain DNS automatically
DNS server 1	8.8.8.8
DNS server 2	
Enable secondary IP	<input checked="" type="checkbox"/>
IP address	192.168.2.66
Subnet mask	255.255.255.0

Figure 15 – Routers WAN Settings: PPPoE client

**MAC address** – specify the clone MAC address if required. The ISP registers the MAC address of the router, and allows only that MAC address to connect to their network. In such case if there is need to change hardware (router), you need to notify your ISP about MAC address change, or simply set the router's MAC address to the MAC address of the previously router/computer.

**VLAN ID** – specify the VLAN ID for traffic tagging on required radio interface [2-4095]. The Station devices that associate using the particular SSID will be grouped into this VLAN.

**User name** – specify the user name for PPPoE.

**Password** – specify the password for PPPoE.

**MTU** – specify the MTU (Maximum Transmission Unit). The default value is 1500 bytes.

**Reconnect mode** – specify PPPoE reconnection mode:

- **Always on** – PPPoE connection automatically starts without timeout. The router will keep trying to bring up the connection if it is disconnected for some reason.
- **On demand** – the PPPoE connection automatically starts when there is outbound traffic to the Internet, and it automatically terminates if the connection is idle based on the value specified in the **Idle time** [1-65535] setting.

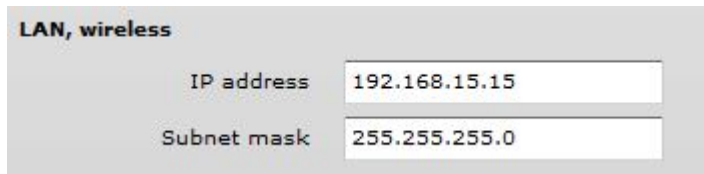
**DNS settings** – allows selecting if automatically assigned or alternative DNS servers should be used.

**Enable secondary IP** – specify the alternative IP address and the netmask for APC unit management.

## LAN Network Settings

LAN network settings includes settings related to the LAN interface.

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The image shows a configuration panel for the LAN interface. It has a title 'LAN, wireless' in bold. Below the title, there are two input fields. The first is labeled 'IP address' and contains the value '192.168.15.15'. The second is labeled 'Subnet mask' and contains the value '255.255.255.0'.

Figure 16 – Router LAN Settings

**IP address** – specify the IP address of the device LAN interface.

**Subnet mask** – specify the subnet mask of the device LAN interface.

## LAN DHCP Settings

**DHCP mode** – choose disabled to disable DHCP on LAN interface.



The image shows a configuration panel for the DHCP mode. It has a label 'DHCP mode' followed by a dropdown menu. The dropdown menu is currently set to 'disabled'.

Figure 17 – Router LAN Settings: DHCP Disabled

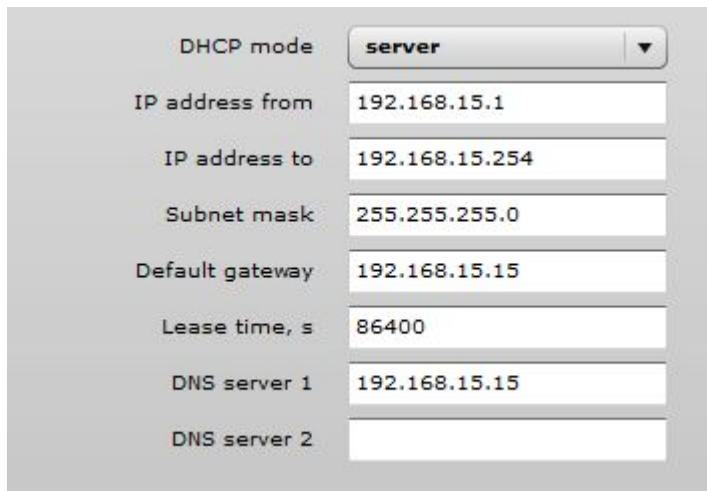
**DHCP mode** – choose relay to enable DHCP relay. The DHCP relay forwards DHCP messages between subnets with different sublayer broadcast domains.



The image shows a configuration panel for the DHCP mode. It has a label 'DHCP mode' followed by a dropdown menu. The dropdown menu is currently set to 'relay'.

Figure 18 – Router LAN Settings: DHCP Relay

**DHCP mode** – choose server to enable DHCP server on LAN interface.



The image shows a configuration panel for the DHCP mode. It has a label 'DHCP mode' followed by a dropdown menu set to 'server'. Below this, there are several input fields: 'IP address from' (192.168.15.1), 'IP address to' (192.168.15.254), 'Subnet mask' (255.255.255.0), 'Default gateway' (192.168.15.15), 'Lease time, s' (86400), 'DNS server 1' (192.168.15.15), and 'DNS server 2' (empty).

Figure 19 – Router LAN Settings: DHCP Server

**IP address from** – specify the starting IP address of the DHCP address pool.

**IP address to** – specify the ending IP address of DHCP address pool.

**Subnet mask** – specify the subnet mask.

**Default gateway** – specify DHCP gateway IP address.

**Lease time** – specify the expiration time in seconds for the IP address assigned by the DHCP server.

**DNS server** – specify the DNS server IP address.

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## Wireless

The Wireless tab is divided in three sections: Basic, Security and Advanced configuration sections. The Basic section contains all parameters that required to configure in order have working wireless link. Security section is used to select authentication and encryption settings. Advanced section contains parameters allowing optimizing the link capacity.



Before changing radio settings manually verify that your settings will comply with local government regulations. At all times, it is the responsibility of the end-user to ensure that the installation complies with local radio regulations.

The APC device can operate in four wireless modes: Access Point, Station, Station WDS, iPoll Access Point and iPoll Station.

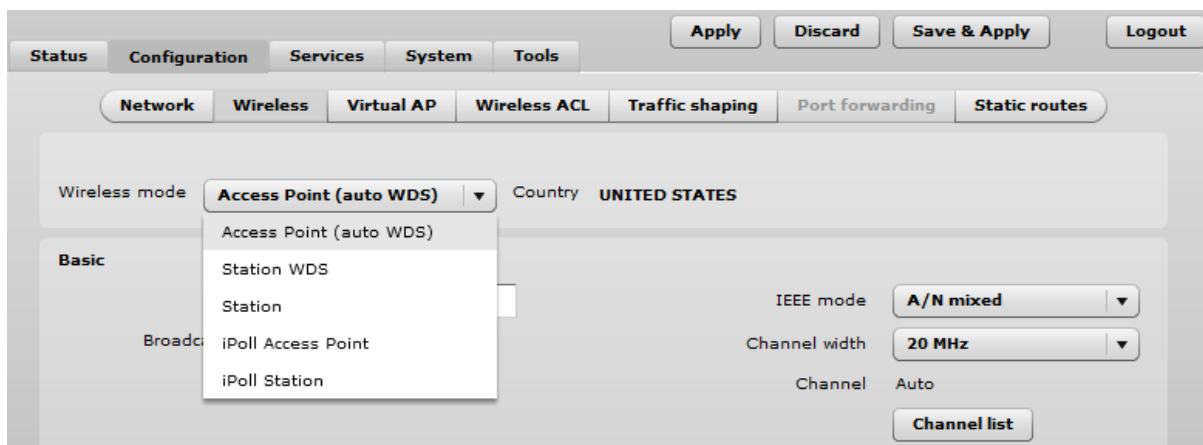


Figure 20 – Device Wireless Operating Mode

Depending on the wireless operation mode selection some of the displayed configuration parameters will differ (e.g. security or advanced wireless settings).

**Wireless mode** – select wireless operation mode:

- **Access Point (auto WDS)** – enables the APC radio function as an access point. When in AP mode, wireless clients can see the AP broadcast and associate to it if settings are configured correctly.
- **Station** – sets the radio to run in client mode. In this mode wireless station does not broadcast an SSID and clients cannot connect to it. Station mode allows the APC radio to connect to other radios functioning as an AP.
- **Station WDS** – a wireless station will communicate with access point in WDS mode. Station WDS mode enables packet forwarding at layer 2 level.
- **iPoll Access Point** – enables APC radio function as access point for point-to-multipoint solution. The iPoll Access Point accepts only iPoll Station requests.
- **iPoll Station** – enables APC radio function as wireless station for point-to-multipoint solution. The iPoll Station can establish a link only with iPoll Access point.



Be sure that both ends of the link have the appropriate wireless mode, otherwise the connection will be not established (e.g. iPoll Station is able to establish a connection only with iPoll AP).

**Country** – displays country in which the APC will operate. The channel list, transmit power limits, IEEE 802.11 mode will be adjusted according to the regulations of the selected country. Initially the operating country is chosen on the beginning of unit configuration.

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## Wireless Mode: Access Point (auto WDS)

Use Basic Wireless Settings to setup radio interface of the device.

The screenshot shows the 'Wireless Mode: Access Point (auto WDS)' configuration interface. At the top, there are tabs for 'Status', 'Configuration', 'Services', 'System', and 'Tools'. Below these are sub-tabs for 'Network', 'Wireless', 'Virtual AP', 'Wireless ACL', 'Traffic shaping', 'Port forwarding', and 'Static routes'. The 'Wireless' tab is selected. The 'Wireless mode' is set to 'Access Point (auto WDS)' and the 'Country' is 'UNITED STATES'. The 'Basic' section includes 'SSID' (my AP), 'Broadcast SSID' (checked), 'IEEE mode' (A/N mixed), 'Channel width' (20/40 MHz), and 'Channel' (Auto). The 'Security' section includes 'Security' (Personal WPA2), 'Encryption' (AES), and a 'Passphrase' (\*\*\*\*\*). The 'Advanced' section includes 'Tx power (dBm)' (12), 'Mode' (MIMO 2x2), 'Max data rate' (Auto), 'Max data rate N' (Auto), 'Disable data rate fallback' (unchecked), 'Short GI' (checked), 'MPDU density' (4), 'ACK timeout' (Distance), 'BA window size' (64), and various checkboxes for 'Enable ATPC', 'Fragmentation', 'RTS', 'Quality of service (WMM)', 'Client isolation', 'Enable DFS', and 'Enable AMSDU'.

Figure 21 – Access Point Wireless Settings

### Basic Wireless Settings

**SSID** – specify the SSID of the wireless network device.

**Broadcast SSID** – enables or disables the broadcasting of the SSID for AP.

**IEEE mode** – specify the wireless network mode.

**Channel width** – The default channel bandwidth for 802.11 radio is 20MHz. The 802.11n allow channel bonding in such way the total channel width becomes 40MHz.

**Channel** – displays the channel at which the AP is operating, or indicates that autochannel function is used.

**Channel list** – select the channel(s) at which the AP unit will operate. If more than one channel is selected, then autochannel feature will be enabled. Automatic channel selection allows AP to select a channel which is not used by any other wireless device or, if there are no free channels available - to select a channel which is least occupied. The table displays detailed information about each channel:

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## Security Settings



Both sides (AP and Station) of the link must have the same security settings.

