8.2.2.3 Manual configuration (Move)

A user can change the classification of an unauthorized AP that is detected by the WI or that is classified according to the rule configured by a user.

Configuration using CLI

1) Go to configure → wi → device configuration mode of CLI.

```
WEC8500# configure terminal
WEC8500/configure# wi
WEC8500/configure/wi# device
WEC8500/configure/wi/device#
```

By using the MAC of an unauthorized AP to change, execute the move command.

- move [MAC] [FROM] [TO]

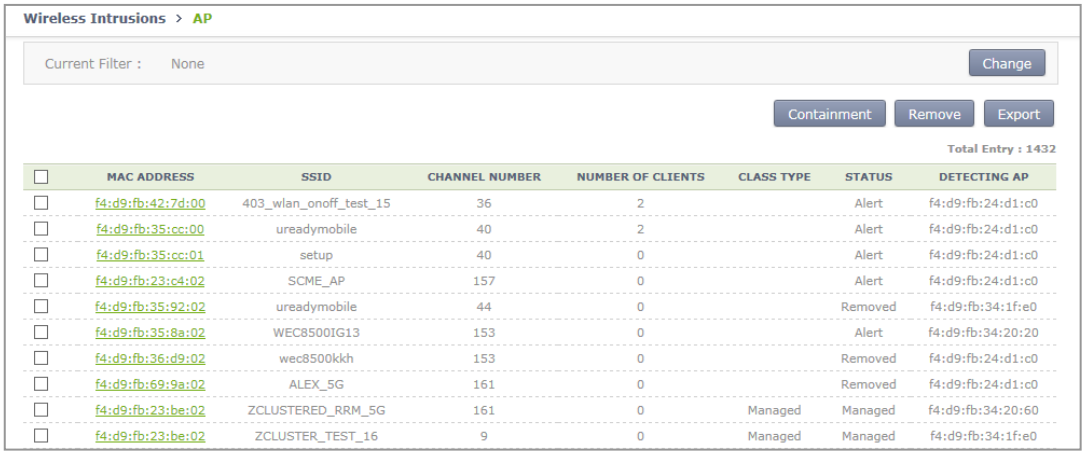
Parameter	Description
MAC	MAC address of a detected AP
FROM	Previous classification of a MAC
TO	Classification to change

2) To check the changed configuration, use the following command.
   - show wi device ap list managed
   - show wi device ap list unmanaged

Configuration using Web UI

In the menu bar of **<WEC Main window>**, select **<Monitor>** and then select the **<Wireless Intrusion>** → **<AP>** menu in the sub-menus. And when the AP list is displayed, select one out of the AP list to go to the detail view screen. In the detail view screen, operator can manually change the classification of an AP by using the top down menu of MOVE CLASSIFICATION MANUALLY.

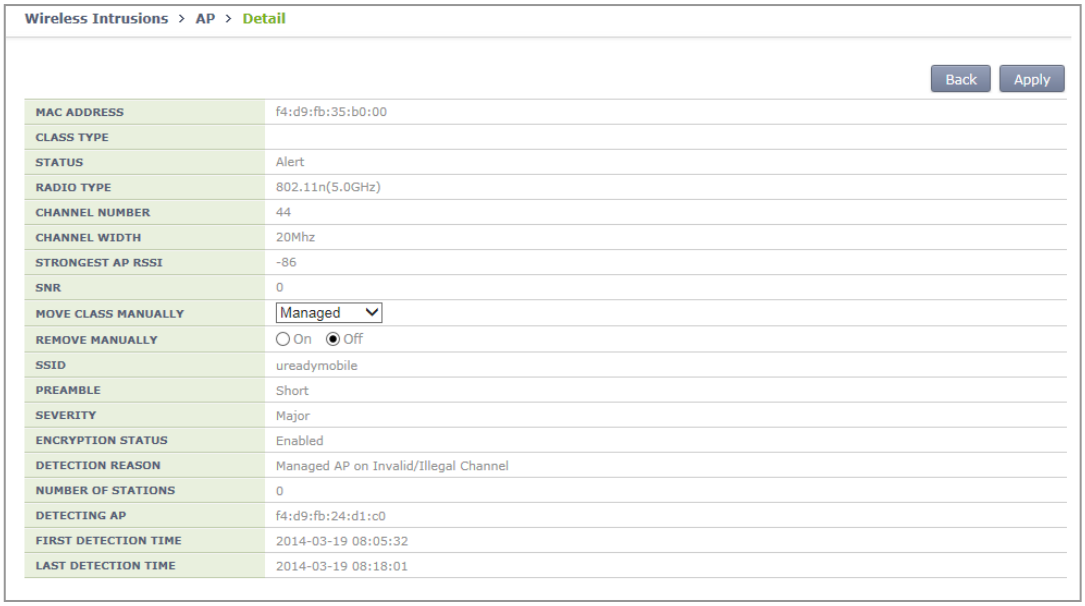
1) In the AP list screen, go to the detail view screen by clicking a MAC address.



MAC ADDRESS	SSID	CHANNEL NUMBER	NUMBER OF CLIENTS	CLASS TYPE	STATUS	DETECTING AP
f4:d9:fb:42:7d:00	403_wlan_onoff_test_15	36	2		Alert	f4:d9:fb:24:d1:c0
f4:d9:fb:35:cc:00	ureadymobile	40	2		Alert	f4:d9:fb:24:d1:c0
f4:d9:fb:35:cc:01	setup	40	0		Alert	f4:d9:fb:24:d1:c0
f4:d9:fb:23:c4:02	SCME_AP	157	0		Alert	f4:d9:fb:24:d1:c0
f4:d9:fb:35:92:02	ureadymobile	44	0		Removed	f4:d9:fb:34:1f:e0
f4:d9:fb:35:8a:02	WEC8500IG13	153	0		Alert	f4:d9:fb:34:20:20
f4:d9:fb:36:d9:02	wec8500kkh	153	0		Removed	f4:d9:fb:24:d1:c0
f4:d9:fb:69:9a:02	ALEX_5G	161	0		Removed	f4:d9:fb:24:d1:c0
f4:d9:fb:23:be:02	ZCLUSTERED_RRM_5G	161	0	Managed	Managed	f4:d9:fb:34:20:60
f4:d9:fb:23:be:02	ZCLUSTER_TEST_16	9	0	Managed	Managed	f4:d9:fb:34:1f:e0

Figure 165. List Window to Manually Change Classification

2) In the AP detail screen, change the classification and click Apply, then the configuration is changed.



MAC ADDRESS	f4:d9:fb:35:b0:00
CLASS TYPE	
STATUS	Alert
RADIO TYPE	802.11n(5.0GHz)
CHANNEL NUMBER	44
CHANNEL WIDTH	20Mhz
STRONGEST AP RSSI	-86
SNR	0
MOVE CLASS MANUALLY	Managed
REMOVE MANUALLY	On Off
SSID	ureadymobile
PREAMBLE	Short
SEVERITY	Major
ENCRYPTION STATUS	Enabled
DETECTION REASON	Managed AP on Invalid/Illegal Channel
NUMBER OF STATIONS	0
DETECTING AP	f4:d9:fb:24:d1:c0
FIRST DETECTION TIME	2014-03-19 08:05:32
LAST DETECTION TIME	2014-03-19 08:18:01

Figure 166. Classification Change Window in AP Detail Screen

8.2.2.4 Manual configuration (Remove)

A user can manually change the status of an unauthorized AP to ‘Removed’, that is detected by the WIDS or that is classified according to the rule configured by a user.

Configuration using CLI

1) Go to configure → wi → device configuration mode of CLI.

```
WEC8500# configure terminal
WEC8500/configure# wi
WEC8500/configure/wi# device
WEC8500/configure/wi/device#
```

2) By using the MAC of an unauthorized AP to change, execute the remove command.
   - remove [MAC]

Parameter	Description
MAC	MAC address of an unauthorized AP

3) To check the changed configuration, use the following command.
   - show wi device ap list removed

Configuration using Web UI

In the menu bar of <**WEC Main window**>, select <**Monitor**> and then select the <**Wireless Intrusion**> → <**AP**> menu in the sub-menus. And when the AP list is displayed, check a desired MAC in the list and click the <**Remove**> button to manually remove an AP. In addition, after going into the detail view screen by selecting one out of the AP list, operator can also remove an AP by changing the REMOVE MANUALLY option to On.

1) In the AP list screen, operator can change the status of several APs to ‘Removed’ by clicking <**Remove**> button.

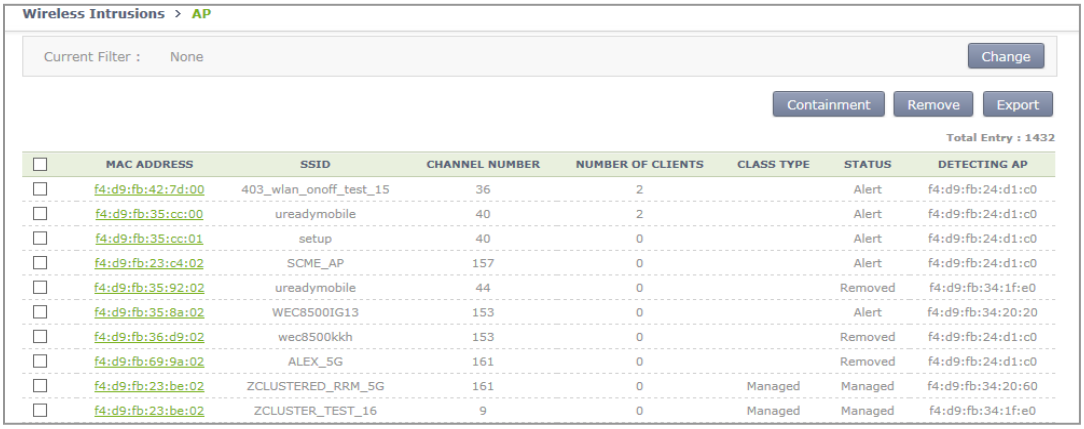


Figure 167. List Window to Manually Remove

2) If you change the setting of REMOVE MANUALLY to ‘On’ in the AP detail screen and click Apply, the AP status is changed to ‘Removed’.

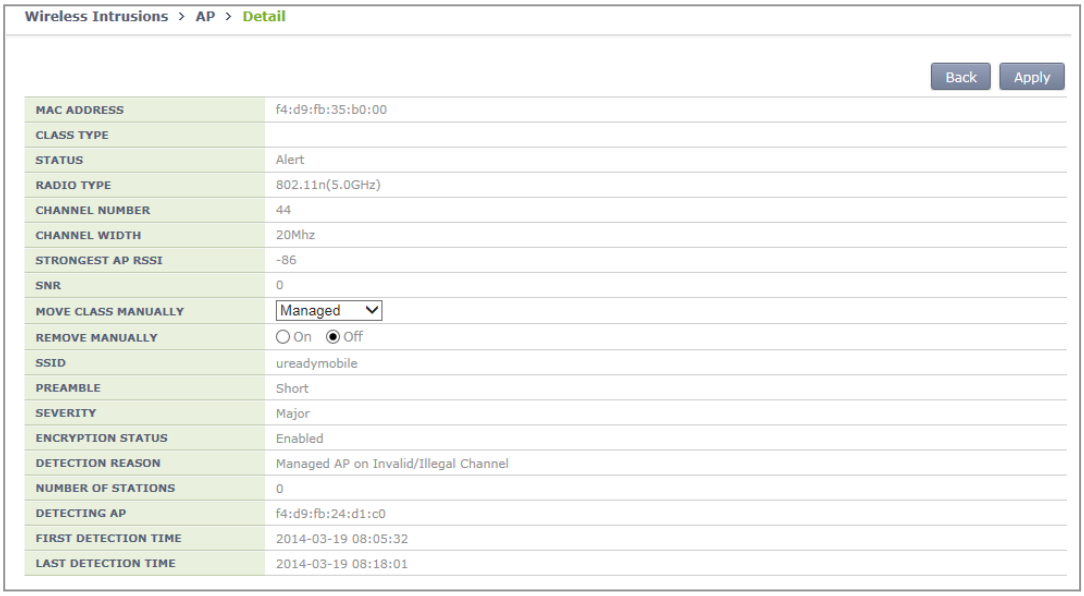


Figure 168. Manual Remove Change Window in AP Detail Screen

8.2.2.5 Unauthorized AP detection option

Operator can enable or disable the AP detection option pre-defined in the system.

Configuration using CLI

1) Go to configure → wi → device → ap configuration mode.

```
WEC8500# configure terminal
WEC8500/configure# wi
WEC8500/configure/wi# device
WEC8500/configure/wi/device# ap
WEC8500/configure/wi/device/ap#
```

2) Using the following command, configure the unauthorized AP detection option.
   - [OPTION] [NOTI_TYPE]

Parameter	Description
OPTION	Unauthorized AP detection option
NOTI_TYPE	Event save option - notify: Notify the state with alarm - detect: Save the state with sys log

The description of OPTION parameter is as follows:

Parameter	Description
ap-blacklist-check	Allocates Rogue ID = 101 by checking a rogue included in the black list.
managed_ssid_invalid_security	Allocates Rogue ID = 102 for an AP that uses a managed SSID and its managed client is in the association status.
fakeap-beacon-on-invalid-channel	Allocates rogue ID = 103 for an AP whose UIC is invalid and that uses a SSID that is not in the ssid white list among the APs that use a managed MAC.
fakeap-beacon-without-ssid	Allocates Rogue ID = 104 for an AP whose UIC is invalid and its SSID is hidden among the APs that use a managed MAC.
fakeap-managed-ssid	Allocates Rogue ID = 105 for an AP whose UIC is invalid and its channel is not in the channel validation list among the APs that use a managed MAC.
illegal-channel	Allocates Rogue ID = 106 if an AP uses a channel that is not in the channel validation list among detected APs.
managedap-invalid-ssid	Allocates Rogue ID = 107 for an AP that uses a SSID that is not in the ssid-whitelist among the APs that use a managed MAC and its UIC is valid.
unknownap-managed-ssid-withauth-client	Allocates Rogue ID = 108 by checking the association status between an unauthorized AP and a managed client.

3) To check the changed configuration, use the following command.
   - show wi device ap current-config

Configuration using Web UI

In the menu bar of **<WEC Main window>**, select **<Configuration>** and then select the **<Wireless Intrusion>** → **<Policy>** → **<Static Rule>** menu in the sub-menus. And then, operator can change the setting by selecting <AP> at the upper tab and clicking Apply.

In the configuration screen, operator can check Option and click Apply for configuration.

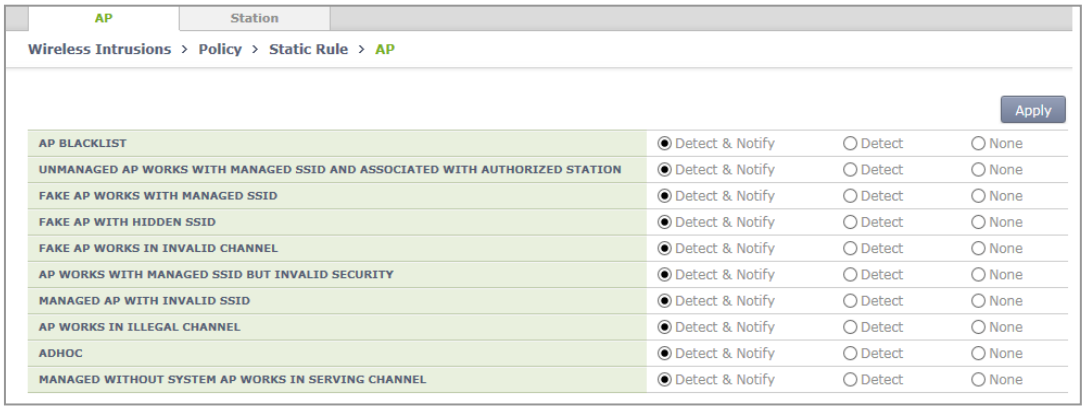


Figure 169. Configuration Window for Unauthorized AP Detection Option

8.2.2.6 Unauthorized client detection option

Operator can enable or disable the client detection option pre-defined in the system.