Device supports various authentication/encryption methods:

- **Open** – no encryption.
- **WEP** – 64bit and 128bit key.
- **Personal** – preshared key encryption with WPA/WPA2 using AES or TKIP.
- **Enterprise** – RADIUS server based authentication with WPA/WPA2 encryption using AES or TKIP (requires configured RADIUS server).
- **UAM** – Web browser based user authentication method. UAM authentication is available only if Access Point is working in router mode. For UAM configuration details refer at the respective chapter *Universal Access Method (UAM)*.

By default there is no encryption enabled on the device:



Figure 22 – Security: Open

**WEP encryption** can be either 64bit or 128bit:



Figure 23 – Security: WEP Encryption

**WEP passkey** – specify the passkey, for the chosen WEP security:

- For **WEP 64bit encryption** – 5 HEX pairs (e.g. aa:bb:cc:dd:ee), or 5 ASCII characters (e.g. abcde);
- For **WEP 128bit encryption** – 13 HEX pairs (e.g. aa:bb:cc:dd:ee:ff:gg:hh:00:11:22:33:44), or 13 ASCII characters (e.g. abcdefghijklm);

To setup **Personal WPA/WPA2** encryption, need to specify the pre-shared key and encryption with chosen AES, TKIP or Auto method:



Figure 24 – Security: Private WPA/WPA2 Encryption

**Passphrase** – specify WPA or WPA2 passphrase [8-63 characters]. The passphrase will be converted to key format, selected above.

**Encryption** – specify WPA/WPA2 encryption algorithm:

- **AES** – APC will accept clients with passphrase encrypted with AES method only;
- **TKIP** – APC will accept clients with passphrase encrypted with TKIP method only;
- **Auto** – APC will accept clients with passphrase encrypted with both: AES and TKIP methods;



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AP has possibility to configure **Enterprise WPA/WPA2** encryption with RADIUS authentication. Properly configured AP will accept wireless stations requests and will send the information to configured RADIUS server for client authentication.



The screenshot shows the 'Security' configuration page. On the left, 'Security' is set to 'Enterprise WPA2' and 'Encryption' is set to 'AES'. On the right, 'RADIUS IP' is '192.166.72.110', 'RADIUS port' is '1812', and 'RADIUS key' is masked with '\*\*\*\*\*'.

Figure 25 – Security: Enterprise WPA/WPA2 Encryption



The properly configured RADIUS server is required for **Enterprise WPA/WPA2** encryption.

**Encryption** – specify WPA/WPA2 encryption algorithm:

- **AES** – AP will accept clients with passphrase encrypted with AES method;
- **TKIP** – AP will accept clients with passphrase encrypted with TKIP method;
- **Auto** – AP will accept clients with passphrase encrypted with both: AES and TKIP methods;

RADIUS authentication settings:

**RADIUS IP** – specify the IP address of the authentication RADIUS server where the authentication requests will be send to.

**RADIUS port** – specify the network port used to communicate with the RADIUS authentication server. Default: 1812 for authentication.


**RADIUS key** – specify the secret key of the authentication server [string]. The shared secret is used to encrypt data packets transmitted between RADIUS server and client.



Shared secrets must be the same on the RADIUS servers and the RADIUS client.

## Advanced Wireless Settings

Advanced parameters allow configuring the device to get the best performance/capacity of the link.



The screenshot shows the 'Advanced' configuration page. On the left, 'Tx power (dBm)' is '12', 'Enable ATPC' is checked, 'Fragmentation' is '256', 'RTS' is '1', 'Quality of service (WMM)' is checked, 'Client isolation' is unchecked, 'Enable DFS' is checked, and 'Enable AMSDU' is unchecked. On the right, 'Mode' is 'MIMO 2x2', 'Max data rate' is 'Auto', 'Max data rate N' is 'Auto', 'Disable data rate fallback' is unchecked, 'Short GI' is checked, 'MPDU density' is '4', 'ACK timeout' is 'Distance', and 'BA window size' is '64'. There is also a 'Kilometers' radio button selected and a 'Miles' radio button.

Figure 26 – Wireless Advanced Settings



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**Tx power** – set the unit's transmitting power at which the device will transmit data. The larger the distance, the higher transmit power is required. To set transmit power level use the slider or enter the value manually. When entering the transmit power value manually, the slider position will change according to the entered value. The maximum transmit power level is limited to the allowed value by country in which device is operating regulatory agency.

**Enable ATPC** – select to enable Automatic Transmit Power Control (ATPC). If enabled, device radio will continuously communicate with remote unit's radio in order to adjust the optimal transmit power automatically.

**Fragmentation** – specify the Fragmentation threshold using slider or enter the value manually [256-2346 bytes]. This is the maximum size for a packet before data is fragmented into multiple packets. Setting the Fragmentation threshold too low may result in poor network performance. Only minor modifications of this value are recommended.

**RTS** – specify the RTS threshold using slider or enter the value manually [0-2347 bytes]. The RTS threshold determines the packet size of a transmission and, through the use of an access point, helps control traffic flow.

**Quality of service (WMM)** – enable to support quality of service for traffic prioritizing.

**Client isolation** – select to enable the layer 2 isolation that blocks clients from communicating with each other. Client isolations is available only in Access Point (auto WDS) mode.

**Enable DFS** – select to enable radar detection. With enabled DFS, APC unit monitors the operating frequency for radar signals. If radar signals are detected on the channel, the APC unit randomly selects a different channel. Note that if AP is operating on channel where DFS is required, this option automatically will be enabled.

**Enable AMSDU** – enable the AMSDU packet aggregation. If enabled, the maximum size of the 802.11 MAC frames will be increased.

**Mode** – choose the AP antenna operating mode:

- **SISO** – single input single output. The device will use only one antenna for data transfer. The antenna will be chosen automatically.
- **MIMO** – multiple input multiple output. The device will use two antennas for data transfer (two simultaneous streams).

**Max data rate** – choose the maximum data rate in Mbps at which should transmit packets. The APC will attempts to transmit data at the highest data rate set. If there will be an interference encountered, the APC will step down to the highest rate that allows data transmission.

**Max data rate N** – choose the data rate in Mbps at which should transmit packets for the selected 802.11n mode. The APC will attempts to transmit data at the highest data rate set. If there will be an interference encountered, the APC will step down to the highest rate that allows data transmission.

**Disable data rate fallback** – when this option is selected, the constant Max data rate will be set without a step back to the next highest data rate for APC data transmission.

**Short GI** – enable short guard interval. If selected, then 400ns value will be used, else 800ns.

**MPDU density** – define minimum time between PPDU's.

**ACK timeout** – specify the ACK timeout using slider or enter the value manually. Ack timeout can be entered by defining the link distance or specifying time value. Too low value of the ACK timeout will give very low throughput. A high value may slow down the link in noisy environment. A low value is far worse than a value slightly too high. ACK Timeout value should be tuned to the optimal value for the maximum link throughput.

**BA window size** – specify BA (Block ACK) window size [1-64].

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## Wireless Mode: Station



**Station WDS** has the same wireless settings.

The Station wireless settings a bit differ from the Access Point's settings: there is possibility to scan SSID of the surrounding APs and choose the required one.

Use Wireless Settings to setup radio interface of the device.

Figure 27 – Station Wireless Settings

### Basic Wireless Settings

**SSID** – specify the SSID of the wireless network device.

**Scan** – click this button to scan for surrounding wireless networks. Found network SSID's will be available in drop down menu.

**IEEE mode** – specify the wireless network mode.

**Channel width** – The default channel bandwidth for 802.11 radio is 20MHz. The 802.11n allow channel bonding in such way the total channel width becomes 40MHz.

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## Security Settings



Both sides (AP and Station) of the link must have the same security settings.

Device supports various authentication/encryption methods:

- **Open** – no encryption.
- **WEP** – 64bit and 128bit key.
- **Personal** – preshared key encryption with WPA/WPA2 using AES or TKIP.
- **Enterprise** – RADIUS server based authentication with WPA/WPA2 encryption using AES or TKIP (requires configured RADIUS server).

By default there is no encryption enabled on the device:

The image shows a web interface for security settings. At the top, the word 'Security' is displayed. Below it, there is a label 'Security' followed by a dropdown menu that currently shows 'Open'.

Figure 28 – Security: Open

**WEP encryption** can be either 64bit or 128bit:

The image shows the security settings interface with 'WEP 64bit' selected in the dropdown menu. To the right of the dropdown is a text input field labeled 'WEP passkey' containing six asterisks (\*\*\*\*\*).

Figure 29 – Security: WEP Encryption

**WEP passkey** – specify the passkey, for the chosen WEP security:

- For **WEP 64bit encryption** – 5 HEX pairs (e.g. aa:bb:cc:dd:ee), or 5 ASCII characters (e.g. abcde);
- For **WEP 128bit encryption** – 13 HEX pairs (e.g. aa:bb:cc:dd:ee:ff:gg:hh:00:11:22:33:44), or 13 ASCII characters (e.g. abcdefghijklm);

**Personal WPA/WPA2** encryption must be specified with the pre-shared key, encrypted with chosen AES or TKIP method (Auto mode on Station is not available):

The image shows the security settings interface. The 'Security' dropdown is set to 'Personal WPA2'. Below it, the 'Encryption' dropdown is set to 'AES'. To the right, there is a text input field labeled 'Passphrase' containing eight asterisks (\*\*\*\*\*).

Figure 30 –Security: Private WPA/WPA2 Encryption

**Passphrase** – specify the WPA or WPA2 passphrase [8-63 characters]. The passphrase will be converted to key format, selected above.

**Encryption** – specify the encryption algorithm:

- **AES** – passphrase encrypted with AES method.
- **TKIP** – passphrase encrypted with TKIP method.

Station has possibility to use **Enterprise WPA/WPA2** encryption with RADIUS authentication. Station will send requests to AP, which will redirect authentication parameters to required RADIUS server.

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Figure 31 – Security: Enterprise WPA/WPA2 Encryption

**Encryption** – choose WPA/WPA2 encryption type:

- **AES** – data encrypted with AES method;
- **TKIP** – data encrypted with TKIP method;

**EAP method** – choose EAP method:

- EAP-TTLS-MSCHAPv2
- PEAP/ MSCHAPv2

**Identity** – specify the identity of the authentication to the RADIUS server.

**Password** – specify the password of the authentication to the RADIUS server.



Identity and Password on the APC must match the identity and password running on the RADIUS server's user list.

## Advanced Wireless Settings

Advanced parameters allow configuring the device to get the best performance/capacity of the link.