Configuration using CLI

1) Go to configure → wi → device → client configuration mode.

```
WEC8500# configure terminal
WEC8500/configure# wi
WEC8500/configure/wi# rogue
WEC8500/configure/wi/device# client
WEC8500/configure/wi/device /client#
```

2) Configure the unauthorized client detection option by using the following command.
   - [OPTION] [NOTI_TYPE]

Parameter	Description
OPTION	Rogue Client detect option
NOTI_TYPE	Event save option - notify: Notify the state with alarm - detect: Save the state with sys log

The description of OPTION parameter is as follows:

Parameter	Description
assoc-fail-det	Classifies a client that exceeds the association fail threshold as an unauthorized client.
auth-fail-det	Classifies a client that exceeds the authentication fail threshold as an unauthorized client.
auth-request-det	Classifies a client that exceeds the authentication request threshold as an unauthorized client.
deauth-request-det	Classifies a client that exceeds the de-authentication request threshold as an unauthorized client.
exclusion-list-check	Classifies a MAC that does not exist in the client blacklist as an unauthorized client.
oneXauth-fail-det	Classifies a client that exceeds the 802.1X authentication fail threshold as an unauthorized client.
oui-list-check	Classifies an OUI that does not exist in the OUI list white list as an unauthorized client.
probe-request-det	Classifies a client that exceeds the probe request threshold as an unauthorized client.
webauth-fail-det	Classifies a client that exceeds the WEB authentication fail threshold as an unauthorized client.

3) To check the changed configuration, use the following command.
   - show wi device client current-config

Configuration using Web UI

In the menu bar of **<WEC Main window>**, select **<Configuration>** and then select the **<Wireless Intrusion>** → **<Policy>** → **<Static Rule>** menu in the sub-menus. And then, operator can change the setting by selecting <Station> at the upper tab and clicking Apply.

In the configuration screen, operator can check Option and click Apply for configuration.

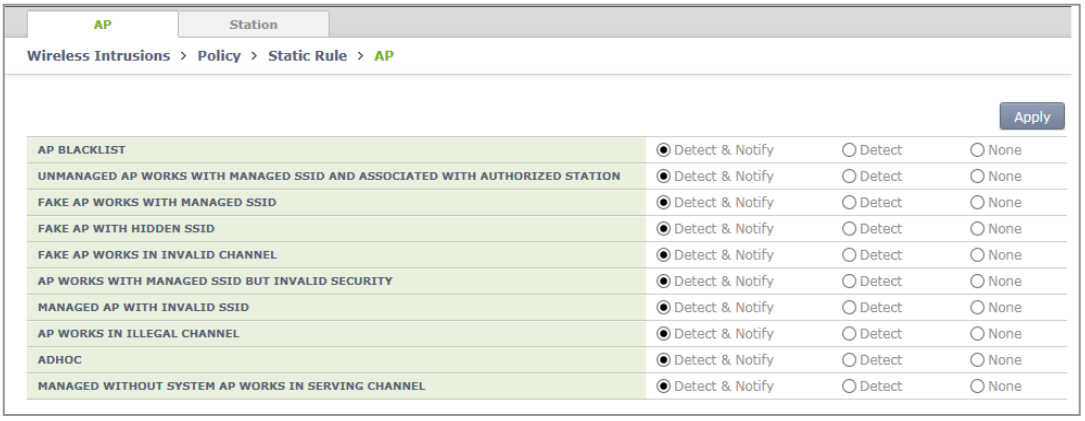


Figure 170. Configuration Window for Unauthorized Station Detection Option

8.2.2.7 Unauthorized Channel Validation Configuration

The unauthorized channel validation function helps an operator detect an AP that uses an unauthorized channel other than configured channels. The configuration procedure is as follows:

Configuration using CLI

1) Go to configure → wi → channel-validation configuration mode of CLI.

```
WEC8500# configure terminal
WEC8500/configure# wi
WEC8500/configure/wi# channel-validation
```

2) Enable the unauthorized channel validation function.

```
WEC8500/configure/wi/channel-validation# enable
```

3) Configure an authorized channel.
   - add [CHANNEL]

Parameter	Description
CHANNEL	Authorized channel number (e.g. add 2, 3, 4)

4) To check the changed configuration, execute the following command.
   - show wi current-config

Configuration using Web UI

In the menu bar of **<WEC Main window>**, select **<Configuration>** and then select the **<Wireless Intrusion>** → **<Channel Validation>** menu in the sub-menus. And then, operator can configure the SERVICE STATE and Valid Channel List in the screen.

Operator can change configuration after changing the SERVICE STATE and Valid Channel List and clicking Apply.

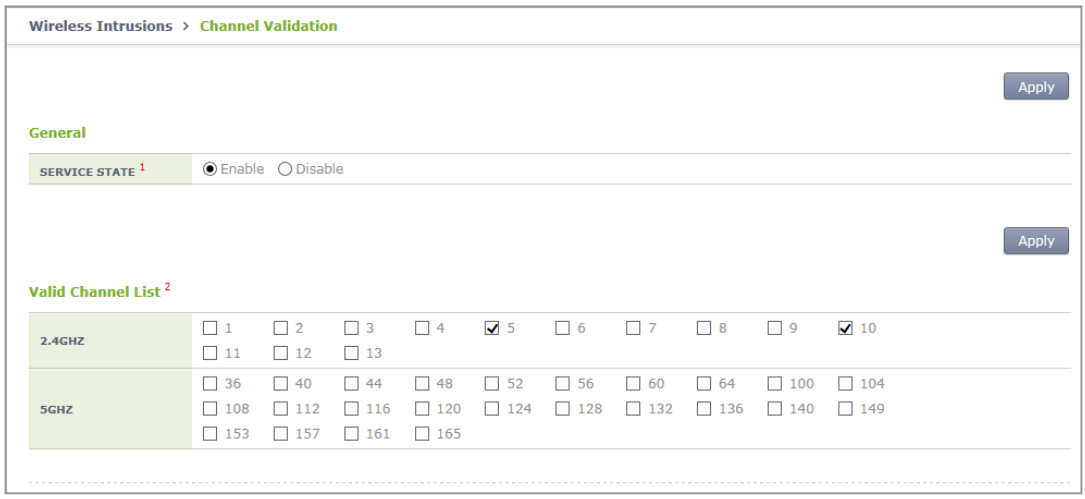


Figure 171. Configuration Window for Channel Validation

8.2.2.8 Configuring and Searching Black/White List

Operator can configure classification to distinguish authorized and unauthorized APs/stations. The administrator configurable lists include <AP black-list, Station black-list, Managed OUI, Managed/Neighbor AP>. The <Managed AP, Managed Station, Managed SSID> are automatically configured and can be used only for search.

Configuration using CLI

1) Go to the configure → wids configuration mode of CLI.

```
WEC8500# configure terminal
WEC8500/configure# wi
```

2) Configure the AP black-list.
   - ap-blacklist [MAC]

Parameter	Description
MAC	MAC address that will be used as AP black-list

3) Configure the station black-list.
   - client-black-list [MAC]

Parameter	Description
MAC	MAC address that will be used as a black-list of the station

4) Configure the Managed Organizationally Unique Identifier (OUI).
   - oui-whitelist [OUI]

Parameter	Description
OUI	First 3 bytes of station MAC address

5) Configure the Managed/Neighbor AP.
   - Managed [MAC] [TYPE]

Parameter	Description
MAC	AP MAC address of Managed/Neighbor AP
TYPE	- Managed: Indicates that the address is located internally during configuration - Neighbor: Indicates that the address is located externally during configuration

6) To check the changed configuration, execute the following command.
   - show wi lists managed-ap
   - show wi lists ap-blacklist
   - show wi lists managed-stat
   - show wi lists client-blacklist
   - show wi lists managed ssid
   - show wi lists oui-list
   - show wi lists neighbor-ap

Configuration using Web UI

In the menu bar of **<WEC Main window>**, select **<Configuration>** and then select the **<Wireless Intrusion>** → **<Classifiation>** menu in the sub-menus. And then, operator can configure and search by using the upper tab in the screen.

1) In the [AP Blacklist] tab, operator can add an AP blacklist by entering a MAC and click Add. Operator can also delete it by using Delete.

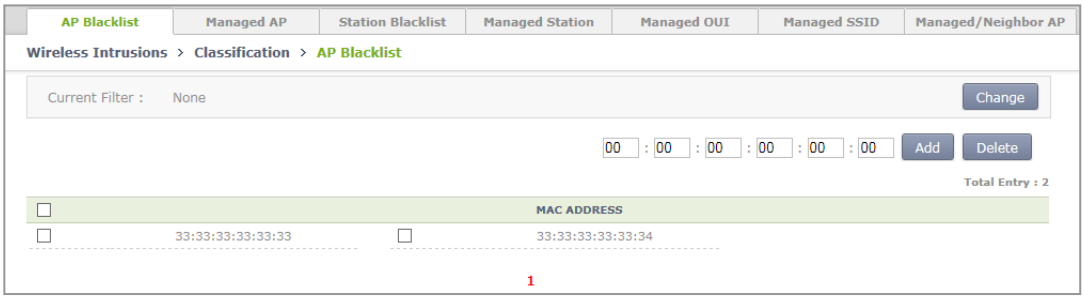


Figure 172. AP blacklist Configuration Window

2) In the [Managed AP] tab, operator can search for a Managed AP.

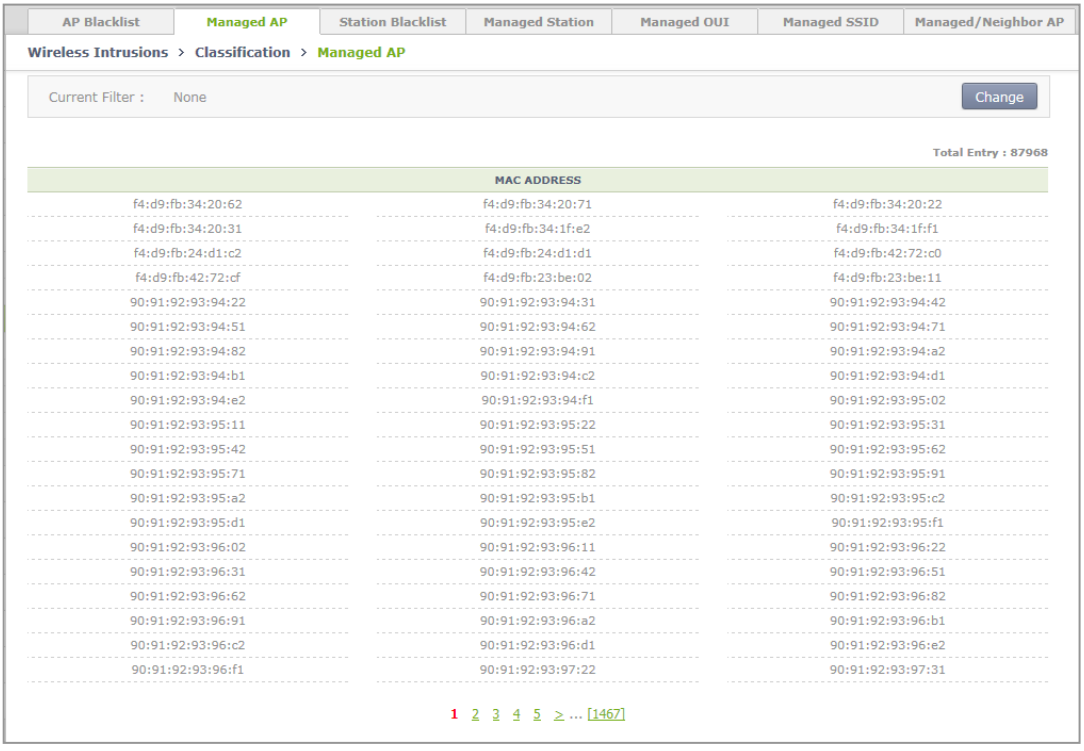


Figure 173. Managed AP Window

3) In the [Station Blacklist] tab, operator can add a station blacklist by entering a MAC and click Add. Operator can also delete it by using Delete.

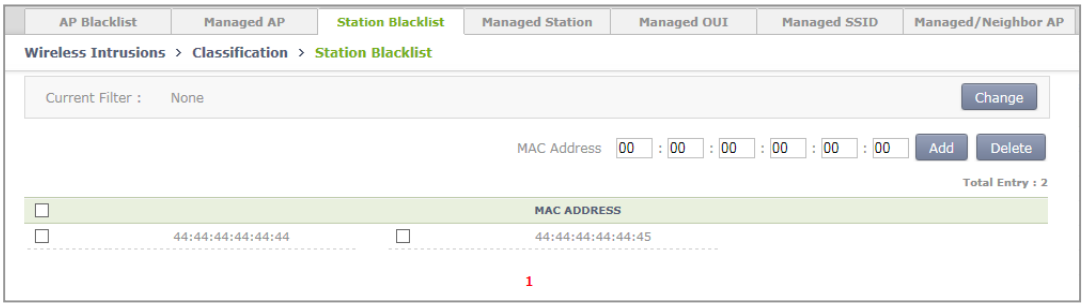


Figure 174. Station blacklist Search/Configuration Window

4) In the [Managed Station] tab, operator can search Managed Station.

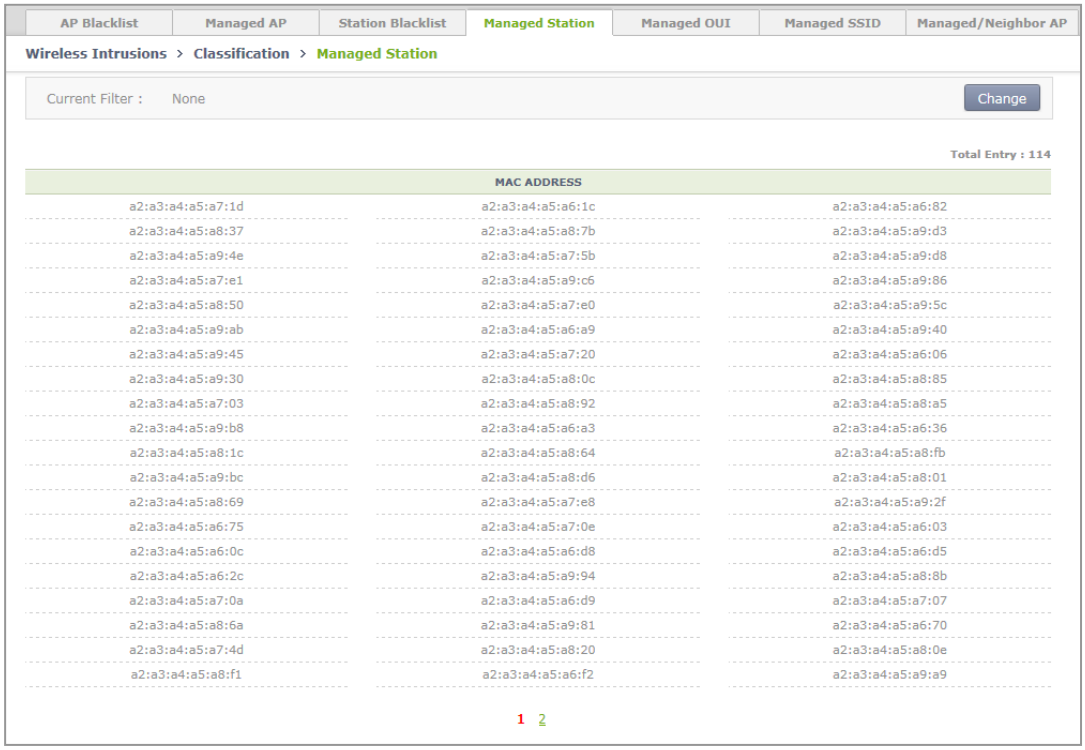
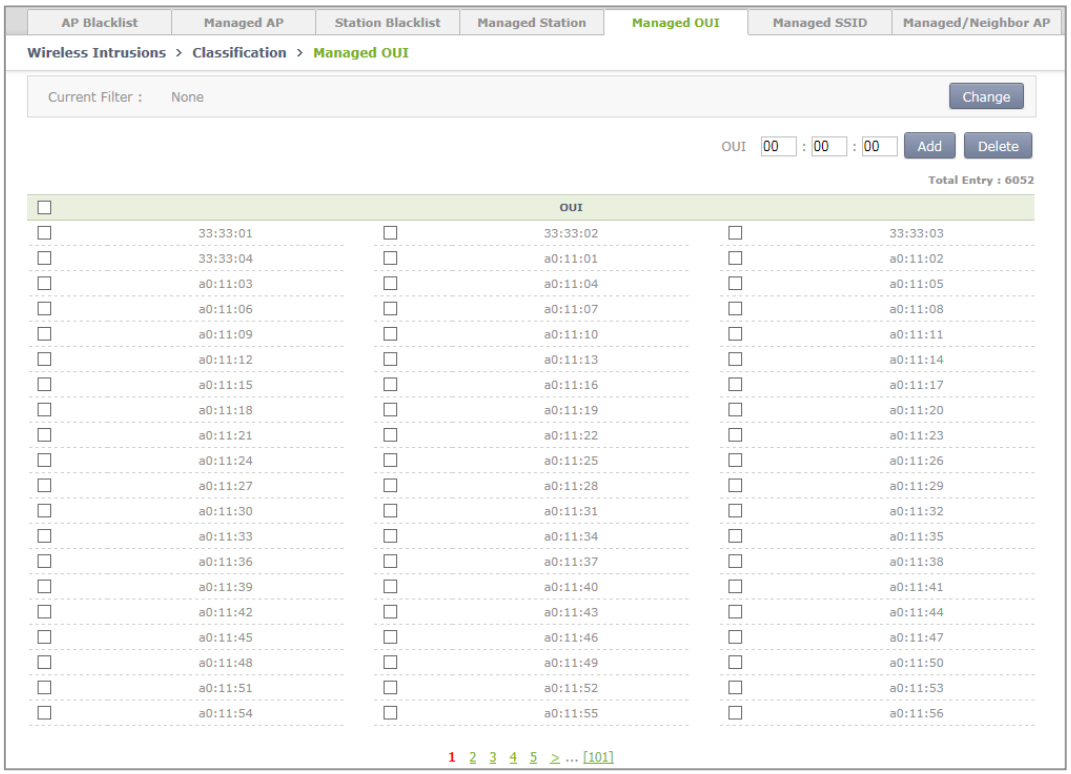


Figure 175. Managed Station Search Window

5) In the [Managed OUI] tab, operator can add a Managed OUI by entering an OUI and click Add. Operator can also delete it by using Delete.



6) In the [Managed SSID] tab, you can check the SSID that the WLAN is using.

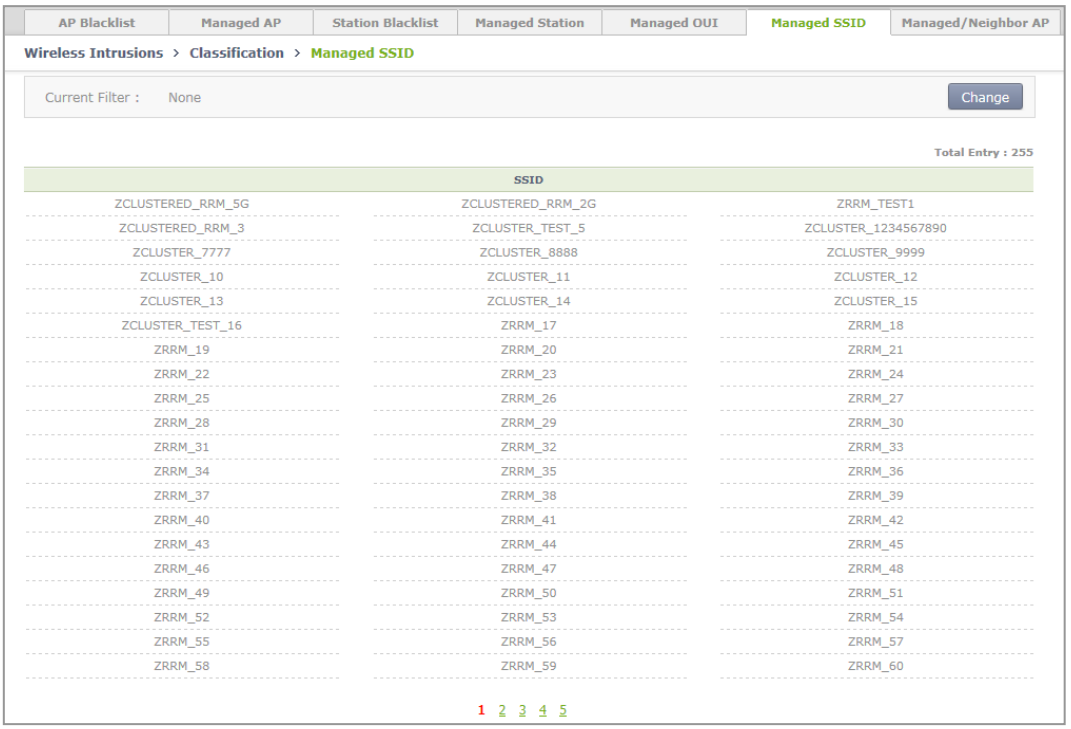


Figure 176. Managed SSID Window

7) If you click Add in the [Managed/Neighbor AP] tab, operator can go to the Managed/ Neighbor AP list addition screen and can add a Managed/Neighbor AP list.
Operator can also delete it by using Delete.
- [Managed/Neighbor AP] tab main screen

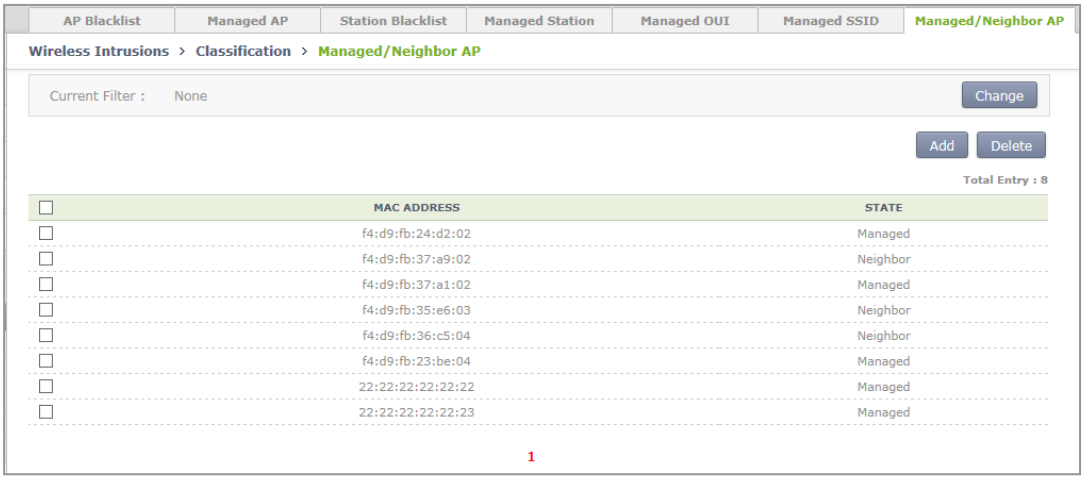


Figure 177. Managed/Neighbor AP Search/Configuration Window

- Managed/Neighbor AP list addition screen

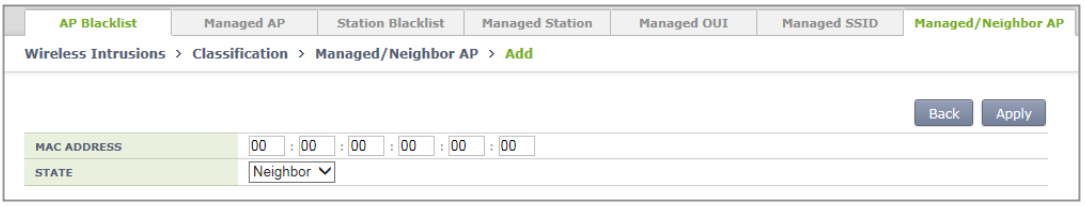


Figure 178. Managed/Neighbor AP List Addition Window

8.2.2.9 Station Allow Limit

The WIDS counts the number of frames and number of authentication failures to distinguish a station that generates too many management frames in a network or that is continuously failed for authentication. A threshold value is defined for the count and a station is recognized as an unauthorized station if the count exceeds the threshold.

Configuration using CLI

1) Go to the configure → wi → device → client configuration mode.

```
WEC8500# configure terminal
WEC8500/configure# wi
WEC8500/configure/wi# device
WEC8500/configure/wi/device# client
WEC8500/configure/wi/device/client#
```

2) Configure a threshold.
   - allowed-limit [OPTION] [COUNT]

Parameter	Description
OPTION	- 80211-auth-req: Authentication requests threshold per second - 80211-probe-req: Probe requests threshold per second - 80211-deauth-req: De-authentication requests threshold per second - 80211-assoc-fail: Association failures threshold per second - 80211-auth-fail: Authentication failures threshold per second - 8021x-auth-fail: 802.1x authentication failures threshold per WIDS interval - web-auth-fail: Web authentication failures threshold that occurs continuously
COUNT	Threshold value of [OPTION] ranging from 3 to 20

Configuration using Web UI

In the menu bar of <**WEC Main window**>, select <**Configuration**> and then select the <**Wireless Intrusion**> → <**Station Allow Limit**> menu in the sub-menus. And then, enter a threshold value and click Apply to configure the value in the screen.

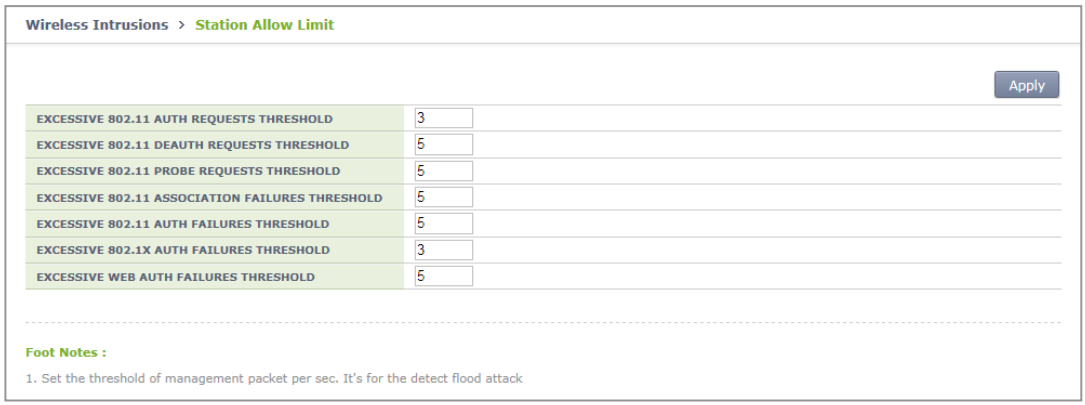


Figure 179. Station Allowed Limit Configuration Window

8.2.3 Enabling Blocking Function

The setting of enabling the blocking function is as follows:

Configuration using CLI

1) Go to configure mode of CLI.

```
WEC8500# configure terminal
```

2) Enable the blocking function.

```
WEC8500/configure# wids containment enable
```

3) To check the configuration information, execute the following command.
   - show wids containment current-config

Configuration using Web UI

In the menu bar of <**WEC Main window**>, select <**Configuration**> and then select <**Wireless Intrusion**> → <**Containment**> → <**General**> menus in the sub-menus.

Select Enable and Disable and press Apply to activate and deactivate the wireless intrusion blocking policy.

Figure 180. Wireless Intrusion Containment General Configuration Window

8.2.4 Blocking

The W-EP WLAN system performs blocking to the detected AP and the wireless device. The method for blocking is classified as follows:

Blocking Method	Description
Manual blocking	The administrator performs blocking manually to APs or UEs.
Automatic blocking	APs or UEs are automatically blocked by the policy defined by the administrator.

8.2.4.1 Configuring Manual Blocking

To configure manual blocking, execute the command as follows:

Configuration using CLI

1) Go to configure → wids → containment configuration mode of CLI.

```
WEC8500# configure terminal
WEC8500/configure# wids
WEC8500/configure/wids# containment
WEC8500/configure/wids/containment#
```

2) Configure manual blocking.
   - manual[TARGET] enable[MAC]

Parameter	Description
TARGET	Select either AP or station which is the target for manual blocking.
MAC	MAC address of the target for manual blocking

Configuration using Web UI

In the menu bar of **<WEC Main window>**, select **<Monitor>** and then select **<Wireless Intrusion>** menu in the sub-menus.

Select the target and perform containment to perform manual blocking.

1) After selecting an AP in the AP list, possible to block by using the containment.

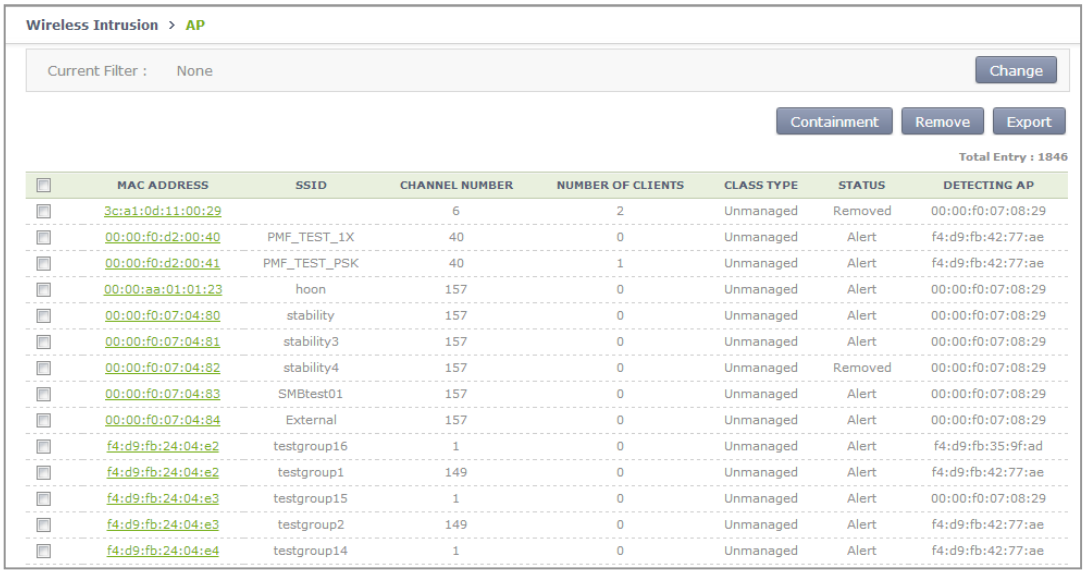


Figure 181. List Window for Blocking AP

2) After selecting a station in the station list, possible to block by using the containment.

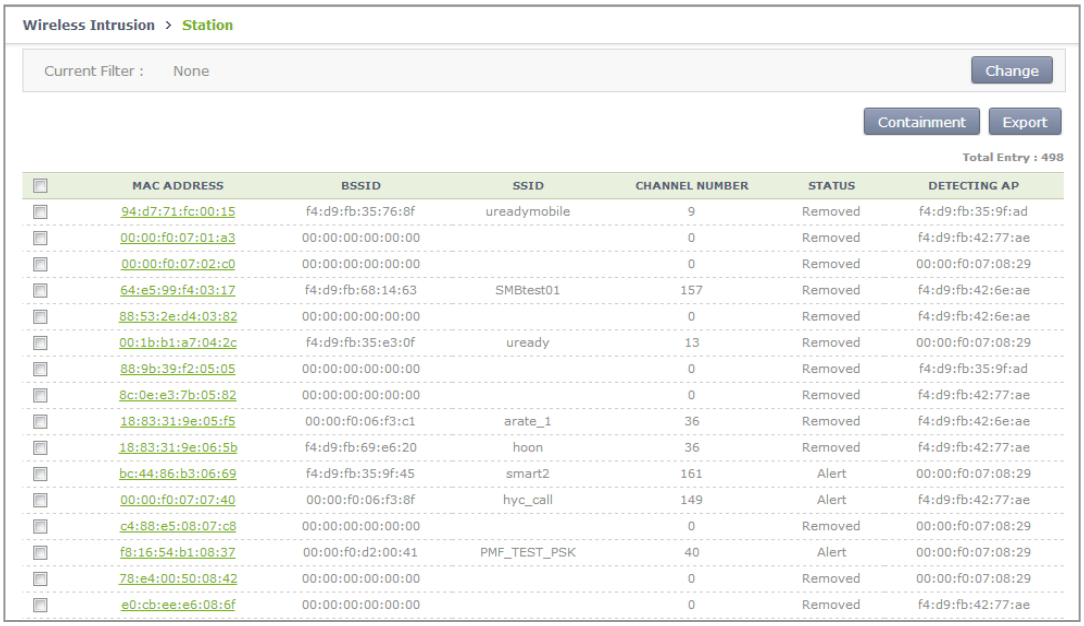


Figure 182. List Window for Blocking Station

8.2.4.2 Configuring Automatic Blocking

To configure automatic blocking, execute the command as follows:

Configuration using CLI

1) Go to configure → wids → containment configuration mode of CLI.

```
WEC8500# configure terminal
WEC8500/configure# wids
WEC8500/configure/wids# containment
WEC8500/configure/wids/containment#
```

2) Configure automatic blocking.
   - auto[OPTION]

   The description of OPTION parameter is as follows:

Parameter	Description
adhoc-connection	If adhoc is detected, it is automatically blocked.
managed-station-associated-with-friendly-external	If the managed station and the neighbor AP are connected, it is automatically blocked.
rogue-ap-with-auth-station	If the managed station and the unmanaged AP are connected, it is automatically blocked.