Figure 32 – Wireless Advanced Settings

**Tx power** – set the unit's transmitting power at which the device will transmit data. The larger the distance, the higher transmit power is required. To set transmit power level use the slider or enter the value manually. When entering the transmit power value manually, the slider position will change according to the entered value. The maximum transmit power level is limited to the allowed value by country in which device is operating regulatory agency.

**Enable ATPC** – select to enable Automatic Transmit Power Control (ATPC). If enabled, device radio will continuously communicate with remote unit's radio in order to adjust the optimal transmit power automatically.

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**Fragmentation** – specify the Fragmentation threshold using slider or enter the value manually [256-2346 bytes]. This is the maximum size for a packet before data is fragmented into multiple packets. Setting the Fragmentation threshold too low may result in poor network performance. Only minor modifications of this value are recommended.

**RTS** – specify the RTS threshold using slider or enter the value manually [0-2347 bytes]. The RTS threshold determines the packet size of a transmission and, through the use of an access point, helps control traffic flow.

**Quality of service (WMM)** – enable to support quality of service for traffic prioritizing.

**Enable DFS** – select to enable radar detection. With enabled DFS, APC unit monitors the operating frequency for radar signals. If radar signals are detected on the channel, the APC unit randomly selects a different channel. Note that if APC is operating on channel where DFS is required, this option automatically will be enabled.

**Enable AMSDU** – enable the AMSDU packet aggregation. If enabled, the maximum size of the 802.11 MAC frames will be increased.

**Mode** – choose the AP antenna operating mode:

- **SISO** – single input single output. The device will use only one antenna for data transfer. The antenna will be chosen automatically.
- **MIMO** – multiple input multiple output. The device will use two antennas for data transfer (two simultaneous streams).

**Max data rate** – choose the maximum data rate in Mbps at which should transmit packets. The APC will attempt to transmit data at the highest data rate set. If there will be an interference encountered, the APC will step down to the highest rate that allows data transmission.

**Max data rate N** – choose the data rates in Mbps at which should transmit packets for the selected 802.11n mode. The APC will attempt to transmit data at the highest data rate set. If there will be an interference encountered, the APC will step down to the highest rate that allows data transmission.

**Disable data rate fallback** – when this option is selected, the constant Max data rate will be set without a step back to the next highest data rate for APC data transmission.

**Short GI** – enable short guard interval. If selected, then 400ns value will be used, else 800ns.

**MPDU density** – define minimum time between PPDU's.

**ACK timeout** – specify the ACK timeout using slider or enter the value manually. ACK timeout can be entered by defining the link distance or specifying time value. Too low value of the ACK timeout will give very low throughput. A high value may slow down the link in noisy environment. A low value is far worse than a value slightly too high. ACK Timeout value should be tuned to the optimal value for the maximum link throughput.

**BA window size** – specify BA (Block ACK) window size [1-64].

## Wireless Mode: iPoll Access Point

The **iPoll** wireless mode is designed for point to multipoint wireless solutions. The iPoll Access Point establishes a connection only with iPoll Stations thus creating a reliable network

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The screenshot shows the 'Wireless' settings page for an iPoll Access Point. The interface includes a top navigation bar with tabs for Status, Configuration, Services, System, and Tools. Below this, there are sub-tabs for Network, Wireless, Virtual AP, Wireless ACL, Traffic shaping, Port forwarding, and Static routes. The 'Wireless' tab is active, showing the 'Wireless mode' set to 'iPoll Access Point' and the 'Country' set to 'UNITED STATES'. The 'Basic' section contains fields for 'SSID' (my AP), 'Broadcast SSID' (checked), 'Channel width' (20/40 MHz), and 'Channel' (Auto). The 'Security' section shows 'Security' set to 'Open'. The 'Advanced' section includes 'Tx power (dBm)' (12), 'Mode' (MIMO 2x2), 'Max data rate' (Auto), 'Tx queue length, frames' (32), and checkboxes for 'Enable ATPC' and 'Enable DFS' (both checked).

Figure 33 – iPoll Access Point's Wireless Settings

## Basic Settings

Use Basic section to setup basic operating settings of the iPoll Access Point's radio.



iPoll Access Point and iPoll Station will operate in 802.11n IEEE mode only.

**SSID** – specify the SSID of the wireless network device.

**Broadcast SSID** – enables or disables the broadcasting of the SSID for iPoll AP.

**Channel width** – The default channel bandwidth for 802.11n radio is 20MHz. The 802.11n allow channel bonding in such way the total channel width becomes 40MHz.

**Channel** – displays the channel at which the iPoll AP is operating, or indicates that autochannel function is used.

**Channel list** – select the channel(s) at which the iPoll AP will operate. If more than one channel is selected, then autochannel feature will be enabled. Automatic channel selection allows iPoll AP to select a channel which is not used by any other wireless device or, if there are no free channels available - to select a channel which is least occupied. The table displays detailed information about each channel:

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## Security Settings



Both sides (iPoll Access Point and iPoll Station) of the link must have the same security settings.

The APC device working, in iPoll Access Point wireless mode, supports authentication/encryption methods listed below:

- **Open** – no encryption.
- **Personal WPA** – preshared key encryption with WPA using AES method.
- **Personal WPA2** – preshared key encryption with WPA2 using AES method.

By default there is no encryption enabled on the device:



Figure 34 – iPoll Security: Open

**Personal WPA/WPA2** encryption must be specified with the pre-shared key:



Figure 35 – iPoll Security: Private WPA/WPA2 Encryption

**Passphrase** – specify the WPA or WPA2 passphrase [8-63 characters]. The passphrase will be converted to key format, selected above.

## Advanced Wireless Settings

Advanced wireless settings allow configuring the iPoll AP to get the best performance/capacity of the link:

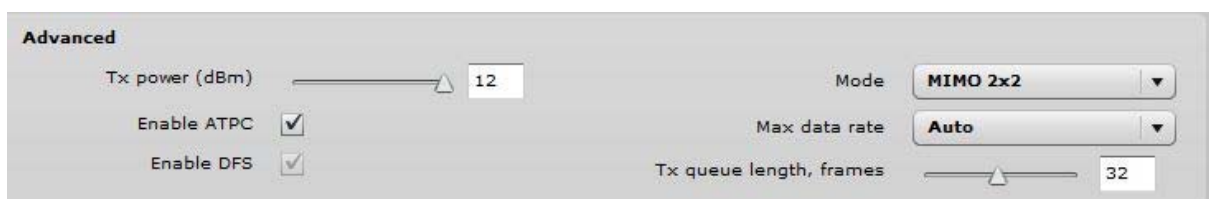


Figure 36 – iPoll Access Point: Advanced Wireless Settings

**Transmit power** – set the unit's transmitting power at which the device will transmit data. The larger the distance, the higher transmit power is required. To set transmit power level use the slider or enter the value manually. When entering the transmit power value manually, the slider position will change according to the entered value. The maximum transmit power level is limited to the allowed value by country in which device is operating regulatory agency.

**Enable ATPC** – select to enable Automatic Transmit Power Control (ATPC). If enabled, device radio will continuously communicate with remote unit's radio in order to adjust the optimal transmit power automatically.

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**Enable DFS** – select to enable a radar detection. With enabled DFS, iPoll AP monitors the operating frequency for radar signals. If radar signals are detected on the channel, the unit randomly selects a different channel. Note that if APC is operating on channel where DFS is required, this option automatically will be enabled.

**Mode** – choose the unit's antenna operating mode:

- **SISO** – single input single output. The device will use only one antenna for data transfer. The antenna will be chosen automatically.
- **MIMO** – multiple input multiple output. The device will use two antennas for data transfer (two simultaneous streams).

**Max data rate** – select the device data transmission rates in Mbps from the drop-down list. The iPoll AP will attempt to transmit data at the highest data rate set. If there will be an interference encountered, the APC will step down to the highest rate that allows data transmission.

**Transmit queue length, frames** – specify the length in frames of the transmit queue.



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## Wireless Mode: iPoll Station

The **iPoll Station** is a wireless client mode which can connect to the iPoll Access Points.

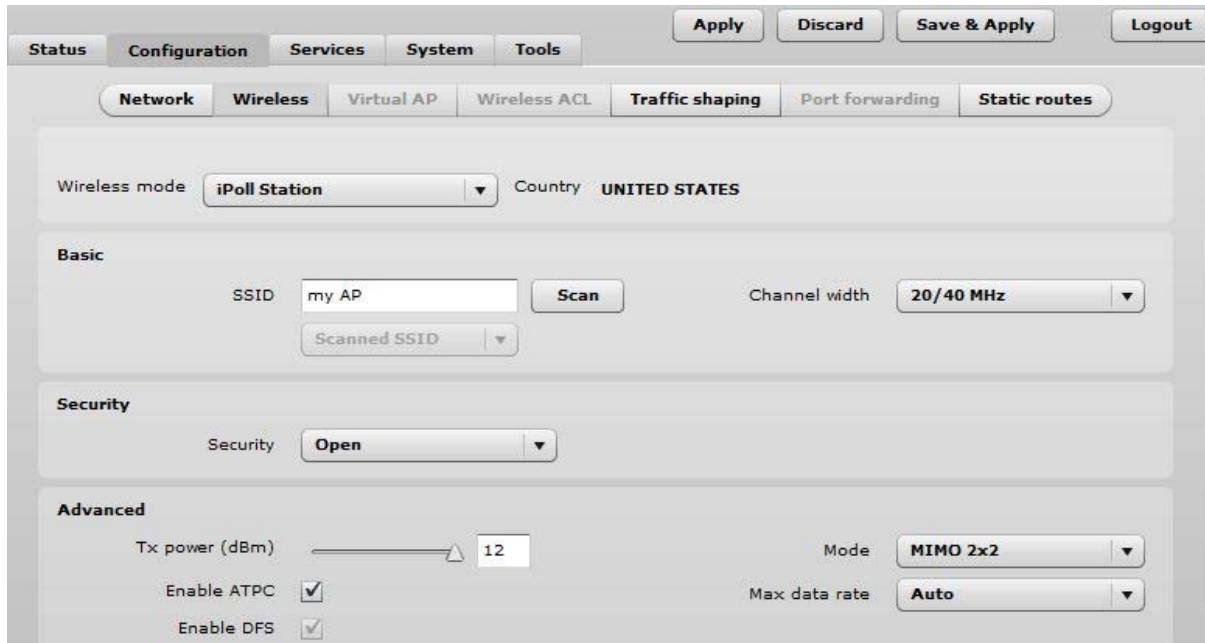


Figure 37 – iPoll Station's Wireless Settings

### Basic Settings

Use this section to setup basic operating settings of the iPoll Station radio.



iPoll Access Point and iPoll Station will operate in 802.11n IEEE mode only.