Parameter	Description
rogue-ap-with-managed-ssid	If the honeypot is detected, it is automatically blocked.
unmanaged-ap	If the unmanaged AP is detected, it is automatically blocked.

3) To check the configuration of automatic blocking, it is possible to use the following command:
   - show wids containment current-config

Configuration using Web UI

In the menu bar of <**WEC Main window**>, select <**Configuration**> and then select <**Wireless Intrusion**> → <**Containment**> menus in the sub-menus.

Select the target and press Apply to configure automatic blocking.

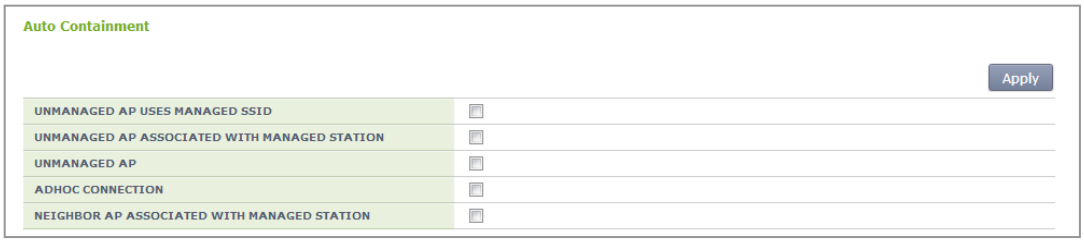


Figure 183. Automatic Blocking Configuration Window

8.3 Captive Portal

The W-EP WLAN system provides the Captive Portal function. A guest user can receive a normal service after connected to a specific WLAN (SSID) and going through user authentication.

8.3.1 Configuring Guest Authentication

Configuration using CLI

To configure guest authentication, go to the Configure mode and execute the command.

1) Go to configure → security → captive-portal configuration mode of CLI.

```
APC# configure terminal
APC/configure# security
APC/configure/security# captive-portal
APC/configure/security/captive-portal#
```

2) The command to add a guest user is as follows:
   - guest add [ID][PASSWD][START_TIME][END_TIME]

Parameter	Description
ID	Login ID of a user
PASSWD	Password
START_TIME	Start time (YYYY-MM-DD:HH:MM:SS format)
END_TIME	End time (YYYY-MM-DD:HH:MM:SS format)

3) The command to add a guest user is as follows:
   - guest delete [ID]

Parameter	Description
ID	User ID

4) To select the authentication method for a guest service, execute the command as follows:
   - auth-type[FLAG]

Parameter	Description
FLAG	Authentication method - local-only: Uses internal authentication. - radius-only: Uses the authentication of the RADIUS server. - local-radius: Uses the authentication of the RADIUS if the internal authentication is failed.

Parameter	Description
	- radius-local: Uses the internal authentication if the RADIUS server authentication is failed.

5) For RADIUS authentication, the operator can configure the primary and secondary servers by using a profile ID.
   - radius-primary [PROFILE_ID]
   - radius-secondary [PROFILE_ID]

Parameter	Description
PROFILE_ID	Profile ID

Configuration using Web UI

In the menu bar of <**WEC Main window**>, select <**Configuration**> and then select <**Security**> → <**CaptivePortal**> → <**Guest Users**> menus in the sub-menus.

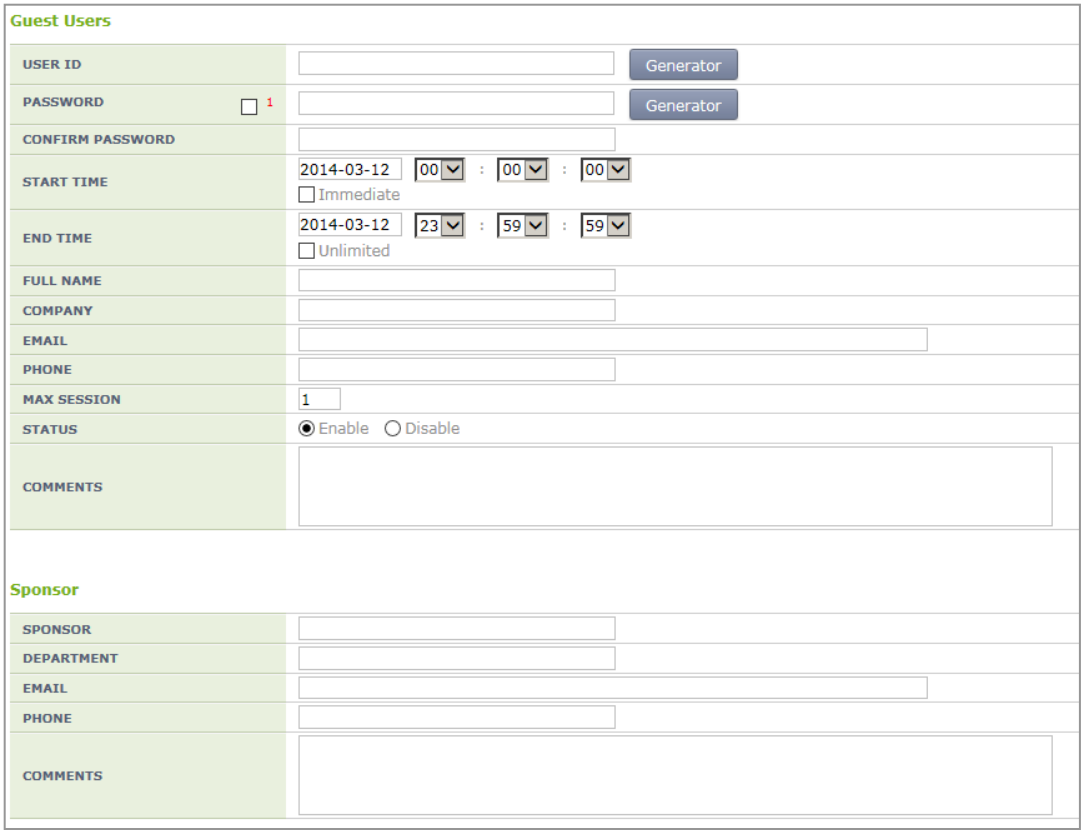


Figure 184. Guest User Configuration Window

The operator can check and delete a guest created in the <Guest Users> menu.

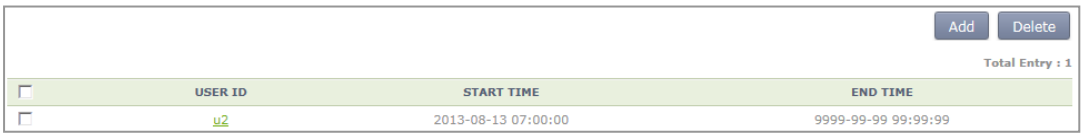


Figure 185. Guest User List Window

In the **<Guest Users>** menu, the operator can select Auth Type and also PRIMARY RADIUS and SECONDARY RADIUS servers.

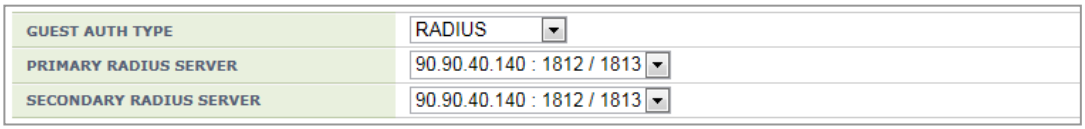


Figure 186. Guest Auth Configuration Window

8.3.2 Configuring Guest ACL

To operate the captive portal services, redirection must be basically performed and if a drop occurs by the Pre-Auth ACL of the WLAN, the redirection is performed.
Accordingly, the proper configuration of the ACL for guests is necessary depending on types of captive portal services.

For the guest ACL, the DNS permit rule, and the permit rule for the web service address used by the captive portal are basically necessary and the permit rule of the address of the external web server is additionally necessary if the external web server is used.

Configuration using CLI

To configure the guest ACL, execute the following command:

1) Go to configure → fqm-mode configuration mode of CLI.

```
WEC8500# configure terminal
WEC8500/configure# fqm-mode
```

2) Configure an access list.

```
WEC8500/configure/fqm-mode#
WEC8500/configure/fqm-mode# access-list ip guest_acl permit seq 1 udp
any eq * any eq 53 os-aware *
WEC8500/configure/fqm-mode#  access-list ip guest_acl permit seq 2 tcp
192.168.20.10 255.255.255.255 eq 80 any eq * os-aware *
WEC8500/configure/fqm-mode#  access-list ip guest_acl permit seq 3 tcp
any eq *  192.168.20.10 255.255.255.255 eq 80 os-aware *
```

```
WEC8500/configure/fqm-mode#  access-list ip guest_acl permit seq 4 tcp
90.90.100.120 255.255.255.255 eq 80 any eq * os-aware *
WEC8500/configure/fqm-mode#  access-list ip guest_acl permit seq 5 tcp
any eq *  90.90.100.120 255.255.255.255 eq 80 os-aware *
WEC8500/configure/fqm-mode#  access-list ip guest_acl permit seq 6 udp
any eq * any eq * os-aware *
WEC8500/configure/fqm-mode#  access-list ip guest_acl permit seq 7 tcp
192.168.10.10 255.255.255.255 eq 80 any eq * os-aware *
WEC8500/configure/fqm-mode#  access-list ip guest_acl permit seq 8 tcp
any eq *  192.168.10.10 255.255.255.255 eq 80 os-aware *
WEC8500/configure/fqm-mode#  access-list ip guest_acl permit seq 10 tcp
192.168.0.0 255.255.0.0 eq * any eq 443 os-aware *
```

Configuration using Web UI

In the menu bar of <**WEC Main window**>, select <**Configuration**> and then select the <**IP ACL**> menu in the <**Access Control Lists**> sub-menu of <**Security**> in the sub-menus.

Select Add on the <**IP ACL**> screen and then configure the ACL.

Figure 187. Access List Addition Window

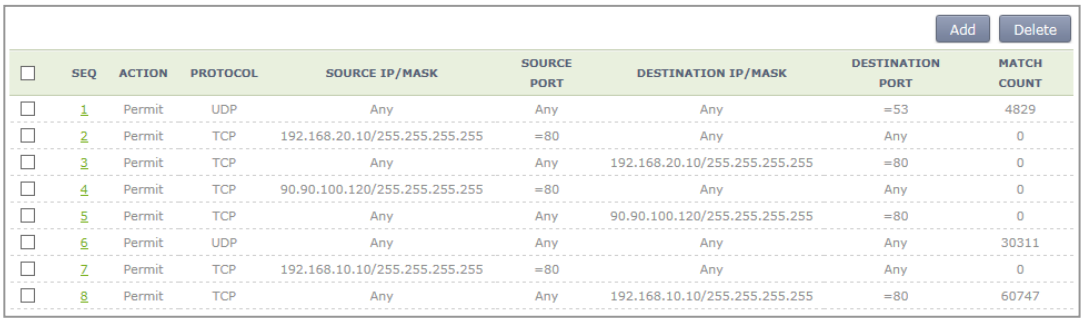


Figure 188. Access List Entry Addition Window

8.3.3 Configuring Web Authentication

To provide the web authentication service, the security L3 item of the WLAN and the web authentication of the captive portal must be configured.

Configuration using CLI

[WLAN Configuration]

To configure web authentication in the WLAN, execute the command as follows:

1) Go to configure → WLAN configuration mode of CLI.

```
WEC8500# configure terminal
WEC8500/configure# wlan 1
```

2) Configure a guest flag (default: disabled).
   - guest-flag

```
WEC8500/configure/wlan 1# guest-flag
```

3) Go to configure → WLAN → security → layer 3 configuration mode of CLI.

```
WEC8500/configure/wlan 1# security
WEC8500/configure/wlan 1/security# layer3
WEC8500/configure/wlan 1/security/layer3#
```

4) Enable the WEB authentication (default: disabled).
   - web-policy authentication

```
WEC8500/configure/wlan 1/security/layer3# web-policy authentication
```

5) Configure the Pre-Authentication ACL.
   - pre-auth-acl [ACL]

Parameter	Description
ACL	ACL applied before the guest is authenticated

6) To change the redirection of the basic captive portal configuration to another address, configure an overriding URL.
   - redirect-URL-override [URL]

Parameter	Description
URL	URL to which the guest is redirected

7) To check the configuration, use the 'show wlan security detail' command.

```
WEC8500# show wlan security detail 1
```

[Captive Portal Configuration]

1) Go to configure → security → captive-portal configuration mode of CLI.

```
WEC8500# configure terminal
WEC8500/configure# security
WEC8500/configure/security# captive-portal
WEC8500/configure/security/captive-portal#
```

2) To configure the web authentication method of web authentication in the captive portal, execute the command as follows:
   - web-auth web-type [FLAG]
   - web-auth external-url [URL]

Parameter	Description
FLAG	Web Authentication Method - internal: Uses the internal authentication page. - external: Uses the authentication page of an external web server. - downloaded: Uses the authentication page downloaded from the system. - customized: Uses the authentication page created through configuration.
URL	Address of an external authentication server

3) To configure the operation after authentication, execute the command as follows:
   - web-auth after-auth [FLAG]
   - web-auth redirect-url [URL]

Parameter	Description
FLAG	Operation after authentication - redirect: Redirect to a specified URL - request: Redirect to a requested URL
URL	URL specified as the operation after authentication

4) To check the configuration, use the 'show security captive-portal web-auth' command.

```
WEC8500# show security captive-portal web-auth
```

Configuration using Web UI

In the menu bar of **<WEC Main window>**, select **<Configuration>** and then select the **<WLANs>** menu in the sub-menus. In the WLANs screen, select WLAN ID and enable the **<GUEST SERVICE>** option.

Figure 189. WLAN Guest Configuration Window

Go to the **<L3>** of the **<Security>** tab.
Enable **<WEB POLICY>** and select the Web Authentication item and then designate the ACL set in the guest ACL to **<PRE-AUTHENTICATION ACL>.**
To change a URL, enable <**OVERRIDING REDIRECT ACL**> and configure <**URL**>.

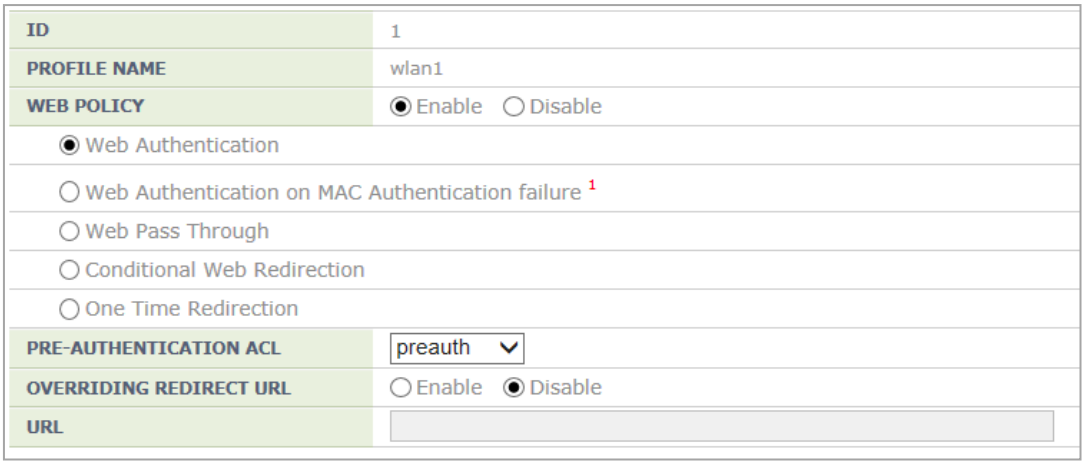


Figure 190. WLAN Web Policy Configuration Window

In the **<CaptivePortal>** → **<Web Authentication>** menu, the operator can select web authentication method. The operator can also configure Redirect as the operation after authentication.

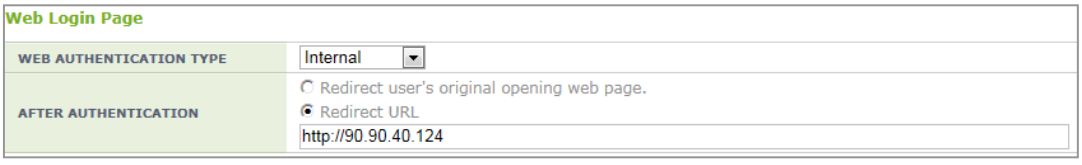


Figure 191. Web Auth Configuration Window

8.3.4 Configuring Web Authentication on MAC Authentication Failure

To provide the service of Web Authentication on MAC Authentication Failure, the MAC Authentication of security L2 of the WLAN must be enabled and the web policy of L3 and the web authentication of the captive portal must be configured.

Configuration using CLI

[WLAN Configuration]

To configure Web Authentication on MAC Authentication Failure in the WLAN, execute the command as follows:

1) Go to configure → WLAN configuration mode of CLI.

```
WEC8500# configure terminal
WEC8500/configure# wlan 1
```

2) Configure a guest flag (default: disabled).
   - guest-flag

```
WEC8500/configure/wlan 1# guest-flag
```

3) Go to configure → WLAN → security → layer 3 configuration mode of CLI.

```
WEC8500/configure/wlan 1# security
WEC8500/configure/wlan 1/security# layer3
WEC8500/configure/wlan 1/security/layer3#
```

4) Enable the WEB authentication (default: disabled).
   - web-policy authentication

```
WEC8500/configure/wlan 1/security/layer3# web-policy macAuthFailure
```

5) Configure the Pre-Authentication ACL.
   - pre-auth-acl [ACL]

Parameter	Description
ACL	ACL applied before the guest is authenticated

6) To change the redirection of the basic captive portal configuration to another address, configure an overriding URL.
   - redirect-URL-override [URL]

Parameter	Description
URL	URL to which the guest is redirected

7) To check the configuration, use the 'show wlan security detail' command.

```
WEC8500# show wlan security detail 1
```

[Captive Portal Configuration]

1) Go to configure → security → captive-portal configuration mode of CLI.

```
WEC8500# configure terminal
WEC8500/configure# security
WEC8500/configure/security# captive-portal
WEC8500/configure/security/captive-portal#
```

2) To configure the web authentication method of web authentication in the captive portal, execute the command as follows:
   - web-auth web-type [FLAG]
   - web-auth external-url [URL]

Parameter	Description
FLAG	Web Authentication Method - internal: Uses the internal authentication page. - external: Uses the authentication page of an external web server. - downloaded: Uses the authentication page downloaded from the system. - customized: Uses the authentication page created through configuration.
URL	Address of an external authentication server

3) To configure the operation after authentication, execute the command as follows:
   - web-auth after-auth [FLAG]
   - web-auth redirect-url [URL]

Parameter	Description
FLAG	Operation after authentication - redirect: Redirect to a specified URL - request: Redirect to a requested URL
URL	URL specified as the operation after authentication

4) To check the configuration, use the 'show security captive-portal web-auth' command.

```
WEC8500# show security captive-portal web-auth
```

Configuration using Web UI

In the menu bar of <**WEC Main window**>, select <**Configuration**> and then select the <**WLANs**> menu in the sub-menus. In the WLANs screen, select WLAN ID and enable the <**GUEST SERVICE**> option.

Figure 192. WLAN Guest Configuration Window

Go to the <**L2**> of the <**Security**> tab.
Enable <**MAC AUTHENTICATION**>.

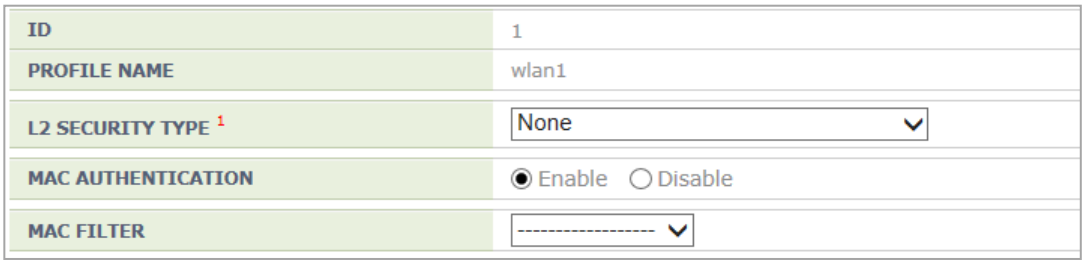


Figure 193. WLAN Layer 2 Security Configuration Window

Go to the <**L3**> of the <**Security**> tab.
Enable <**WEB POLICY**> and select the Web Authentication on MAC Authentication Failure item and then designate the ACL set in the guest ACL to <**PRE-AUTHENTICATION ACL**>.
To change a URL, enable <**OVERRIDING REDIRECT ACL**> and configure <**URL**>.

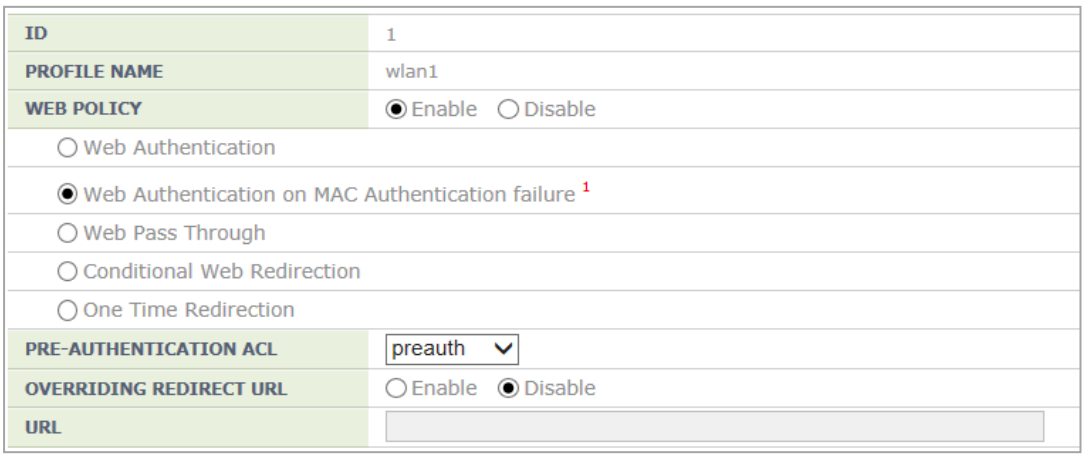


Figure 194. WLAN Web Policy Configuration Window

In the <**CaptivePortal**> → <**Web Authentication**> menu, the operator can select web authentication method. The operator can also configure Redirect as the operation after authentication.

Figure 195. Web Auth Configuration Window

8.3.5 Configuring Web Pass-through

The APC provides the web pass-through function to move to a specific address all the time when the user uses the web.

Configuration using CLI

[WLAN Configuration]

To configure web pass-through in the WLAN, execute the command as follows:

1) Go to configure → WLAN configuration mode of CLI.

```
WEC8500# configure terminal
WEC8500/configure# wlan 1
```

2) Configure a guest flag (default: disabled).
   - guest-flag

```
WEC8500/configure/wlan 1# guest-flag
```

3) Go to configure → WLAN → security → layer 3 configuration mode of CLI.

```
WEC8500/configure/wlan 1# security
WEC8500/configure/wlan 1/security# layer3
WEC8500/configure/wlan 1/security/layer3#
```

4) Enable the WEB authentication (default: disabled).
   - web-policy pass-through

```
WEC8500/configure/wlan 1/security/layer3# web-policy pass-through
```

5) Configure the Pre-Authentication ACL.
   - pre-auth-acl [ACL]

Parameter	Description
ACL	ACL for occurrence of redirection

6) To change the redirection of the basic captive portal configuration to another address, configure an overriding URL.
   - redirect-URL-override [URL]

Parameter	Description
URL	URL to which the guest is redirected

7) To check the configuration, use the 'show wlan security detail' command.

```
WEC8500# show wlan security detail 1
```

Configuration using Web UI

In the menu bar of <**WEC Main window**>, select <**Configuration**> and then select the <**WLANs**> menu in the sub-menus. In the WLANs screen, select WLAN ID and enable the <**GUEST SERVICE**> option.

Figure 196. WLAN Guest Configuration Window

Go to the <**L3**> of the <**Security**> tab.
Enable <**WEB POLICY**> and select Web PassThrough.
Enable <**OVERRIDING REDIRECT URL**> and configure <**URL**>.

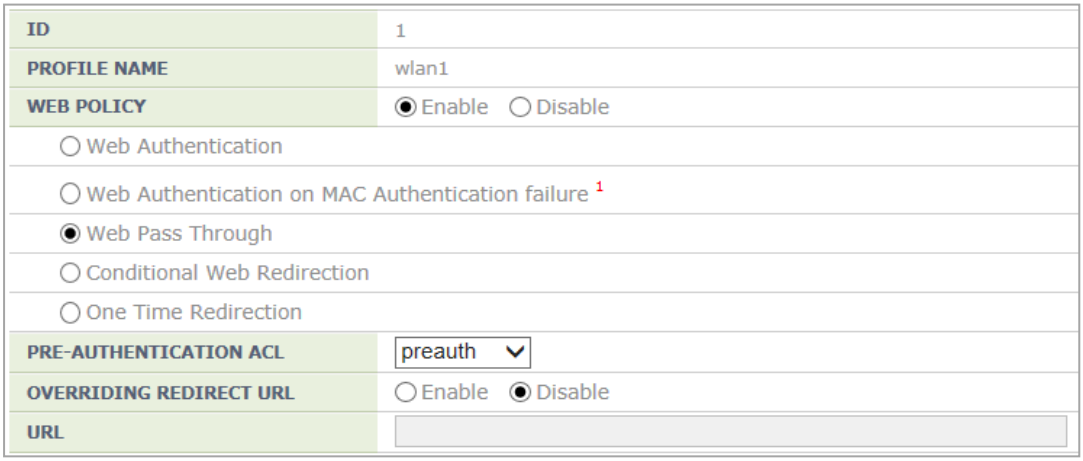


Figure 197. Web Pass-through Configuration Window

8.3.6 Configuring One Time Redirection

To provide the One Time Redirection service, the security L3 of the WLAN must be configured.

Configuration using CLI

[WLAN Configuration]

To configure one time redirection in the WLAN, execute the command as follows:

1) Go to configure → WLAN configuration mode of CLI.

```
WEC8500# configure terminal
WEC8500/configure# wlan 1
```

2) Configure a guest flag (default: disabled).
   - guest-flag

```
WEC8500/configure/wlan 1# guest-flag
```

3) Go to configure → WLAN → security → layer 3 configuration mode of CLI.

```
WEC8500/configure/wlan 1# security
WEC8500/configure/wlan 1/security# layer3
WEC8500/configure/wlan 1/security/layer3#
```

4) Enable the WEB authentication (default: disabled).
   - web-policy oneTimeRedirection

```
WEC8500/configure/wlan 1/security/layer3# web-policy
oneTimeRedirection
```

5) Configure the Pre-Authentication ACL.
   - pre-auth-acl [ACL]

Parameter	Description
ACL	ACL to perform redirection

6) To change the redirection of the basic captive portal configuration to another address, configure an overriding URL.
   - redirect-URL-override [URL]

Parameter	Description
URL	URL to which the guest is redirected

7) To check the configuration, use the 'show wlan security detail' command.

```
WEC8500# show wlan security detail 1
```

Configuration using Web UI

In the menu bar of <**WEC Main window**>, select <**Configuration**> and then select the <**WLANs**> menu in the sub-menus. In the WLANs screen, select WLAN ID and enable the <**GUEST SERVICE**> option.

Figure 198. WLAN Guest Configuration Window

Go to the <**L3**> of the <**Security**> tab.
Enable <**WEB POLICY**> and select One Time Redirection.
Enable <**OVERRIDING REDIRECT URL**> and configure <**URL**>**.**

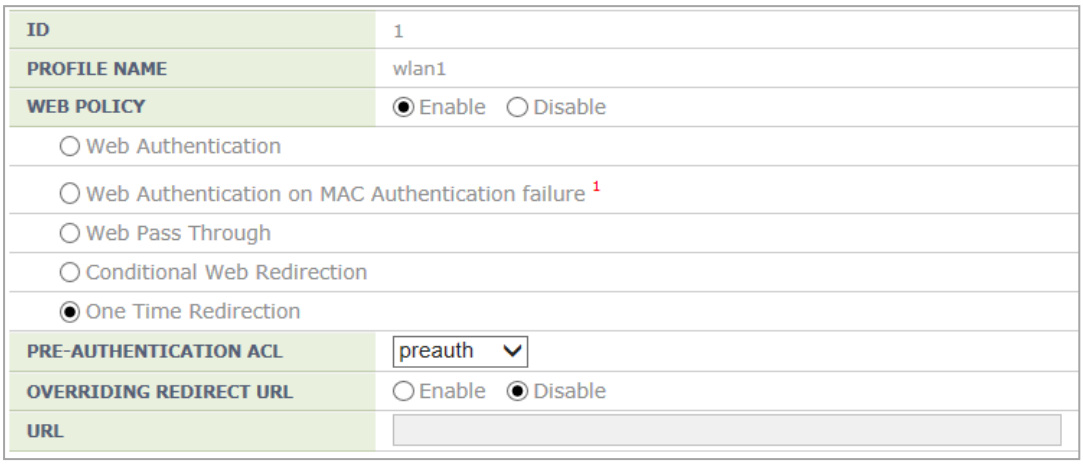


Figure 199. One Time Redirection Configuration Window

8.3.7 Redirection Address Format

The Captive Portal attempts at first redirection for the request of the web service of the station.
The redirection address transmitted by the station in the APC to perform redirection is formed as follows:

1) Redirection Address Format
   - Destination Address + Redirection Option Information

2) Redirection Address Option

Option	Description
forward	The address of the APC to receive the station information in case of the external web authentication
redirect	URL to move to after authentication
essid	ESS ID to which the station is connected
bssid	BSS ID to which the station is connected
apname	The name of the AP to which the station is connected
client_ip	IP address of the station
client_mac	MAC Address of the station
osname	OS information of the station, effective when the OS Aware function is configured.
model_name	Model information of the station, effective in case of the FMC station.
os_version	OS version of the station, effective in case of the FMC station.
build_num	OS build number of the station, effective in case of the FMC station.

8.4 NAT and Firewall Configuration

The APC provides the NAT and firewall function to provide stable network to a WLAN user.

8.4.1 Firewall Configuration

Configuration using CLI

[Firewall Configuration]

1) Go to configure mode of CLI.

```
WEC8500# configure terminal
```

2) Configure the accelerator function of a firewall.

```
WEC8500/configure# firewall enable
```

[Firewall Configuration using Access List]

1) Go to configure mode of CLI.

```
WEC8500# configure terminal
```

2) Create an access-list.

```
WEC8500/configure# access-list fw fw4 deny tcp any any eq 23
```

3) Configure a firewall to the interface using an access-list.

```
WEC8500/configure# interface vlan1.10
WEC8500/configure/interface vlan1.10# ip access-group fw forward fw4
WEC8500/configure/interface vlan1.10# exit
```

Configuration using Web UI

In the menu bar of **<WEC Main window>**, select **<Configuration>** and then select the **<Security>** → **<Firewall>** → **<General>** menu in the sub-menus. You can configure whether to use a firewall.

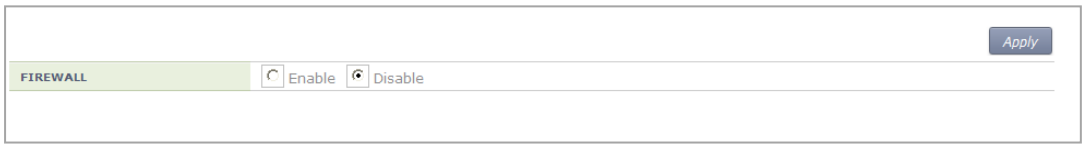


Figure 200. Firewall configuration (1)

In the menu bar of **<WEC Main window>**, select **<Configuration>** and then select the **<Security>** → **<Firewall>** → **<Interface>** menu in the sub-menus.
You can configure an interface for which a firewall will be applied by clicking the **<Add>** button of Interface window.