**SSID** – specify the SSID of the wireless network device manually, or use **Scan** functionality.

**Scan** – click this button to scan for surrounding iPoll Access Points. Found network SSID's will be available in drop down menu.

**Channel width** – The default channel bandwidth for 802.11 N radio is 20/40MHz. The 802.11n allow channel bonding in such way the total channel width becomes 40MHz.

### Security Settings



Both sides (iPoll Access Point and iPoll Station) of the link must have the same security settings.

The APC device working, in iPoll Station wireless mode, supports authentication/encryption methods listed below:

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- **Open** – no encryption.
- **Personal WPA** – preshared key encryption with WPA using AES method.
- **Personal WPA 2** – preshared key encryption with WPA2 using AES method.

By default there is no encryption enabled on the device:

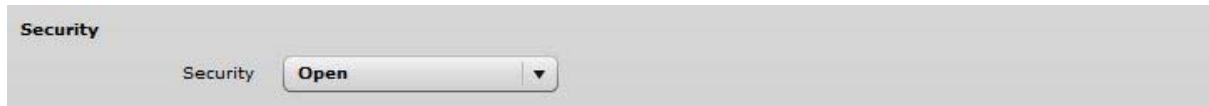


Figure 38 – iPoll Security: Open

**Personal WPA/WPA2** encryption must be specified with the pre-shared key:



Figure 39 – iPoll Security: Private WPA/WPA2 Encryption

**Passphrase** – specify the WPA or WPA2 passphrase [8-63 characters]. The passphrase will be converted to key format, selected above.

## Advanced Wireless Settings

Advanced wireless settings allow configuring the iPoll Station unit to get the best performance/capacity of the link:



Figure 40 – iPoll Station: Advanced Wireless Settings

**Transmit power** – set the unit's transmitting power at which the device will transmit data. The larger the distance, the higher transmit power is required. To set transmit power level use the slider or enter the value manually. When entering the transmit power value manually, the slider position will change according to the entered value. The maximum transmit power level is limited to the allowed value by country in which device is operating regulatory agency.

**Enable ATPC** – select to enable Automatic Transmit Power Control (ATPC). If enabled, device radio will continuously communicate with remote unit's radio in order to adjust the optimal transmit power automatically.

**Enable DFS** – select to enable the radar detection. With enabled DFS, iPoll Station unit monitors the operating frequency for radar signals. If radar signals are detected on the channel, the unit randomly selects a different channel. Note that if APC is operating on channel where DFS is required, this option automatically will be enabled.

**Mode** – choose the unit's antenna operating mode:

- **SISO** – single input single output. The device will use only one antenna for data transfer. The antenna will be chosen automatically.
- **MIMO** – multiple input multiple output. The device will use two antennas for data transfer (two simultaneous streams).

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**Max data rate** – select the device data transmission rates in Mbps from the drop-down list. The unit will attempt to transmit data at the highest data rate set. If there will be an interference encountered, the iPoll Station will step down to the highest rate that allows data transmission.

## Virtual AP



Virtual AP functionality is available only in **Access Point (auto WDS)** wireless mode.

Use the **Configuration | Virtual AP** page to configure to create up to 3 additional Virtual AP interfaces. The Virtual AP defines a logical wireless network, and the APC can be configured to provide additional 3 wireless networks on each device radio. All the VAPs may be active at the same time meaning that client devices can associate to the APC using any of the VAP SSID.

The Virtual AP table displays a summary of all virtual radio interfaces running on the APC:

Virtual AP list	
SSID	Security
VAP1	Open
VAP2	Personal WPA TKIP
<div><div>+</div><div>-</div></div>	

Figure 41 – VAP Table

To create a new Virtual AP, click on **+** button to add new entry on the VAP table, then select this entry and specify required parameters:

Virtual AP edit	
SSID	<input type="text" value="VAP2"/>
Broadcast SSID	<input checked="" type="checkbox"/>
Security	<div>Personal WPA</div>
Encryption	<div>TKIP</div>
Quality of service (WMM)	<input checked="" type="checkbox"/>
Client isolation	<input checked="" type="checkbox"/>
Passphrase	<input type="text" value="*****"/>

Figure 42 – VAP Settings:

**SSID** – specify the unique name for the VAP [string].

**Broadcast SSID** – when this option is selected the particular SSID is visible during network scans on a wireless station. When unselected, the VAP SSID is not visible and not broadcasted to wireless stations.

**Quality of service (WMM)** – enable to support quality of service for prioritizing traffic.

**User isolation** – enable the user Layer 2 isolation. The Layer 2 isolation blocks the wireless clients from communicating with each other.

Each VAP security is configured by default as an “open system”, which broadcasts a beacon signal including the configured SSID. For more secure network choose one of the security mechanisms for each VAP interface.

**Security** – choose the wireless security and encryption method from the drop-down list (for detailed security configuration, refer to the respective section *Access Point (auto WDS) Security Settings*).

- **Open** – no encryption.
- **WEP** – 64bit and 128bit key.

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- **Personal** – preshared key encryption with WPA/WPA2 using AES or TKIP.
- **Enterprise** – RADIUS server based authentication with WPA/WPA2 encryption using AES or TKIP (requires configured RADIUS server).
- **UAM** – Web browser based user authentication method. UAM authentication is available only if Access Point is working in router mode. For UAM configuration details refer at the respective chapter *Universal Access Method (UAM)*.



Wireless clients must be able to process the WPA or WPA2 information element and respond with a specific security configuration.

## Wireless ACL



Wireless ACL is active only in **Access Point (auto WDS)** and **iPoll Access Point** wireless mode.

Access Control provides the ability to limit associations wirelessly based on MAC address to an AP by creating an Access Control List (ACL) on each wireless interface (including VAPs).

MAC address	Name
00:90:45:5c:de:7b	friend 1
00:90:e6:55:81:ca	friend 2

Figure 43 – Wireless ACL Configuration

**Policy** – define the policy:

- **Open** – no rules applied
- **Allow MAC in the list** – only listed MAC clients can connect to the AP (white list).
- **Deny MAC in the list** – only listed MAC clients can NOT connect to the AP (black list).

To add new rule, press the “+” button.

To remove the rule, first select the rule then press the “–” button.

To edit the rule double click on the field.

## Traffic Shaping

Use **Traffic Shaping** to control download or upload bandwidth in order to optimize or guarantee performance. There are two methods to control network traffic:

- **Limit all traffic** – limits overall APC upload and download traffic.
- **Limit per IP traffic** – limits upload and download traffic for a specified IP addresses.

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The screenshot shows a configuration window for traffic shaping. At the top, 'Traffic shaping mode' is set to 'Limit all traffic'. Below this, the 'All traffic limitation' section has two checked options: 'Enable download shaping' and 'Enable upload shaping'. For download, the 'Download limit, kbps' is set to 512 and the 'Download burst, kbytes' is set to 100. For upload, the 'Upload limit, kbps' is set to 512 and the 'Upload burst, kbytes' is set to 100. Each limit and burst value is accompanied by a slider control.

Figure 44 – Traffic Shaping Configuration

Limit all traffic

- Enable download shaping** – select to enable limitation of the download traffic.
- Download limit, kbps** – specify the maximum download (from wireless interface to Ethernet interface) bandwidth value in Kbps.
- Download burst, kbytes** – specify the download burst size in kbytes.
- Enable upload shaping** – select to enable limitation of the upload traffic.
- Upload limit, kbps** – specify the maximum upload (from Ethernet interface to wireless interface) bandwidth value in Kbps.
- Upload burst, kbytes** – specify the upload burst size in kbytes

Limit per IP traffic

Use + button to create new traffic limitation rules

Per-IP traffic limitation				
IP address	DOWN rate, kbps	DOWN burst, kbytes	UP rate, kbps	UP burst, kbytes
192.177.32.9	512	100	512	100
<div>+ -</div>				

Figure 45 – Traffic Shaping: Per IP Limitation

- IP address** – specify IP address for which the traffic will be limited.
- Down rate, kbps** – specify the maximum download (from wireless interface to Ethernet interface) bandwidth value in Kbps.
- Down burst, kbytes** – specify the download burst size in kbytes.
- UP rate, kbps** – specify the maximum upload (from Ethernet interface to wireless interface) bandwidth value in Kbps.
- UP burst, kbytes** – specify the download burst size in kbytes

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## Port Forwarding



**Port forwarding** is active only in Router network mode..



**Port Forwarding, UPnP and DMZ** is effective only if NAT is enabled.

The **Port forwarding** section gives the ability to pass traffic behind an interface that has NAT enabled. For instance if the unit is in router mode with NAT enabled on the WAN interface, no devices on the outside of the WAN interface can see any private IPs on the LAN side of the unit. By using port forwarding or DMZ it is possible to pass traffic through to these private IP addresses.

The screenshot shows the 'Port forwarding settings' section of a network configuration interface. At the top, there are two checkboxes: 'Enable UPnP' and 'Enable DMZ'. The 'Enable DMZ' checkbox is selected, and next to it is a text field labeled 'IP address' containing the value '0.0.0.0'. Below this, the 'Port forwarding settings' section contains a table with four columns: 'Public port', 'Private host', 'Private port', and 'Protocol'. The table has two rows of data. The first row shows 'Public port' 8080, 'Private host' 192.168.100.3, 'Private port' 2000, and 'Protocol' TCP. The second row shows 'Public port' 8080, 'Private host' 79.169.49.10, 'Private port' 76, and 'Protocol' TCP. At the bottom of the table, there are two buttons: a '+' button and a '-' button.

Public port	Private host	Private port	Protocol
8080	192.168.100.3	2000	TCP
8080	79.169.49.10	76	TCP

Figure 46 – Port Forwarding Configuration

**Enable UPnP** – select to enable UPnP (Universal Plug and Play connectivity) service. The UPnP enables APC communicate with other network devices automatically opening required ports, without manual intervention.

**Enable DMZ** – select to enable DMZ. DMZ opens all TCP/UDP ports to particular IP address. It allows setting up servers behind the APC. The feature is used commonly for setting up VoIP or Multi-Media servers.

**Public port** – specify the port that will be accessed externally using the public IP address.

**Private host** – specify the IP address behind NAT that public traffic will get forwarded to.

**Private port** – specify the listening port on private computer behind NAT.

**Protocol** – select type of forwarding traffic: TCP or UDP.

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## Static Routes



**Static routes** is active only in Router network mode.

A routing rule is defined by the destination subnet (Destination IP address and netmask) and/or gateway where to route the target traffic. To add a new static route, specify the following parameters:

Destination IP	Netmask	Gateway
192.168.2.0	255.255.255.0	0.0.0.0

Below the table are two buttons: a plus sign (+) and a minus sign (-).

Figure 47 – Static Route Configuration

**Destination IP** – specify the destination IP address.

**Netmask** – specify destination netmask.

**Gateway** – specify the gateway address for the route. 0.0.0.0 stands for the default gateway of the selected interface.

## Services

### WNMS

Wireless Network Management System (WNMS) is a centralized monitoring and management system for wireless network devices. The communication between managed devices and the WNMS server is always initiated by an WNMS client service running on every device.

**Wireless Network Management System (WNMS)**

☒ Enable WNMS agent

Server/Collector URL:

**Enable WNMS agent** – select to enable WNMS agent.

**Server/Collector URL** – specify the URL of the WMS server to which that heartbeat notifications will be sent to.

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## System alerts

The device is able to send external alerts when there are system errors. The alerts can be sent via SNMP Traps or/and SMTP notifications.

System alerts

System check interval, s

10

SNMP	SMTP	Alert description		
<input type="checkbox"/>	<input type="checkbox"/>	Wireless link status change		
<input type="checkbox"/>	<input type="checkbox"/>	Ethernet link status change		
<input type="checkbox"/>	<input type="checkbox"/>	RSSI level lower than	<div><div></div></div>	25
<input type="checkbox"/>	<input type="checkbox"/>	Noise level greater than, dBm	<div><div></div></div>	-60
<input type="checkbox"/>	<input type="checkbox"/>	RX drop greater than, %	<div><div></div></div>	6
<input type="checkbox"/>	<input type="checkbox"/>	TX retry greater than, %	<div><div></div></div>	9
<input type="checkbox"/>	<input type="checkbox"/>	Device reboot		

Figure 48 – Device Alerts

**Enable alerts** – select to enable alert notifications on the system.

**System check interval, s** – specify interval in seconds at which the device will send notifications of unexpected system behavior.

System alerts:

**Wireless link status change** – system will send notification on Wireless link status change.

**Ethernet link status change** – system will send notification on Ethernet link status change.

**RSSI level lower than** – system will send notification when RSSI reach value lower than specified. Default: 25

**Noise level greater than** – system will send notification when signal noise will reach value greater than specified. Default: -60 dBm.

**RX drop greater than** – system will send notification when percent of RX dropped packets become higher than specified value. Default: 250 packets per seconds.

**TX retry greater than** – system will send notification when percent of TX retries becomes higher than specified value. Default: 250 packets per seconds.

**Device reboot** – system will send notification about unexpected or administrator initiated device reboot.

SNMP traps settings

Manager address

192.168.3.173

Manager port

162

Trap community

public

☒ Use inform

Retry count

5

Retry timeout

1

SMTP settings

Server address

182.253.9.100

Server port

25

Source e-mail address

AP@alerts.com

Destination e-mail address

admin@admin.com

E-mail notification interval, s

0

Figure 49 – Device Alerts: SNMP Traps and SMTP Configuration



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## SNMP Traps Settings

**Manager address** – specify the IP address or hostname of SNMP Trap receiver.

**Manager port** – specify the port number of the Trap receiver. Default port number is 162.

**Trap community** - specify the SNMP community string. This community string acts as password between SNMP manager and device by default Trap community string is "public".

**Use inform** – select to wait for an acknowledgment from SNMP manager that trap was received.

**Retry count** – specifies maximum number of times to resend an inform request [1-10]. Default: 5.

**Retry timeout** – specifies number in seconds to wait for an acknowledgment before resending request [1-10]. Default: 1.

## SMTP Settings

**Server address** – specify the IP address or hostname of the networked SMTP server.

**Server port** – specify the SMTP Port Number is the port number used by the networked SMTP server. By default the port number is 25.

**Source e-mail address** – specify the e-mail address that will be used by the device.

**Destination e-mail address** – specify the e-mail address where the device will send the alert messages.

**E-mail notification interval** – specify interval in seconds at which the e-mail notification will be sent from the device [0-86400]. If 0 specified, then device will send an e-mail notification immediately after unexpected system behavior.

## SNMP

SNMP is the standard protocol that is widely used for remote network management over the Internet. With the SNMP service enabled, the device will act as SNMP agent.

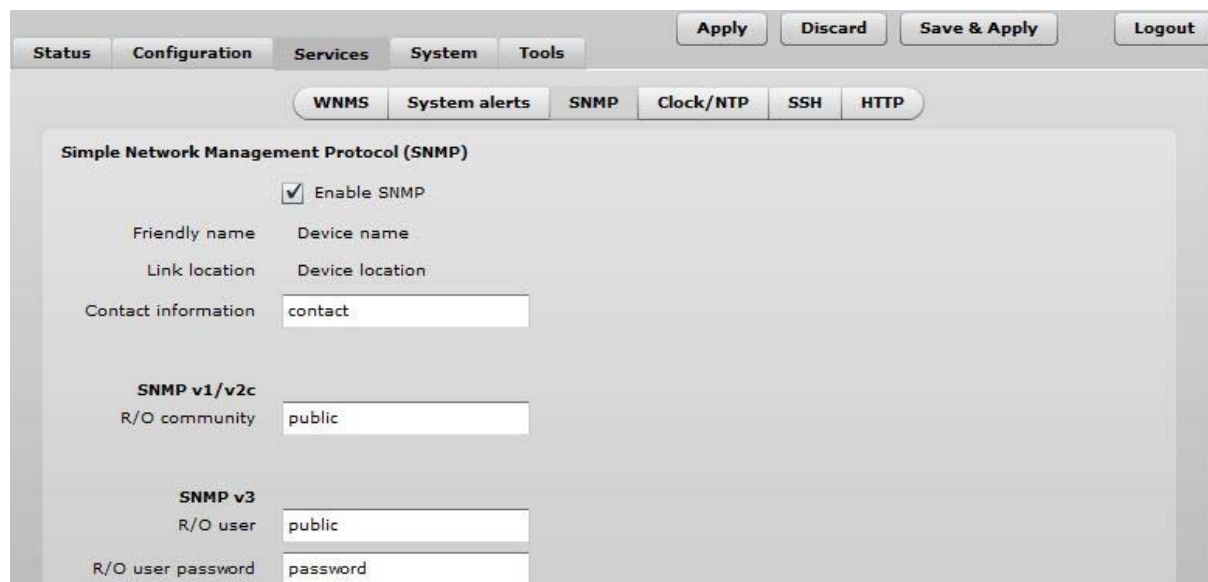
The image shows a web-based configuration interface for an SNMP service. At the top, there are tabs for 'Status', 'Configuration', 'Services', 'System', and 'Tools'. Below these are buttons for 'Apply', 'Discard', 'Save & Apply', and 'Logout'. A sub-menu bar contains 'WNMS', 'System alerts', 'SNMP' (which is selected), 'Clock/NTP', 'SSH', and 'HTTP'. The main content area is titled 'Simple Network Management Protocol (SNMP)'. It features a checkbox labeled 'Enable SNMP' which is checked. Below this, there are two columns of settings: 'Friendly name' and 'Link location' on the left, and 'Device name' and 'Device location' on the right. A 'Contact information' field contains the text 'contact'. Under the 'SNMP v1/v2c' section, the 'R/O community' field is set to 'public'. Under the 'SNMP v3' section, the 'R/O user' field is set to 'public' and the 'R/O user password' field is set to 'password'.

Figure 50 – SNMP Service Settings

**Enable SNMP** – specify the SNMP service status.

**Friendly name** – displays name of the APC that will be used to identify the unit. This name has the same value as Friendly name in the *Device settings*.

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**Link location** – displays the physical location of the device. This name has the same value as Device location in the *Device settings*.

**Contact information** – specify the identification of the contact person for this managed device, together with information on how to contact this person.

**R/O community** – specify the read-only community name for SNMP version 1 and version 2c. The read-only community allows a manager to read values, but denies any attempt to change values.

**R/O user** – specify the user name for read-only SNMPv3 access. The read-only community allows a manager to read values, but denies any attempt to change values.

**R/O user password** – specify the password for read-only SNMPv3 access [string].

## Clock/NTP

Use this section to manage the system time and date on the device automatically, using the Network Time Protocol (NTP), or manually, by setting the time and date on the device.

The NTP (Network Time Protocol) client synchronizes the clock of the device with the defined time server. Choose NTP from the configuration menu, select your location time zone and enter NTP server in order to use the NTP service.



Figure 51 – Device Clock: NTP Configuration

**Configuration** – choose the system clock configuration mode [NTP/Manual].

**Timezone** – select the timezone. Time zone should be specified as a difference between local time and GMT time.

**Save last known time** – select to recall the timestamp that was saved on last reboot. When NTP is enabled, this option will set system clock to last reboot time if no NTP servers are available.

**NTP server** – specify the trusted NTP server IP or hostname for synchronizing time with [IP address].

To adjust the clock settings manually, choose the configuration mode as Manual and specify the following settings:



Figure 52 – Device Clock: Manual Configuration

**Configuration** – choose the system clock configuration mode [NTP/Manual].

**Timezone** – select the timezone. Time zone should be specified as a difference between local time and GMT time.

**Save last known time** – select to recall the timestamp that was saved on last reboot.

**Date** – specify the new date value in format MM/DD/YYYY

**Time** – specify the time in format hh:mm.

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## SSH

Use this menu to manage access to the device via SSH port:

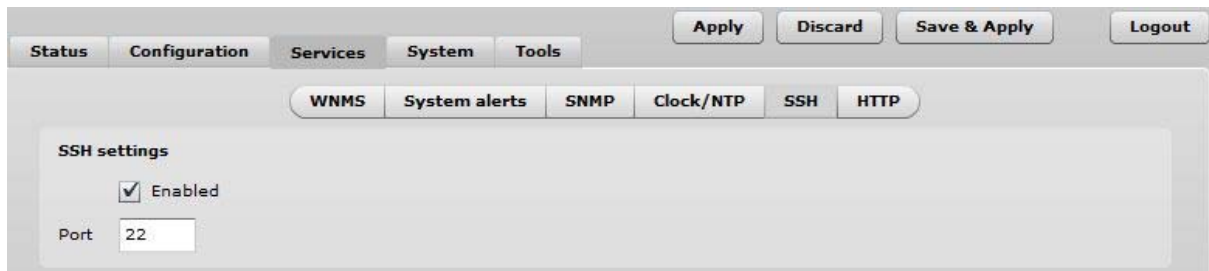


Figure 53 – SSH Port Configuration

**Enabled** – enable or disable SSH access to device.

**Port** – the SSH service port. By default SSH port is 22.

## HTTP

Use this menu to control HTTP connection on device web management:

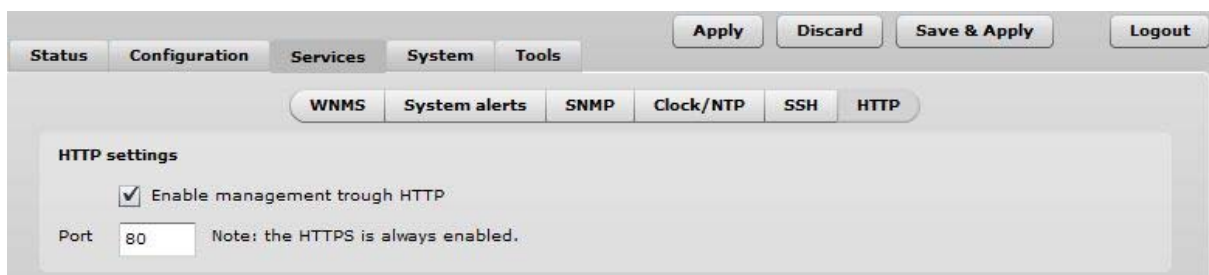


Figure 54 – HTTP Settings

**Enable management through HTTP** – select this option to enable or disable HTTP access to the device management.

**Port** – specify HTTP port. Standard HTTP port is 80.



**HTTPS** connection via the standard port 8080 is always enabled.

## Autodiscovery



**Autodiscovery** function is available only on Station, Station WDS and IPoll Station wireless modes.

Enable this feature to allow the APC unit discovery within reach of a single multicast packet.