Figure 201. Firewall configuration (2)

8.4.2 Access List Configuration

Configuration using CLI

1) Go to configure mode of CLI.

```
WEC8500# configure terminal
WEC8500/configure#
```

2) Create an access-list.
   - access-list fw [ACL_NAME] [ACTION] [SRC_ADDRESS (SRC_PORT)] [DST_ADDRESS (DST_PORT)] [PROTOCOL]

Parameter	Description
ACL_NAME	ACL name to configure
ACTION	Action configuration (deny/permit)
SRC_ADDRESS(SRC_PORT)	Source IP address and port
DST_ADDRESS(DST_PORT)	Destination IP address and port
PROTOCOL	Protocol

Configuration using Web UI

In the menu bar of <**WEC Main window**>, select <**Configuration**> and then select the <**Security**> → <**Firewall**> → <<**Policy**> menu in the sub-menus. Click the <**Add**> button to configure the firewall Policy.

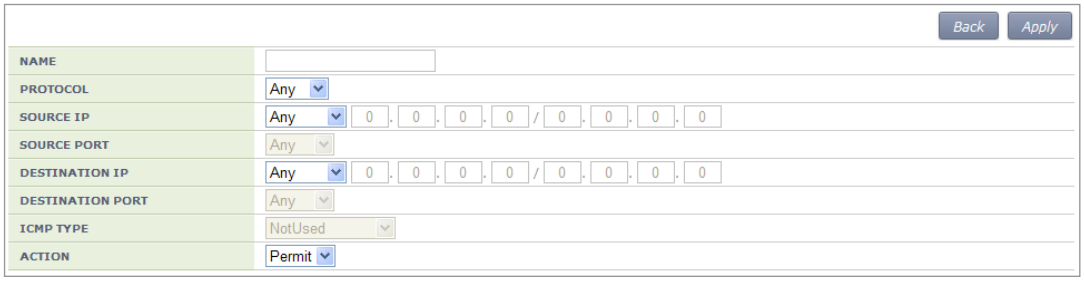


Figure 202. Access-list configuration

8.4.3 NAT Configuration

Configuration using CLI

[SNAT Configuration using Access List]

To add Source NAT (SNAT) using an access-list, execute the command as follows:

1) Go to configure mode of CLI.

```
WEC8500# configure terminal
```

2) Create an access-list.

```
WEC8500/configure# access-list fw fw1 deny any 10.10.10.10/32 any
```

3) Create a NAT pool.

```
WEC8500/configure# ip nat pool pool1 30.30.30.1 30.30.30.1
255.255.255.0
```

4) Configure a NAT to the interface.

```
WEC8500/configure# interface vlan1.30
WEC8500/configure/interface vlan1.30# ip nat inside
WEC8500/configure/interface vlan1.30#exit
```

5) Add the NAT rule by using access-list and pool.

```
WEC8500/configure# ip nat outside source list fw1 pool pool1
```

[SNAT Configuration using Static IP]
To add SNAT using a static IP, execute the command as follows:

1) Go to configure mode of CLI.

```
WEC8500# configure terminal
```

2) Configure a NAT to the interface.

```
WEC8500/configure# interface vlan1.30
WEC8500/configure/interface vlan1.30#ip nat outside
WEC8500/configure/interface vlan1.30#exit
```

3) Configure a NAT rule using a static IP.

```
WEC8500/configure# ip nat outside source static 10.10.10.10 30.30.30.1
```

[DNAT Configuration using Access List]
To add Destination NAT (DNAT) using an access-list, execute the command as follows:

1) Go to configure mode of CLI.

```
WEC8500# configure terminal
```

2) Create a NAT pool.

```
WEC8500/configure# ip nat pool pool2 10.10.10.10 10.10.10.10
255.255.255.0
```

3) Configure a NAT to the interface.

```
WEC8500/configure# interface vlan1.30
WEC8500/configure/interface vlan1.30#ip nat outside
WEC8500/configure/interface vlan1.30#exit
```

4) Add the NAT rule by using access-list and pool.

```
WEC8500/configure# ip nat outside destination list fw6 pool pool2
```

[DNAT Configuration using Static IP]
To add DNAT using a static IP, execute the command as follows:

1) Go to configure mode of CLI.

```
WEC8500# configure terminal
```

2) Configure a NAT to the interface.

```
WEC8500/configure# interface vlan1.30
WEC8500/configure/interface vlan1.30#ip nat outside
WEC8500/configure/interface vlan1.30#exit
```

3) Configure a NAT rule using a static IP (A port can be also specified for DNAT).

```
WEC8500/configure# ip nat outside destination static tcp 10.10.10.1
4300 30.30.30.2 23
```

[Checking NAT Configuration]
To check the created NAT, use the following command.

```
WEC8500/configure# show nat
```

Configuration using Web UI

1) In the menu bar of **<WEC Main window>**, select **<Configuration>** and then select the **<Security>** → **<NAT>** → **<Pool>** menu in the sub-menus. **Click the <Add>** button and configure the NAT pool.

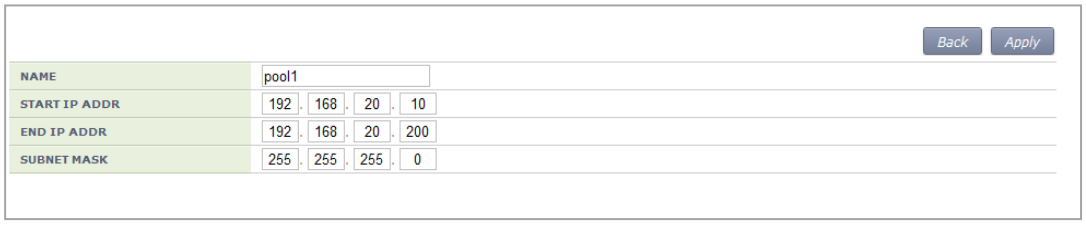


Figure 203. NAT configuration (1)

2) Click the **<Add>** button in the Translation Rule window and configure the Translation Rule. Select NAT TYPE as either SNAT or DANT. Select STATIC checkbox to configure Static and configure the values of Original IP Addr: Port and Translated IP Addr: Port.

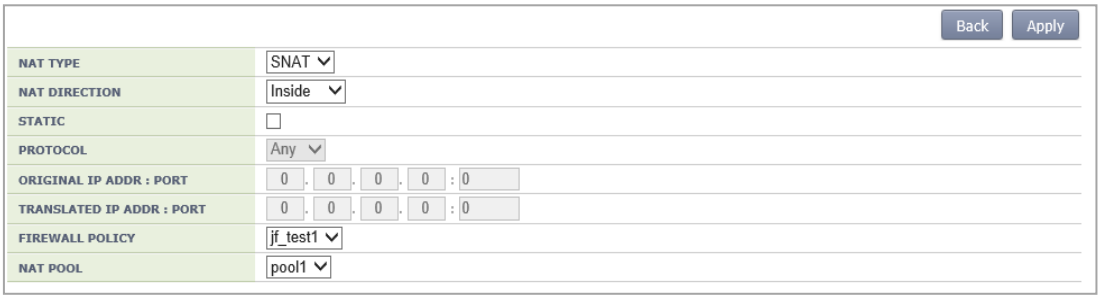


Figure 204. NAT configuration (2)

NOTE

To proceed with NAT configuration, you must create an access list first.

8.5 MAC Filter

The W-EP wireless LAN system provides the MAC filter function. A user may experience connection restriction due to MAC filtering when connecting to a specific WLAN (SSID).

Configuration using CLI

To configure a MAC list for connection control by the MAC filter, execute the command as follows:

1) Go to configure → security configuration mode of CLI.

```
WEC8500# configure terminal
WEC8500/configure# security
```

2) Creates a MAC filter list.

```
WEC8500/configure/security# mac-filter [ID]
```

Parameter	Description
ID	MAC filter list table ID (range: 1-20)

3) Configure the filtering policy.

```
WEC8500/configure/security/mac-filter 1# policy [POLICY]
```

Parameter	Description
POLICY	Table policy of MAC filtering list

4) Configure a MAC entry.

```
WEC8500/configure/security/mac-filter 1# mac [MAC_ADDRESS]
```

Parameter	Description
MAC_ADDRESS	MAC address (XX:XX:XX:XX:XX:XX format)

5) Specify the MAC filter ID that is configured in the WLAN to which a MAC filter will be applied.

```
WEC8500/configure/wlan 1/security# mac-filter <MAC_FILTER_ID>
```

Parameter	Description
MAC_FILTER_ID	MAC FILTER ID (range: 1-20)

6) You can check the configured information below.

```
show security mac-filter summary
```

```
WEC8500# show security mac-filter detail
```

Configuration using Web UI

In the menu bar of <**WEC Main window**>, select <**Configuration**> and then select the <**Security**> → <**MAC Filter**> menu in the sub-menus.

You can create a MAC filter table for station access control by clicking the <**Add**> button.

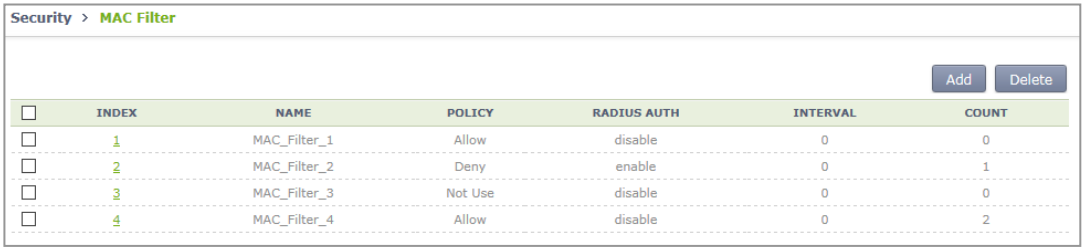


Figure 205. MAC configuration

The procedure for MAC entry configuration is given below.

1) In the MAC Filter initial window, select an INDEX item to switch to the Edit screen and then click the <**Add**> button to configure a MAC entry.

Figure 206. MAC entry configuration window(1)

2) Configure the policy in the Edit configuration screen by selecting the index of MAC filter list.

Figure 207. MAC entry configuration(2)

3) Select a WLAN for which the MAC filter will be applied. Check a MAC FILTER ID to apply in the Security > L2 configuration screen.
To apply the configuration, click the <**Apply**> button.

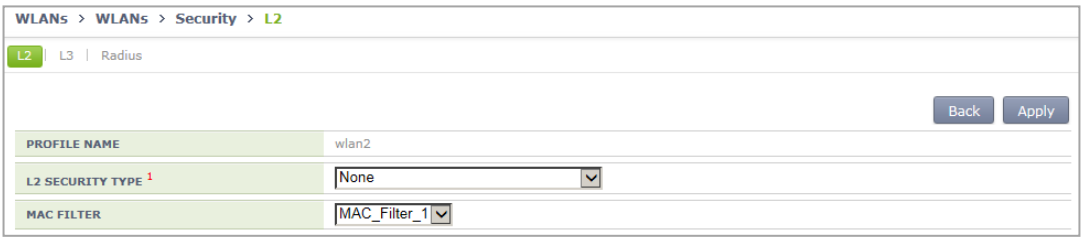


Figure 208. MAC entry configuration(3)

8.6 Operator Authentication through Interoperation with TACACS+ Server

A W-EP wireless LAN system provides an operator authentication function by interoperating with an external TACACS+ server.

8.6.1 Configuring External TACACS+ Server

A W-EP wireless LAN system provides an operator authentication function by interoperating with an external TACACS+ server and the procedure detailed below is carried out for interoperation with a TACACS+ server.

8.6.1.1 Basic Settings

The default configuration of the TACACS+ server is as follows:

Configuration using CLI

1) Go to configure → security → tacacs configuration mode of CLI.

```
WEC8500# configure terminal
WEC8500/configure# security
WEC8500/configure/security# tacacs 1
WEC8500/configure/security/tacacs 1#
```

2) Configure the IP address of the TACACS+ server.

```
WEC8500/configure/security/tacacs 1# server-ip [IP_ADDRESS]
```

Parameter	Description
IP_ADDRESS	IP address of the TACACS+ server

3) Set the public key of the TACACS+ server.

```
WEC8500/configure/security/tacacs 1# shared-secret [KEY_STRING]
```

Parameter	Description
KEY_STRING	Public key of the TACACS+ server

4) Configure the port number of the TACACS+ server.

```
WEC8500/configure/security/tacacs 1# server-port [PORT_NUMBER]
```

Parameter	Description
PORT_NUMBER	Port number of the TACACS+ server (range: 1-65,535, default value: 49)

5) Configure the items related to retransmissions in TACACS+ communications. You can use default values without changing configuration.

```
WEC8500/configure/security/tacacs 1# retransmit-interval
[RETRY_INTERVAL]
WEC8500/configure/security/tacacs 1# retransmit-count [FO_RETRY_COUNT]
```

Parameter	Description
RETRY_INTERVAL	Retransmission interval for a TACACS+ message (unit: seconds, range: 1-5, default value: 3)
FO_RETRY_COUNT	Maximum message retransmission count before a TACACS+ server failover is attempted (range: 0-3, default value: 2)

6) If necessary, configure the source IP address of the TACACS+ message.

```
WEC8500/configure/security/tacacs 1# source-ip [IP_ADDRESS]
```

Parameter	Description
IP_ADDRESS	Source IP address of the TACACS+ message Note: it must be one of the IP addresses configured in the W-EP wireless LAN system.

7) Configure whether to transfer packets to the TACACS+ server. You can use default values without changing configuration.

```
WEC8500/configure/security/tacacs 1# status [STATUS]
```

Parameter	Description
STATUS	Status indicating whether packets are transferred to the TACACS+ server (default value: enable)

8) Exit TACACS+ server configuration and then security configuration mode.

```
WEC8500/configure/security/tacacs 1# exit
WEC8500/configure/security# exit
```

9) You can view configuration information by using the ‘show security tacacs server config’ and ‘show security tacacs server detail [SERVER ID]’ commands.

Configuration using Web UI

In the menu bar of **<WEC Main Window>**, select **<Configuration>**, and then select **<Security>** → **<AAA>** → **<TACACS+>** in the submenus.

If you click the **<Add>** button in the TACACS+ initial window, you can add a TACACS+ server.
The server addition window is shown below.

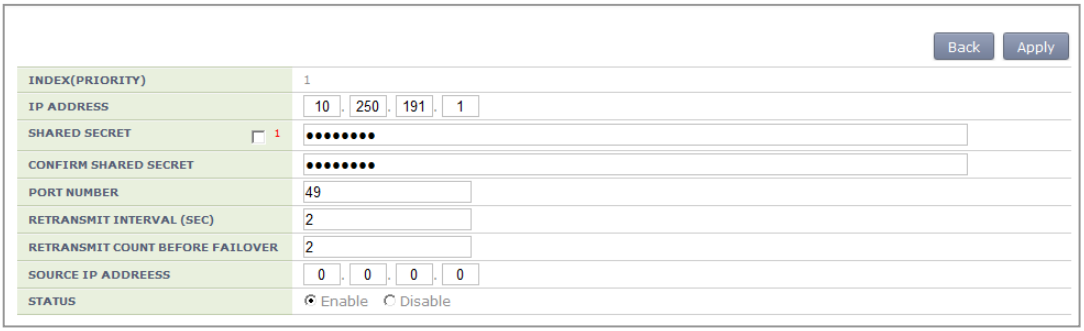


Figure 209. TTACACS+ Server Configuration Window

Item	Description
INDEX (PRIORITY)	ID that distinguishes TACACS+ server configurations
IP ADDRESS	IP address of the TACACS+ server
SHARED SECRET	Public key of the TACACS+ server
CONFIRM SHARED SECRET	Re-enters the key for TACACS+ server communications for confirmation
PORT NUMBER	Communication port number of the TACACS+ server (range: 1-65,535, default value: 49)
RETRANSMIT INTERVAL	Retransmission interval for a TACACS+ message (range: 1-5, default value: 2, unit: seconds)
RETRANSMIT COUNT BEFORE FAILOVER	Maximum message retransmission count before a TACACS+ server failover is attempted (range: 0-3, default value: 2)
SOURCE IP ADDRESS	Source IP address of the TACACS+ message - Note: it must be one of the IP addresses configured in the W-EP wireless LAN system.
STATUS	Status indicating whether packets are transferred to the TACACS+ server (default value: enable)

8.6.2 Configuring Authentication Type of Operator Account

The steps for configuring the authentication type of the operator account are as follows:

Configuration using CLI

1) Go to configure mode of CLI.

```
WEC8500# configure terminal
WEC8500/configure#
```

2) Configure the type of operator account authentication.

```
WEC8500/configure# mgmt-user auth-type [AUTH_TYPE]
```

Parameter	Description
AUTH_TYPE	Authentication type of the operator account (default value: local) - local: Authentication is performed using the database stored inside. - tacacs: Authentication is performed using the TACACS+ server. - local-tacacs: Authentication is performed using the database stored inside first, and, failing that, an authentication request is transmitted to the TACACS+ server. - tacacs-local: An authentication request is transmitted to the TACACS+ server first, and, failing that, authentication is performed using the DB stored inside.

3) You can view the configuration information by using the 'show mgmt-users auth-type' command.

Configuration using Web UI

In the menu bar of **<WEC Main Window>**, select **<Configuration>**, and then select **<Security>** → **<AAA>** → **<Management User>** in the submenus.

Figure 210. Operator Account Authentication Type Configuration Window

8.7 Role Based Access Control

The W-EP WLAN system can manage the user's access authority depending on a designated role.
It can designate ACL, limit the bandwidth, designate the interface, or manage redirecting URL, etc. by user.

8.7.1 Configuring Role Profile

The W-EP WLAN system can designate the configuration of ACL, QoS, VLAN, and URL and manage as a profile.
To provide a service of a role desired to a specific user or a user group, it can use a role profile.

8.7.1.1 Configuring Profile

The basic settings of the role profile are as follows:

Configuration using CLI

Example:

```
WEC8500# configure terminal
WEC8500/configure# rbac
WEC8500/configure/rbac# role-profile role_01
WEC8500/configure/rbac/role-profile role_01# acl acl1
WEC8500/configure/rbac/role-profile role_01# qos 1
WEC8500/configure/rbac/role-profile role_01# vlan 10
WEC8500/configure/rbac/role-profile role_01# url http://www.role1
WEC8500/configure/rbac/role- profile role_01# end

WEC8500# configure terminal
WEC8500/configure# rbac
WEC8500/configure/rbac# no role-profile role_01
WEC8500/configure/rbac# end
```

CLI for confirming configuration:

```
WEC8500# show rbac role-profile summary

===== Role Profile Summary =====

Id ProfileName  Acl        Qos Vlan Url
== ===========  ========== === ==== ====================
1  role_01      acl1       1    10   http://www.role1
```

Configuration using Web UI

Configuration > Security > Role Based Access Control > Role Profile

Example:

Figure 211. Role Profile Configuration

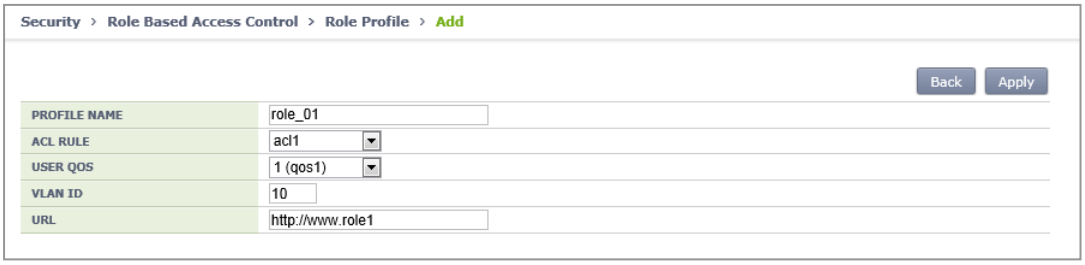


Figure 212. Role Profile Add Configuration

8.7.2 Configuring Derivation Profile

The W-EP WLAN system can edit conditions to allocate roles and manage by profile. It can manage a role by user depending on the edited conditions.

8.7.2.1 Configuring Profile

The basic settings of the derivation profile are as follows:

Configuration using CLI

Example:

```
WEC8500# configure terminal
WEC8500/configure# rbac
WEC8500/configure/rbac# derivation-profile derivation_1
WEC8500/configure/rbac/derivation-profile derivation_1# condition
priority 11 user equal derivationUser role role_1
WEC8500/configure/rbac/derivation-profile derivation_1# condition
priority 12 user start-with derivation role role_2
WEC8500/configure/rbac/derivation-profile derivation_1# condition
priority 13 user contain vation role role_3
```

```
WEC8500/configure/rbac/derivation-profile derivation_1# condition
priority 14 user end-with User role role_4
WEC8500/configure/rbac/derivation-profile derivation_1# condition
priority 15 user not-equal samsung role role_5
WEC8500/configure/rbac/derivation-profile derivation_1# exit
WEC8500/configure/rbac# derivation-profile derivation_2
WEC8500/configure/rbac/derivation-profile derivation_2# end

WEC8500# configure terminal
WEC8500/configure# rbac
WEC8500/configure/rbac# no derivation-profile derivation_2
WEC8500/configure/rbac# end
```

CLI for confirming configuration:

```
WEC8500# show rbac derivation-profile summary

derivation-profile derivation_1
 condition priority 11 user equal derivationUser role role_1
 condition priority 12 user start-with derivation role role_2
 condition priority 13 user contain vation role role_3
 condition priority 14 user end-with User role role_4
 condition priority 15 user not-equal samsung role role_5
```

Configuration using Web UI

Configuration > Security > Role Based Access Control > Derivation Profile

Example:

Figure 213. Derivation Profile Configuration

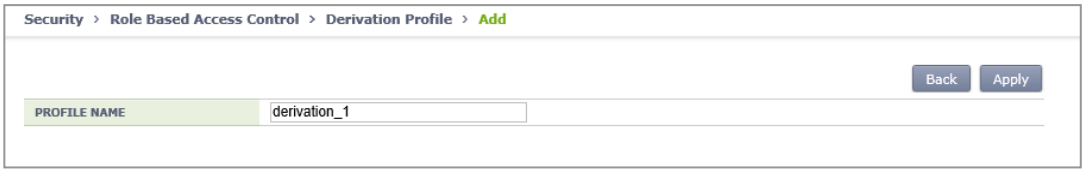


Figure 214. Derivation Profile Add Configuration

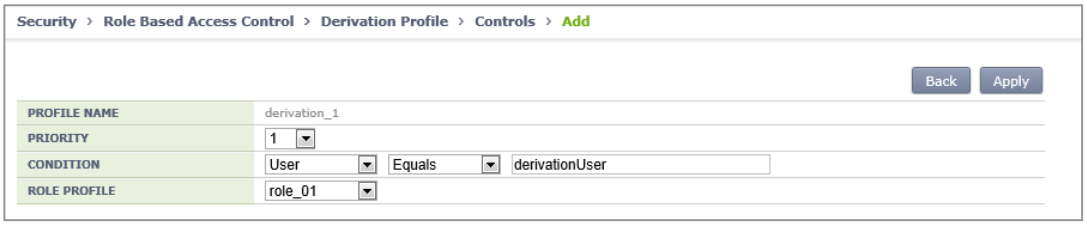


Figure 215. Derivation Profile Configuration

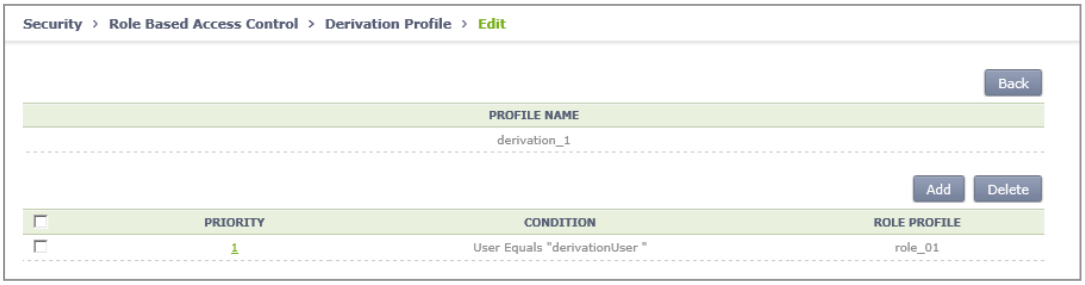


Figure 216. Derivation Profile Add Configuration

8.7.2.2 WLAN Configuration

The method for configuring a derivation profile in the WLAN is as follows:

Configuration using CLI

Example:

```
WEC8500# configure terminal
WEC8500/configure# wlan 1
WEC8500/configure/wlan 1# derivation-profile ieee8021x derivation_1
WEC8500/configure/wlan 1# end
```

CLI for confirming configuration:

```
WEC8500# show rbac wlan-derivation-config

================ RbacDerivationConfigForWlan ================

WlanId  Owner             DerivationProfileId
======  ================  ===================
1       Global            0
1       Open              0
1       Radius            1
1       CaptivePotal      0
```

Configuration using Web UI

Configuration > WLANs > Security > Radius

Example:

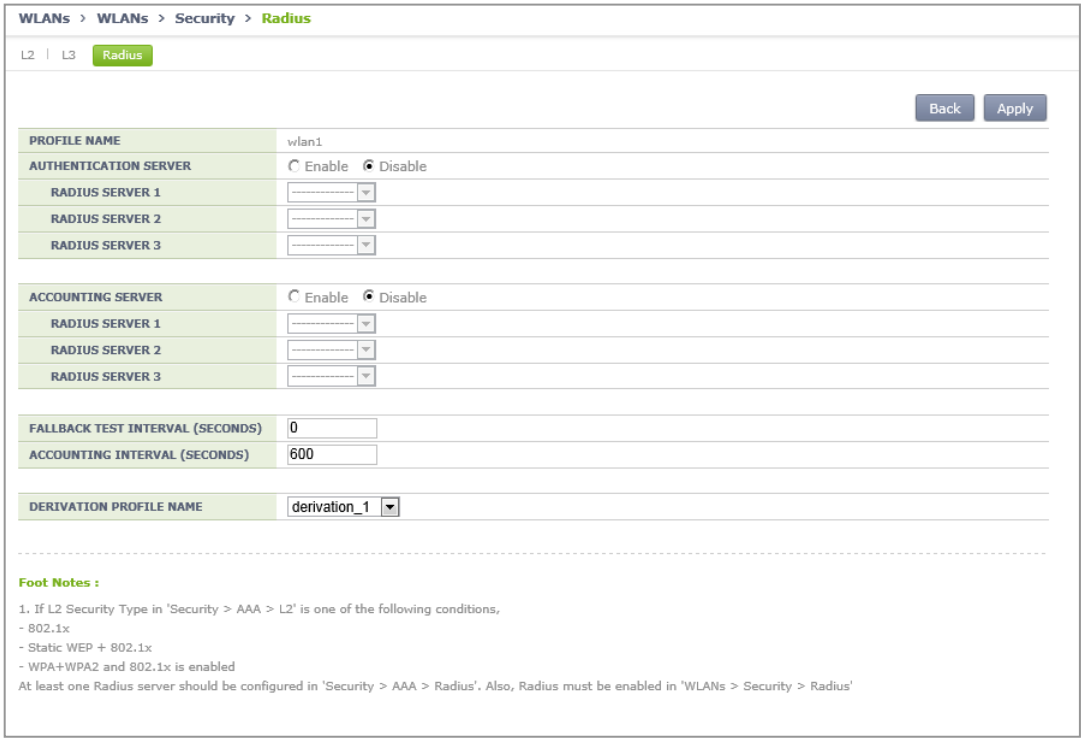


Figure 217. Wlan Derivation Profile Configuration

8.7.3 Configuring ACL Profile

The W-EP WLAN system can manage ACL to apply to a user if the AP of the remote group operates as local bridge.

8.7.3.1 Configuring Profile

The basic settings of the ACL profile are as follows:

Configuration using CLI

Example:

```
WEC8500# configure terminal
WEC8500/configure# rbac
WEC8500/configure/rbac# acl-profile aclPro_1
WEC8500/configure/rbac/acl-profile aclPro_1# add-acl acl1
WEC8500/configure/rbac/acl-profile aclPro_1# add-acl acl2
WEC8500/configure/rbac/acl-profile aclPro_1# exit
WEC8500/configure/rbac# acl-profile aclPro_2
WEC8500/configure/rbac/acl-profile aclPro_2# end

WEC8500# configure terminal
WEC8500/configure# rbac
WEC8500/configure/rbac# no acl-profile aclPro_2
WEC8500/configure/rbac# end
```

CLI for confirming configuration:

```
WEC8500# show rbac acl-profile summary

================ LocalSwAclProfile ================

Id ProfileName TotalRuleCnt AclCnt RmtCnt
== =========== ============ ====== ======
1  aclPro_      1    2          2     0
```

Configuration using Web UI

Configuration > Security > Role Based Access Control > Derivation Profile

Example:

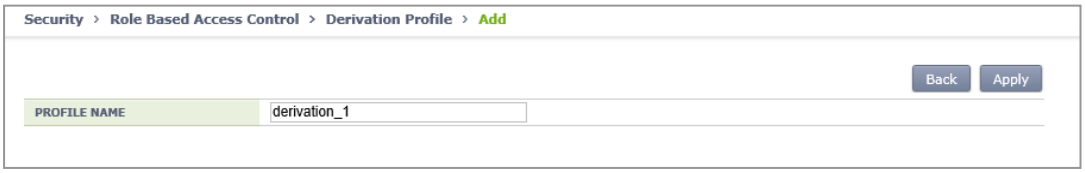


Figure 218. Acl Profile Configuration

Figure 219. Acl Profile Add Configuration

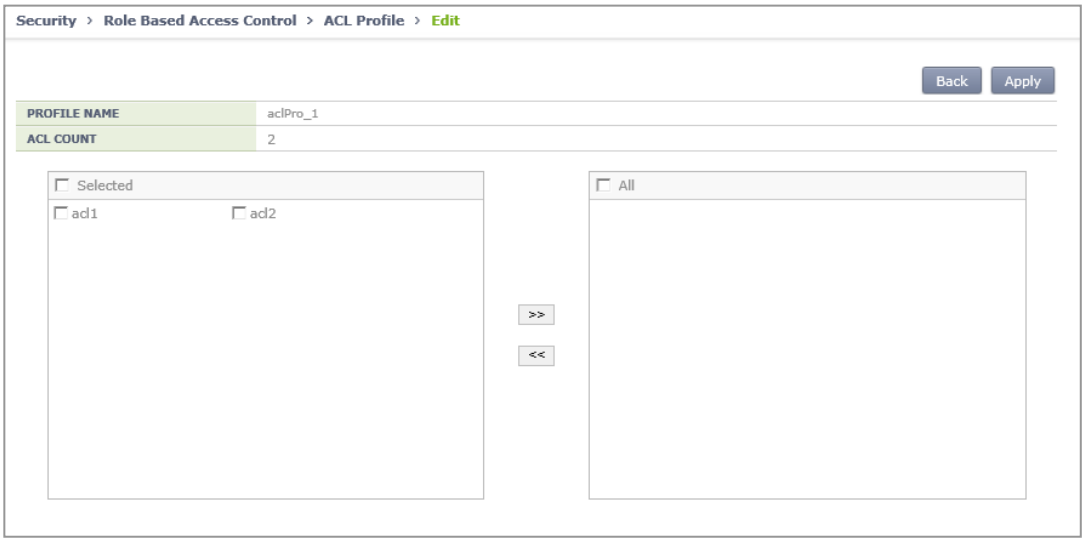


Figure 220. Acl Profile Edit Configuration

8.7.3.2 Remote Ap Group Configuration

The method for configuring the ACL profile to the remote AP group is as follows:

Configuration using CLI

Example:

```
WEC8500# configure terminal
WEC8500/configure# ap-group apg_1
WEC8500/configure/ap-group apg_1# remote
WEC8500/configure/ap-group apg_1/remote# acl-profile aclPro_1
WEC8500/configure/ap-group apg_1/remote# end
```

CLI for confirming configuration:

```
WEC8500# show rbac remote-group summary

 GRP_ID    GRP_NAME            PRO_ID  Role Config File Name
 ======   ==================   ======  ==========================
2           apg_1               1
etc/rmtapgrp/rbac_cfg_rmtapgrp2_XXXX.tar
```

Configuration using Web UI

Configuration > AP Groups > Remote AP Group > ACL Profile

Change the configuration of the ACL PROFILE NAME and then press Apply.
After that, press Send To APs to transmit the ACL profile and the relevant settings to APs.