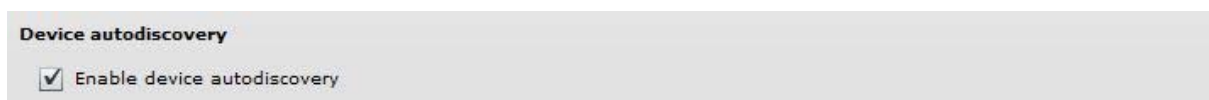


Figure 55 – Device Autodiscovery

**Enable device autodiscovery** – select to enable Autodiscovery function.

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## System

### Administration



For security reasons it is recommended to change the default administrator username and password as soon as possible.

System menu allows you to manage main system settings and perform main system actions (reboot, restore configuration, etc.). The section is divided into further three sections: Device settings, Account settings and system functions.

Figure 56 – Device Administration Settings

#### Device settings

**Friendly name** – specify name of the APC that will be used to identify the unit.

**Device location** – describe the location of the device [maximum 255 ASCII characters].

**Longitude** – specify the longitude coordinates of the device [specific decimal format, e.q. 54.869446].

**Latitude** – specify the latitude coordinates of the device [specific decimal format, e.q. 23.891058]. Both coordinates helps indicate accurate location of the device.

#### Account settings

The Administrative Account menu is for changing the administrator's password.



Default administrator logon settings are:

Username: **admin**

Password: **admin01**

**Username** – change the administrator's username.

**Old password** – enter the old administrator password.

**New password** – enter the new administrator password for user authentication.

**Verify password** – re-enter the new password to verify its accuracy.



The only way to gain access to the web management if you forget the administrator password is to reset the unit to factory default settings.

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## System functions

**Reboot device** – reboot device with the last saved configuration.

**Reset device to factory defaults** – click to restore unit's factory configuration.



Resetting the device is an irreversible process. Current configuration and the administrator password will be set back to the factory default.

**Download troubleshooting file** – click to download the troubleshooting file. The troubleshooting file contains valuable information about device configuration, routes, log files, command outputs, etc. When using the troubleshooting file, the device quickly gathers troubleshooting information automatically, rather than requiring you to gather each piece of information manually. This is helpful for submitting problems to the support team.

**Backup configuration file** – click to save the current configuration file. The saved configuration file is useful to restore a configuration in case of a device misconfiguration or to upload a standard configuration to multiple devices without the need to manually configure each device through the web interface.

**Restore configuration from file** – click to upload an existing configuration file to the device.

**Installer radio test mode** – select to enable Installer radio test mode. If enabled, responsibility for the compliance of the device performance with the regulatory rules must be taken by the installer.

## Log

Use the log tab to configure device to view or save log messages to the local or remote server using standard syslog facility:

Figure 57 – Device System Log

**View system log** – click to view current trace messages. The system log viewer utility provides debug information about the system services and protocols. If the device's malfunction occurs recorded messages can help operators to locate misconfiguration and system errors.

**Message level** – specify system's message tracing level. The level determines the importance of the message and the volume of messages generated by the device. The levels are in increased importance order [emergency, alert, critical, error, warning, notice, information, debug]. Default: info.

The device can be configured to send system log messages to a remote server:

**Syslog forward** – select to enable remote system logging.

**Forward server** – specify the remote host IP address or hostname where syslog messages will be sent.

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**Forward port** – specify the port to which syslog messages will be forwarded [0-65535]. Default: 514.

**Forward message level** – specify the level of the message which will be sent to the remote syslog server. The level determines the importance of the message and the volume of messages generated by the device. The levels are in order of increasing importance [emergency/alert/critical/error/warning/notice/information/debug]. Default: information.

**Forward backup** – select to enable remote syslog logging backup.

**Backup server** – specify the backup host IP address or hostname where syslog messages will be send to.

**Backup port** – specify the port to which syslog messages will be forwarded [0-65535]. Default: 514.

## LED Control

The APC is equipped with 6 LEDs: power, LAN and 4 Signal LEDs that indicates the signal strength of current connection. The signal level is classified into 4 levels, thus corresponding 4 LEDs switches on as soon as indicated threshold is reached.

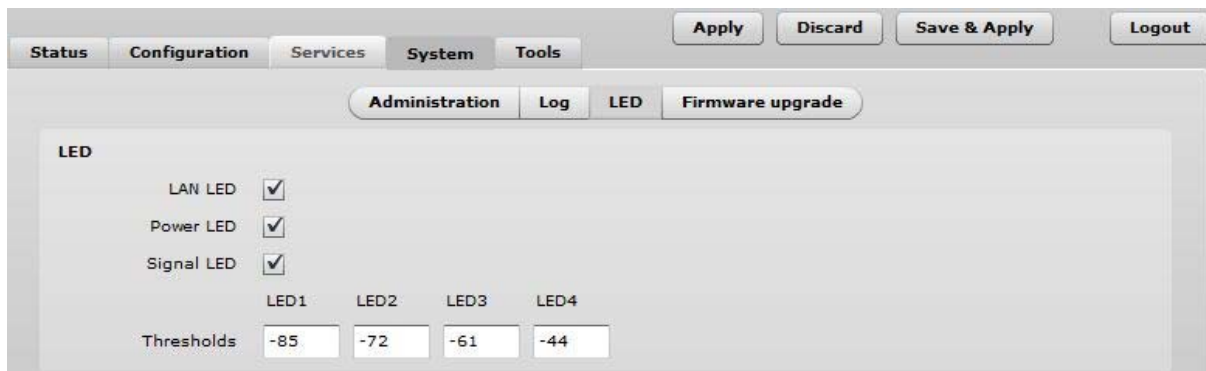
The screenshot shows a web interface for 'Device LED Control'. At the top, there are tabs for 'Status', 'Configuration', 'Services', 'System', and 'Tools'. Below these are buttons for 'Apply', 'Discard', 'Save & Apply', and 'Logout'. The 'System' tab is active, and within it, there are sub-tabs for 'Administration', 'Log', 'LED', and 'Firmware upgrade'. The 'LED' sub-tab is selected. Under the 'LED' heading, there are three checkboxes: 'LAN LED' (checked), 'Power LED' (checked), and 'Signal LED' (checked). Below these, there are four input fields for 'Thresholds' corresponding to 'LED1', 'LED2', 'LED3', and 'LED4'. The values entered are -85, -72, -61, and -44 respectively.

Figure 58 – Device LED Control

**LAN LED** – select to enable LAN LED. The red LED will be blinking on LAN activity, off – no LAN connection.

**Power LED** – select to enable Power LED. The steady red LED when power is on, off – no power.

**Signal LED** – select to enable signal strength indication LEDs:

**Thresholds** – specify the RSSI threshold at which corresponding LED will switch on.



The Signal LEDs are working only when the connection is established. Therefore, please make sure all wireless settings are correct and the connection is established.

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## Firmware Upgrade

To update your device firmware use the **System | Firmware upgrade** menu. Press **Upload firmware**, select the firmware file and click the **Upload firmware** button:

**Current version** – displays version of the current firmware.

**Upload firmware** – click the button to select the new firmware image for uploading it to the device.

The device system firmware upgrade is compatible with all configuration settings. When the device is upgraded with a newer version or the same version builds, all the system's configuration will be preserved after the upgrade.

The new firmware image is uploaded to the controller's temporary memory. It is necessary to save the firmware into the device permanent memory. Click the Upgrade button:

**Upgrade** – upgrade device with the uploaded image and reboot the system.



Do not switch off and do not disconnect the device from the power supply during the firmware upgrade process as the device could be damaged.

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## Tools

### Antenna Alignment

The Antenna Alignment tool measures signal quality between the Station and AP. For best results during the antenna alignment test, turn off all wireless networking devices within range of the device except the device(s) with which you are trying to align the antenna. Watch the constantly updated display in the Alignment Test window as you adjust the antenna.

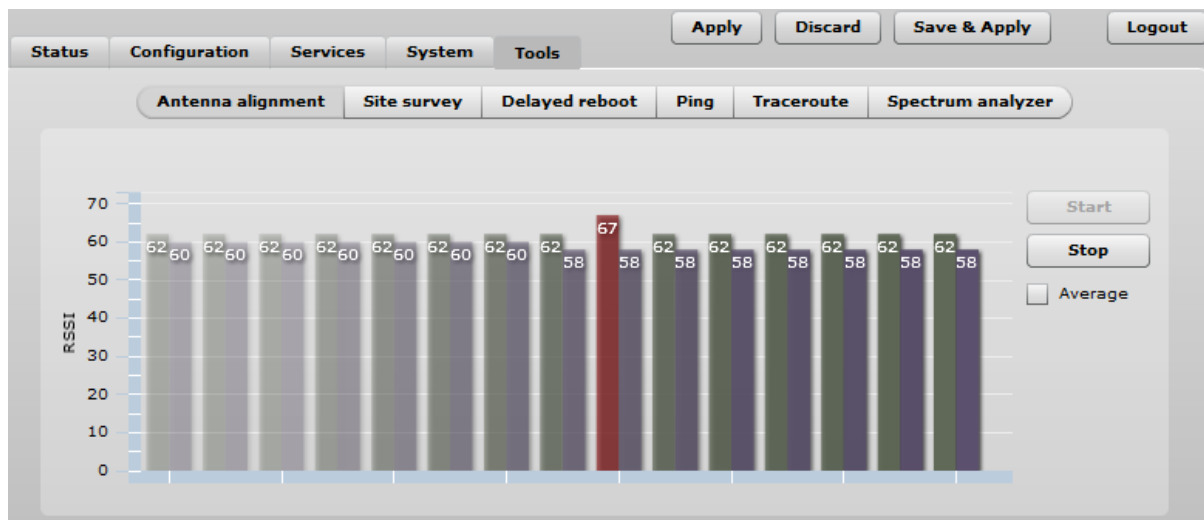


Figure 59 – Antenna Alignment

**Start** – press this button to start antenna alignment.

**Stop** – press this button to stop antenna alignment.

**Average** – if this option selected, the graph will display the average RSSI of both antennas.

### Site Survey

The Site Survey tool shows overview information for wireless networks in a local geographic area. Using this test, an administrator can scan for working access points, check their operating channels, encryption and see signal/noise levels.

To perform the Site Survey test currently, click the **Start scan**:

**Last updated before** – displays when the last scan was performed.

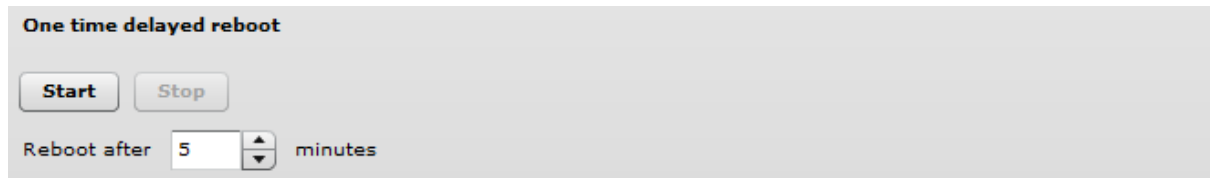
The results of the Site Survey test are converted to handy two graphs: AP count and RSSI. An administrator can use this to identify the best channel for device operation that will not receive interference from adjacent APs.



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## Delayed Reboot

This tool is extremely useful while tuning radio settings – once you defined hypothetical radio parameters and set them with Apply button (not written to the permanent memory), device starts operating with the new settings, and in case the link fails, device will be rebooted in specified minutes, thus the old settings will be set back.



One time delayed reboot

Start Stop

Reboot after 5 minutes

Figure 60 – Delayed Reboot Configuration

**Reboot after** – specify time in minutes, after which the device will be rebooted.

**Start/Stop** – click to start or stop delayed reboot tool.

## Ping

This command is used to test whether a particular host is reachable across an IP network. The Ping results will be displayed graphically:

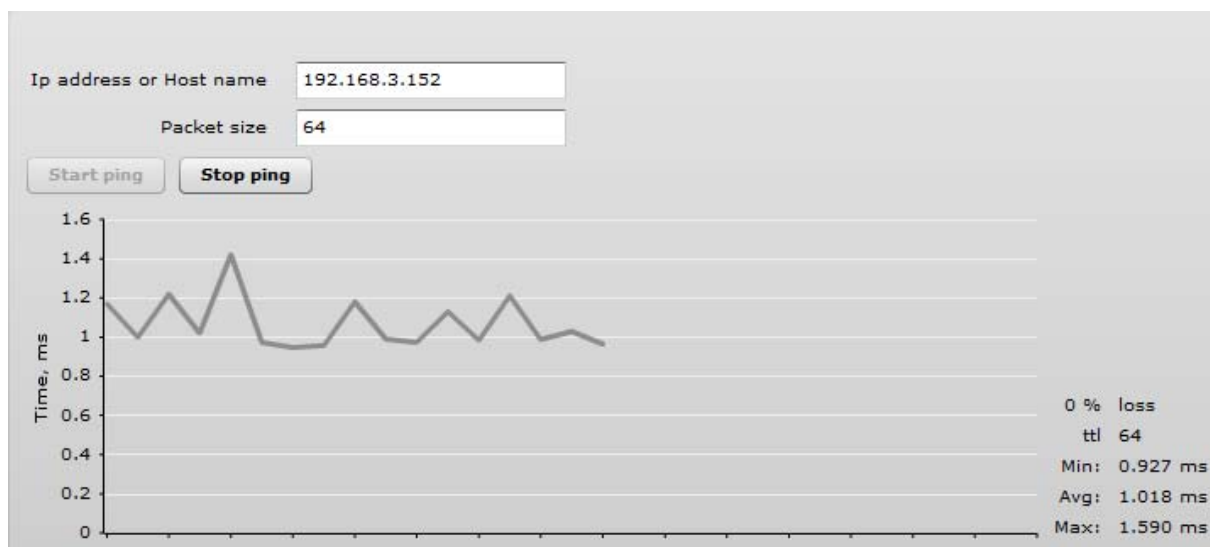


Figure 61 – Ping Results

**IP address or Host name** – specify the destination IP address or Host name.

**Packet size** – specify the packet size.

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## Traceroute

This tool is a route-tracing utility used to determine the path that an IP packet has taken to reach a destination. This is useful when trying to find out why destination is unreachable, as you will be able to see where the connection fails.

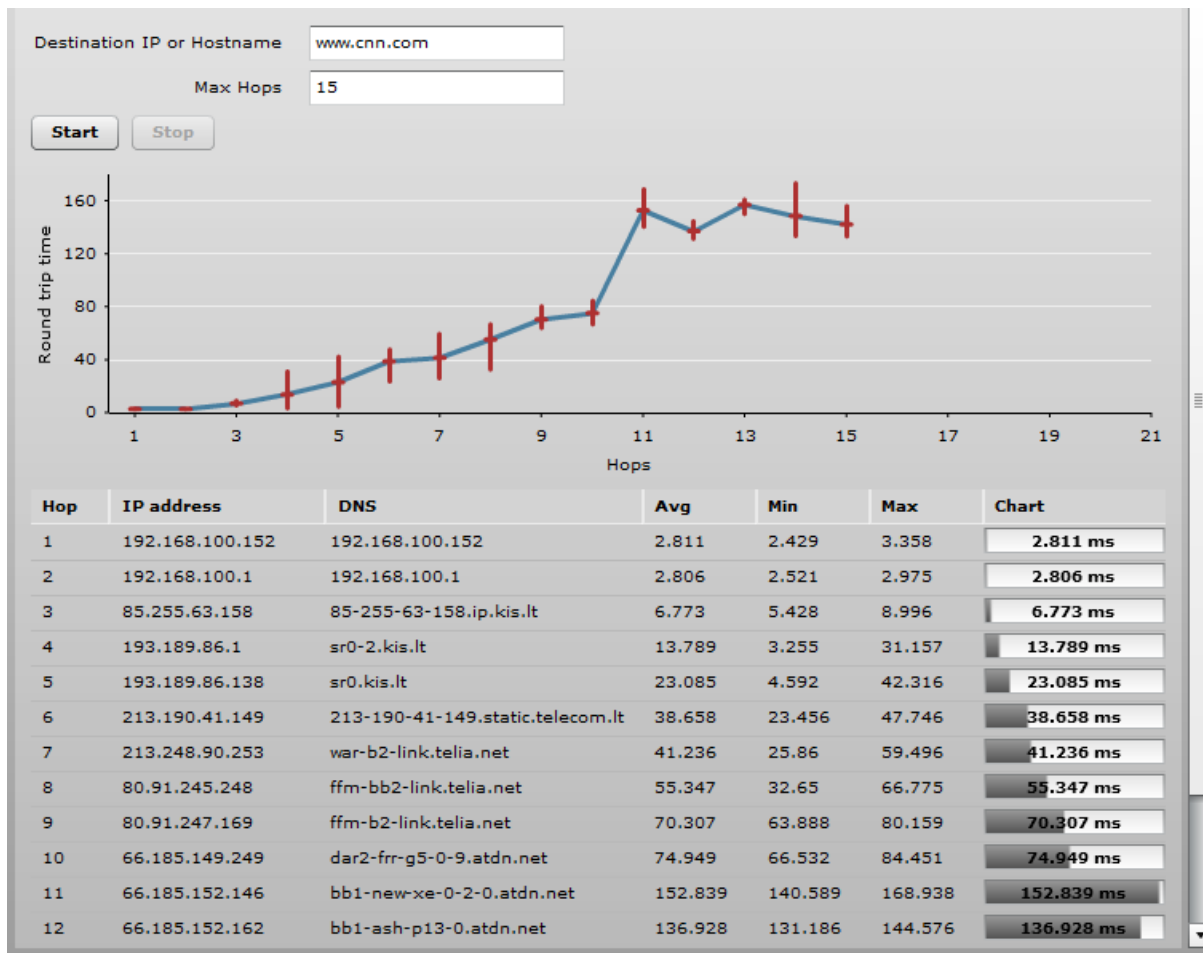


Figure 62 – Traceroute Results

**Destination IP or Hostname** – specify hostname or IP address of the target host.

**Max Hops** – Specifies the maximum number of hops to search for target.

**Start/Stop** – click to start or stop traceroute tool.

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## Spectrum Analyzer

The **Spectrum analyzer** test displays detailed information about signal level of each APC unit's antenna on each available frequency. This enables administrator choose the best available frequency/channel for the unit operation. The frequency list depends on the Country at which the unit is operating, and chosen channel width.



Do not use the Spectrum analyzer on the remote unit of the link, as the connection to the device will be lost during the test.

Click **Start** button to perform the test:

**Operating frequency range** – displays the channel frequency range at which the APC unit is operating currently.

**Maximum** – color indicates a the maximum achieved signal level on the appropriate frequency.

**Current** – color indicates the current signal level on the appropriate frequency.

**Average** – indicates average of the signal level on the appropriate frequency.

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## Universal Access Method (UAM)

Universal Access Method (UAM) is a simple Web browser based user authentication method. On initial HTTP request to any Web site, client's browser is redirected to the authentication page for login to the network. The login page can be served by internal Web server or by external Web Application Server.

### UAM Overview

When using internal UAM, the **Login** page is the first page a client receives when he starts his Web browser and enters any URL. To get access to the network, the user should enter his authentication settings: **login name** and **password** and click the **login** button:

**My HotSpot**

**Welcome to my HotSpot!**

You can use the Internet, but have to login first.  
You must also agree to these [terms and conditions](#).

Username

Password

Figure 63 – UAM Login Page

The DLB APC could be shared by several Wireless Internet Service Providers (WISP). They are uniquely identified by specifying WISP domain name in addition to subscriber user name when logging in. APC can be configured to send authentication and accounting information to different Authentication, Authorization, and Accounting (AAA) servers associated with different WISP domains.



Subscriber's login format:

- username

### UAM Configuration



UAM authentication is available on radio interfaces (including VAPs) only if DLB APC is working as **router** in **Access Point (auto WDS)** wireless mode.

The APC allows user authentication through external or internal Web portal. This authentication method is called UAM. User provides login credentials and then Web portal attempts to authenticate and authorize the client using the provided information. Client will not send any authentication requests directly to the APC, the Web portal will do this. On success, APC will allow access to the Internet; otherwise Web portal will display failure notice.

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Use Security section on Wireless or VAP (depending on the interface on which the UAM will be configured) page for UAM configuration: choose the security option UAM:

**Security**

Security: **UAM**

**RADIUS settings**

NAS ID: nas

RADIUS server 1: 192.168.2.182

RADIUS server 2:

RADIUS secret: \*\*\*\*\*

RADIUS Auth port: 1812

RADIUS Acct port: 1813

RADIUS WEB page type: **Internal**

☐ Use HTTPS

Key Certificate

WISPr Location name:

**WISPr Location ID**

Operator name:

Network name:

ISO country code:

E.164 country code:

E.164 area code:

**WISPr default max bandwidth**

Download, kbps:

Upload, kbps:

Interface IP address: 192.168.20.66

**DHCP server settings**

Network: 192.168.20.0

Subnet mask: 255.255.255.0

DNS server 1: 192.168.20.66

DNS server 2:

**Data encryption settings**

Security: **Personal WPA2**

Encryption: **TKIP**

Passphrase: \*\*\*\*\*

Figure 64 – UAM Settings

## RADIUS Settings

**NAS ID** – specify the NAS identifier.

**RADIUS server 1** – specify the name or IP address of the primary RADIUS server.

**RADIUS server 2** – specify the name or IP address of the secondary RADIUS server.

**RADIUS secret** – specify the RADIUS shared secret.

**RADIUS authentication port** – specify the UDP port number to use for radius authentication requests, default 1812

**RADIUS accounting port** – specify the UDP port number to use for radius accounting requests, default 1813

**RADIUS WEB page type** – choose the authentication Web portal type:

- **Internal** – use the built in authentication Web page. If selected, then when a users first tries to access the Internet, they will be blocked, and re-directed to the built-in login page. The logon data will be sent to the Radius Server for authentication.
- **External** – specify the external authentication Web page URL and settings. If selected, then when a user first tries to access the Internet, they will be blocked, and re-directed to the URL specified below.
- **Custom internal** – upload a customized internal page.

**Use HTTPS** – enable to use the HTTPS protocol for connection and authentication.

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- **Key** – upload a PEM formatted private key file.
- **Certificate** – upload a PEM formatted certificate file.

#### WISPr Settings

**WISPr location name** – specify the WISPr location name.

**Operator name** – specify the operator's name

**Network name** – specify the network name

**ISO country code** – specify the country code in ISO standard.

**E.164 country code** – specify the country code in E.164 standard.

**E.164 area code** – specify the area code in E.164 standard.

**WISPr default max bandwidth** – specify the default bandwidth limitation for clients. Note that if the external RADIUS server has traffic limitations preconfigured, then RADIUS overrides these settings.

**Download, kbps** – specify max download bandwidth in kbps.

**Upload, kbps** – specify the max upload bandwidth in kbps.

**Interface IP address** – specify the LAN interface IP address. Note that LAN settings on Network menu will be disabled if UAM is enabled.

**DHCP settings** – specify the dynamic IP settings for the connected users:

**Network** – specify the network for IP address pool.

**Subnet mask** – specify the subnet mask for the DHCP.

**DNS server** – specify the primary and the secondary DNS servers.

**Data encryption settings** – choose the data encryption method:

- **Open** – no encryption.
- **Personal WPA** – preshared key encryption with WPA using AES method.
- **Personal WPA 2** – preshared key encryption with WPA2 using AES method.

## White/Black List

The white and black access lists control user access to Web content through the APC. The unauthenticated users will be allowed to access sites from white list while access to the sites from black list will be denied even for authenticated users.

White/Black list	
<b>White list</b>	
Host/IP address	Notes
188.213.65.22	homepage
+ -	
<b>Black list</b>	
Host/IP address	Notes
+ -	

Figure 65 – White List and Black List

Use “+” sign to add new entry to the list, and “-” sign to remove required one.

#### White list

**Host/IP address** – specify the IP addresses or hosts for free access even for unauthenticated users.

**Notes** – add a description for the specified host or IP address.

#### Black list

**Host/IP address** – specify the IP addresses or hosts that will be not accessible even for the authenticated users.

**Notes** – a description for the specified host or IP address.

## Appendix

### A) Resetting Device to Factory Defaults

Device has the capability of being reset to defaults by pinging the device with a certain packet size when the radio is booting. During the startup of the device, when the drivers of the Ethernet interfaces are loaded, the discovery daemon is started. The daemon suspends startup process for 3 seconds and waits for ICMP "echo request" packet of length 369 bytes. If the packet received, the discoveryd resets the device to default configuration.



It is recommended to connect PC to the device via switch, as depending on PC OS settings, the ARP table might be flushed during wired link status change (connecting the device that will be reset).

Steps to reset to default settings:

**Step 1.** Power off the APC device.

**Step 2.** Obtain the device MAC address.

**Step 3.** Connect a PC to the same physical subnet as the device.

**Step 4.** Execute 'arp -s' command to assign the IP address (IP address should be from the same subnet as PC) to the device MAC address:

```
arp -s <IP address to assign> <device MAC address>
```



Note that syntax of MAC address differs depending on OS:

- Linux OS: AA:BB:CC:DD:EE:FF
- Windows OS: AA-BB-CC-DD-EE-FF

**Step 5.** Start ping the device:

**For Linux users:** ping <IP address> -s 369

**For Windows users:** ping <IP address> -l 369 -t -w 0.2

**Step 6.** Power up APC device and wait about 30sec or more (depending on device hardware).

**Step 7.** Stop ping the device, and let the device boot as usual. The device should start up with factory default settings.

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## B) RADIUS Attributes

The following RADIUS attributes and messages are supported by the DLB APC.

### General Attributes

Attribute	Description
User-name (1)	Full username as entered by the user.
User-Password (2)	Used for UAM as alternative to CHAP-Password and CHAP-Challenge.
CHAP-Password (3)	Used for UAM CHAP Authentication
CHAP-Challenge (60)	Used for UAM CHAP Authentication
EAP-Message (79)	Used for WPA Authentication
NAS-IP-Address (4)	IP address of Chilli (set by the <i>nasip</i> or <i>radiuslisten</i> option, and otherwise "0.0.0.0")
Service-Type (6)	Set to Login (1) for normal authentication requests. The Access-Accept message from the radius server for configuration management messages must also be set to Administrative-User.
Framed-IP-Address (8)	IP address of the user, which is configurable during MAC authentication in the Access-Accept.
Filter-ID (11)	Filter ID pass on to scripts possibly.
Reply-Message (18)	Reason of reject if present.
State (24)	Sent to chilli in Access-Accept or Access-Challenge. Used transparently in subsequent Access-Request.
Class (25)	Copied transparently by chilli from Access-Accept to Accounting-Request.
Session-Timeout (27)	Logout once session timeout is reached (seconds)
Idle-Timeout (28)	Logout once idle timeout is reached (seconds)
Called-Station-ID (30)	Set to the nasmac option or the MAC address of chilli.
Calling-Station-ID (31)	MAC address of client
NAS-Identifier (32)	Set to radiusnasid option if present.
Acct-Status-Type (40)	1=Start, 2=Stop, 3=Interim-Update
Acct-Input-Octets (42)	Number of octets received from client.
Acct-Output-Octets (43)	Number of octets transmitted to client.
Acct-Session-ID (44)	Unique ID to link Access-Request and Accounting-Request messages.
Acct-Session-Time (46)	Session duration in seconds.
Acct-Input-Packets (47)	Number of packets received from client.
Acct-Output-Packets (48)	Number of packets transmitted to client.
Acct-Terminate-Cause (49)	1=User-Request, 2=Lost-Carrier, 4=Idle-Timeout, 5=Session-Timeout, 11=NAS-Reboot
Acct-Input-Gigawords (52)	Number of times the Acct-Input-Octets counter has wrapped around.
Acct-Output-Gigawords (53)	Number of times the Acct-Output-Octets counter has wrapped around.
NAS-Port-Type (61)	19=Wireless-IEEE-802.11
Message-Authenticator (80)	Is always included in Access-Request. If present in Access-Accept, Access-Challenge or



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Attribute	Description
	Access-reject chilli will validate that the Message-Authenticator is correct.
Acct-Interim-Interval (85)	If present in Access-Accept chilli will generate interim accounting records with the specified interval (seconds).
MS-MPPE-Send-Key (311,16)	Used for WPA
MS-MPPE-Recv-Key (311,17)	Used for WPA

## WISPr Attributes

Attribute	Description
WISPr-Location-ID (14122, 1)	Location ID is set to the radiuslocationid option if present. Should be in the format: isocc=, cc≤E.164_Country_Code>, ac≤E.164_Area_Code>, network≤ssid/ZONE>
WISPr-Location-Name (14122, 2)	Location Name is set to the radiuslocationname option if present. Should be in the format: ,
WISPr-Logoff-URL (14122, 3)	Included in Access-Request to notify the operator of the log off URL. Defaults to " http://uamlisten:uamport/logoff".
WISPr-Redirection-URL (14122, 4)	If present the client will be redirected to this URL once authenticated. This URL should include a link to WISPr-Logoff-URL in order to enable the client to log off.
WISPr-Bandwidth-Max-Up (14122, 7)	Maximum transmit rate (b/s). Limits the bandwidth of the connection. Note that this attribute is specified in bits per second.
WISPr-Bandwidth-Max-Down (14122, 8)	Maximum receive rate (b/s). Limits the bandwidth of the connection. Note that this attribute is specified in bits per second.
WISPr-Session-Terminate-Time (14122, 9)	The time when the user should be disconnected in ISO 8601 format (YYYY-MM-DDThh:mm:ssTZD). If TZD is not specified local time is assumed. For example a disconnect on 18 December 2001 at 7:00 PM UTC would be specified as 2001-12-18T19:00:00+00:00.

## ChilliSpot Attributes

Attribute	Description
ChilliSpot-Max-Input-Octets (14559, 1)	Maximum number of octets the user is allowed to transmit. After this limit has been reached the user will be disconnected.
ChilliSpot-Max-Output-Octets (14559, 2)	Maximum number of octets the user is allowed to receive. After this limit has been reached the user will be disconnected.
ChilliSpot-Max-Total-Octets (14559, 3)	Maximum total octets the user is allowed to send or receive. After this limit has been reached the user will be

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Attribute	Description
	disconnected.
ChilliSpot-Bandwidth-Max-Up (14559, 4)	Maximum bandwidth up
ChilliSpot-Bandwidth-Max-Down (14559, 5)	Maximum bandwidth down
ChilliSpot-Config (14559, 6)	Configurations passed between chilli and back-end as name value pairs
ChilliSpot-Lang (14559, 7)	Language selected in user interface
ChilliSpot-Version (14559, 8)	Version of Chilli sending this AccessRequest