Example:

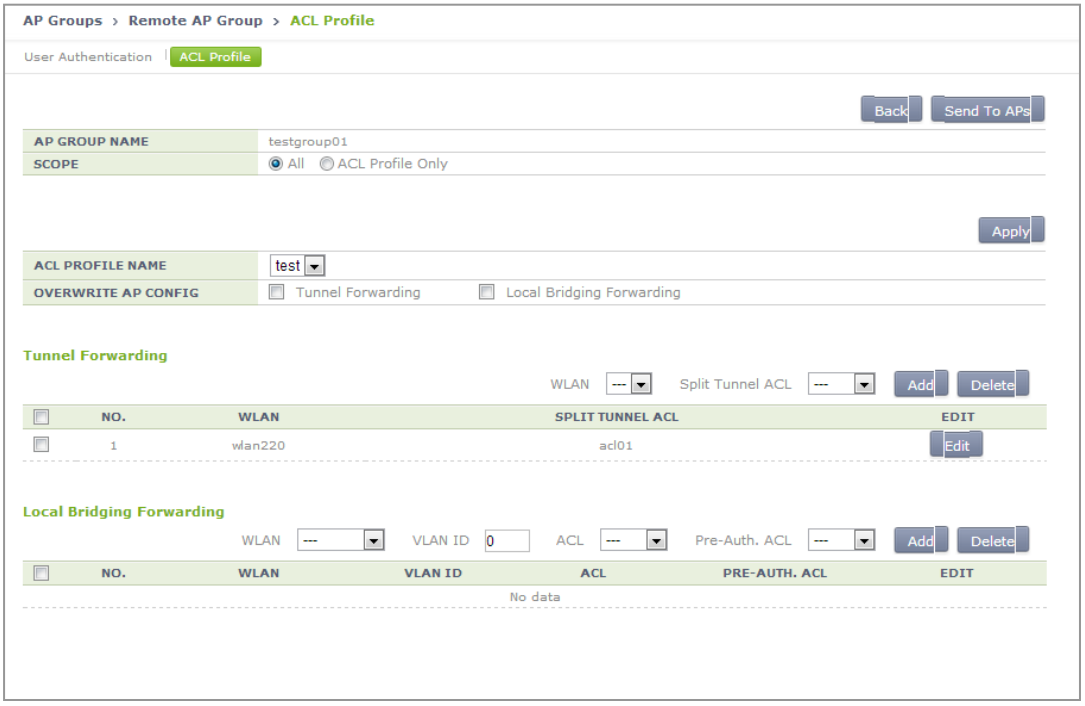


Figure 221. Remote Ap Group-Alc Profile Configuration

8.7.4 Configuration Synchronization (Remote AP Group)

The W-EP WLAN system provides a function of synchronizing the configuration of the AP of the remote group and ACL if the AP of the remote group operates as a local bridge.

8.7.4.1 Requesting Synchronization

If the remote AP operates with the local switching mode, the configuration of the ACL between APC and AP must be synchronized. If AP and CAPWAP run, the configuration of the ACL is automatically synchronized, but if the operator changes the ACL of the APC, the synchronization of ACL configuration must be performed as follows:

Configuration using CLI

The synchronization of the AP of the remote group uses the following CLI:

```
WEC8500# configure terminal
WEC8500/configure# rbac
WEC8500/configure/rbac# sync-config ?

     acl-profile             Sync-config Acl profile
     all                     Sync-config All
     ap                      Sync-config Remote Ap Group
     remote-ap-group         Sync-config Remote Ap Group
```

- all: Perform synchronization for all APs of the remote group.
- remote-ap-group [group-name]: Performs synchronization only for the APs included in the corresponding remote group.
- acl-profile [profile-name]: Performs synchronization only for the APs included in the remote group which uses the corresponding ACL profile (CLI only).
- ap [ap-profile-name]: Performs synchronization only for a specific AP (CLI only).

Synchronization can be confirmed as follows:

```
WEC8500# show rbac remote-group summary

 GRP_ID   GRP_NAME   PRO_ID    Role    Config File Name
 ======   ==================   ======  ==========================
     2    rmt_grp_01           1
etc/rmtapgrp/rbac_cfg_20140305094752849046.tar
```

Configuration using Web UI

Configuration > Security > Role Based Access Control > ACL Profile
→ 'Send To APs'

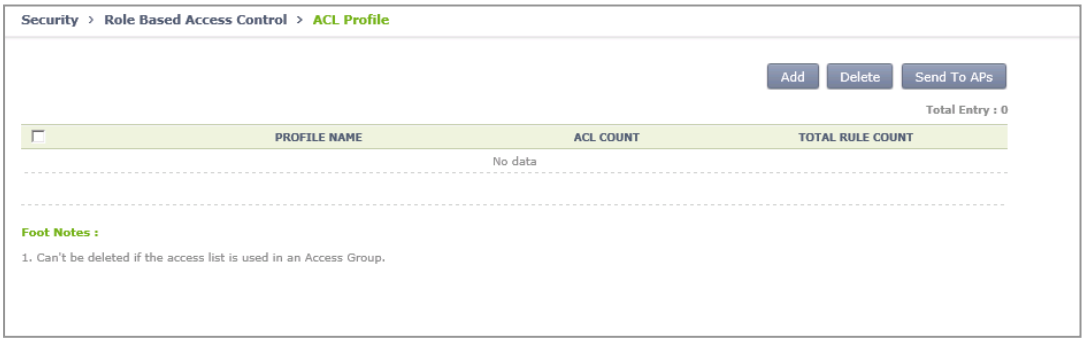


Figure 222. ACL Configuration Synchronization - All

Configuration > AP Groups > Remote AP Group > ACL Profile
→ 'Send To APs'

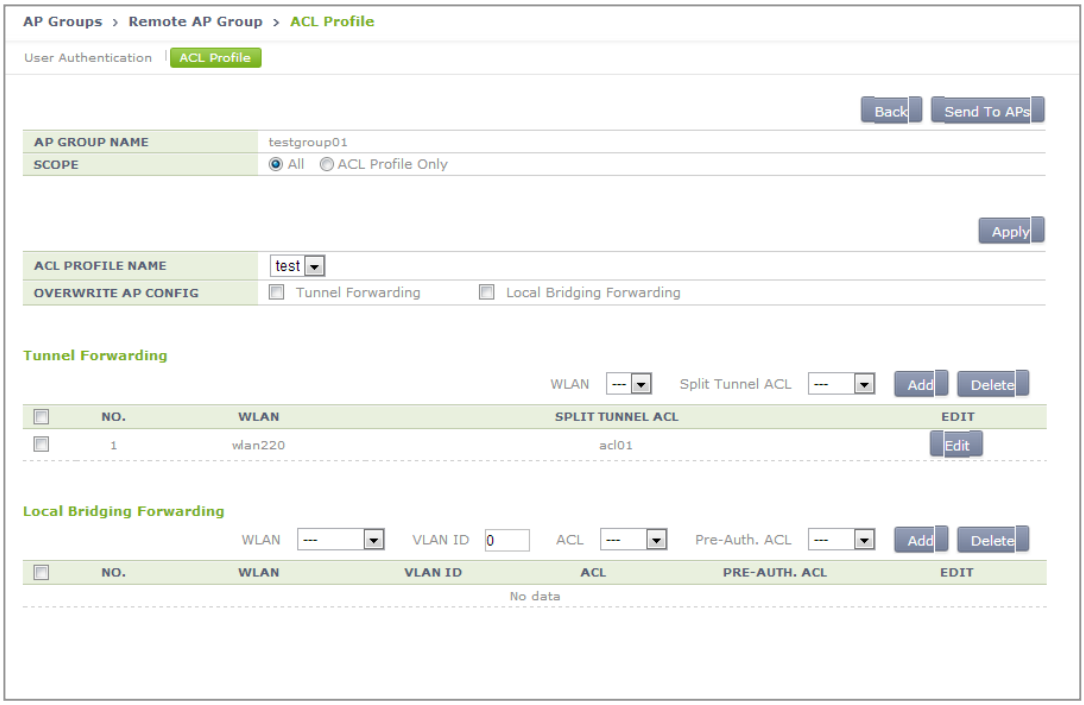


Figure 223. ACL Configuration Synchronization - Remote Group

Configuration > Access Points > Remote AP
→ 'Send To APs'

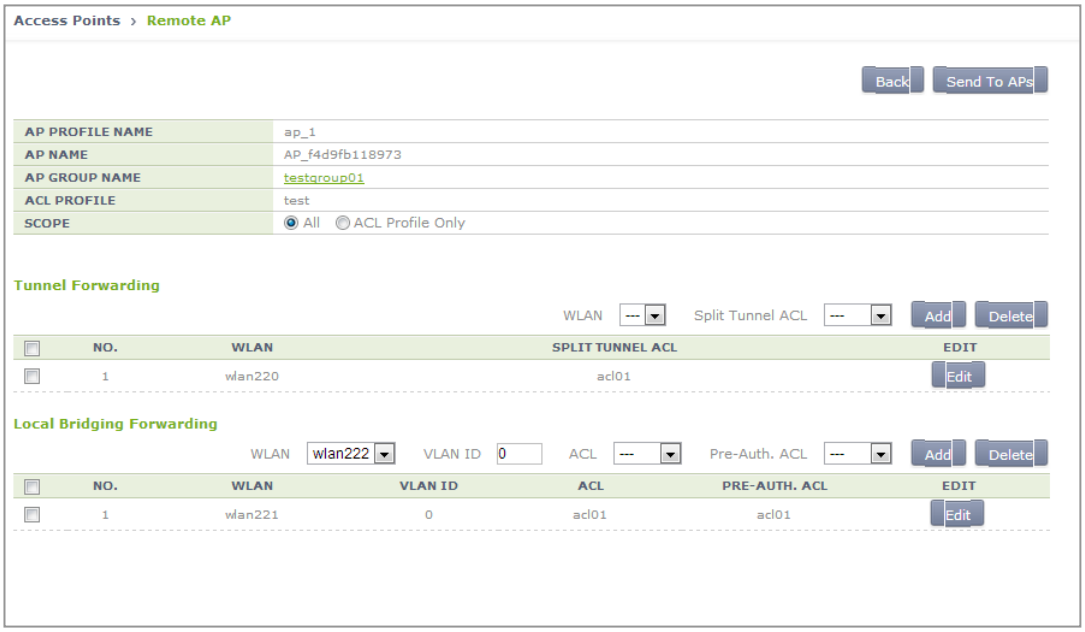


Figure 224. ACL Configuration Synchronization - Remote AP

8.8 External BYOD Server

The W-EP WLAN system provides a function of interoperating with the external BYOD server. To use the BYOD function, a separate BYOD server is necessary. Employees and guest users can receive a service after being connected to a specific WLAN (SSID) and going through authentication.
(The external BYOD server now supported is only AirCuve BYOD.)

8.8.1 Configuring External BYOD Server

Configuration using CLI

To configure the interoperation with external BYOD, execute the command as follows:

1) Go to configure → security → byod of CLI.

```
WEC8500# configure terminal
WEC8500/configure# security byod
```

2) Enter the IP address of the BYOD server.

```
WEC8500/configure/security/byod# address1 10.10.10.20
```

To interoperate with AirCuve BYOD Suite, enter Airfront IP in address1 and Byfront IP in address2.

3) Enable the function of interoperating with the external BYOD server.

```
WEC8500/configure/security/byod# enable
```

4) Configure a HTTPS request URL.
Upon the interoperation with AirCuve BYOD Suite, the HTTPS request URL is necessary to update the list of all authentications. The basically set value is used and if change is required in the future, change as follows:

```
WEC8500/configure/security/byod# https-requrl
regist.do?cmd=dhcpTableXMLReceiver
```

5) To check the configured environment, use the ‘show security byod configuration’ command.

Configuration using Web UI

In the menu bar of **<WEC Main window>**, select **<Configuration>** and then select **<Security>** → **<AAA>** → **<External BYOD Server>** in the sub-menus.

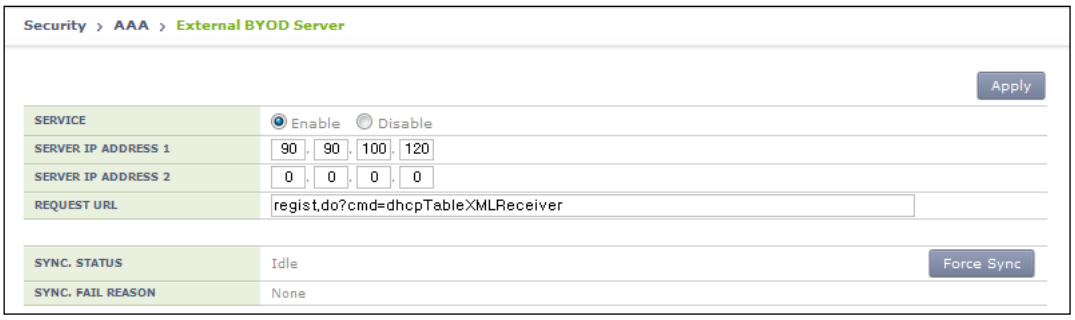


Figure 225. External BYOD Server Configuration Window

1) Service
   Enable the function of interoperating with the external BYOD server.
2) Server IP Address 1
   Enter the IP address of the BYOD server. Enter the Airfront IP upon the interoperation with AirCuve BYOD Suite.
3) Server IP Address 2
   Enter the Byfront IP upon the interoperation with AirCuve BYOD Suite.
4) Requested URL
   It is necessary to update the list of all authentications upon the interoperation with AirCuve BYOD Suite. Basically use the set value and enter a new URL if change is required.
5) SYNC. Status
   Display the result value of updating the list of all authentications.
   The status value has one of the following four items:
   - 0: Idle, 1: In progress, 2: Success, 3: Failure
6) SYNC. Failure Reason
   If the update of the list of all authentications fails, display the reason of failure.
   Failure reason items
   - None: No failure.
   - No response: When there is no response from the BYOD server
   - Invalid data format: When the BYOD server failed to send the data on the list of all authentications or in the invalid format

8.8.2 Captive Portal Configuration

To use the external BYOD service, the External Web Authentication of the Captive Portal is necessary to be configured. The Captive Portal service must configure ACL basically and apply the ACL to L3 security of the WLAN. Below is an example of how to configure the captive portal to use the BYOD service.

Configuration using CLI

1) Configuring PreAuthentication ACL
   PRE-AUTH ACL must have the basic permit rules for the HTTP port to DNS and web servers.

```
WEC8500# configure terminal
WEC8500/configure# fqm-mode
WEC8500/configure/fqm-mode # access-list ip preauth permit seq 1 udp
any eq * any eq 53 os-aware *
WEC8500/configure/fqm-mode # access-list ip preauth permit seq 2 tcp
192.168.20.10 255.255.255.255 eq 80 any eq * os-aware *
WEC8500/configure/fqm-mode # access-list ip preauth permit seq 3 tcp
any eq *  192.168.20.10 255.255.255.255 eq 80 os-aware *
WEC8500/configure/fqm-mode # access-list ip preauth permit seq 4 tcp
90.90.100.120 255.255.255.255 eq 80 any eq * os-aware *
WEC8500/configure/fqm-mode # access-list ip preauth permit seq 5 tcp
any eq *  90.90.100.120 255.255.255.255 eq 80 os-aware *
WEC8500/configure/fqm-mode # ip access-group wireless preauth
WEC8500/configure/wlan 1/security/layer3# pre-auth-acl preauth
```

2) Configuring WLAN
   To configure WLAN, set a guest flag and designate the configuration of the web policy of Layer 3 as authentication.

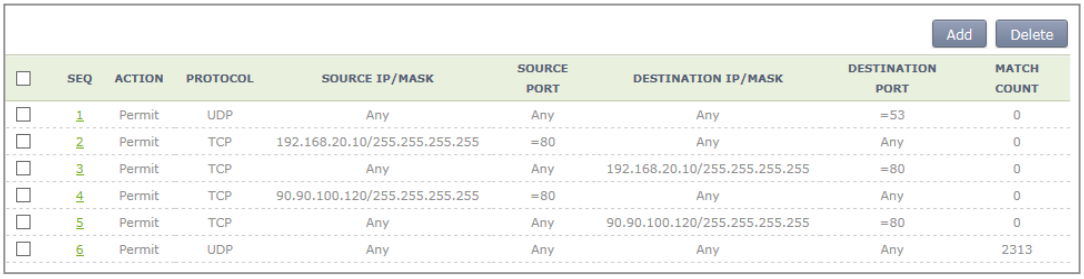
```
WEC8500# configure terminal
WEC8500/configure# wlan 1
WEC8500/configure/ wlan 1# guest-flag
WEC8500/configure/ wlan 1# security
WEC8500/configure/ wlan 1/security# layer3
configure/wlan 1/security/layer3# web-policy authentication
```

3) Configuring Web Authentication Type

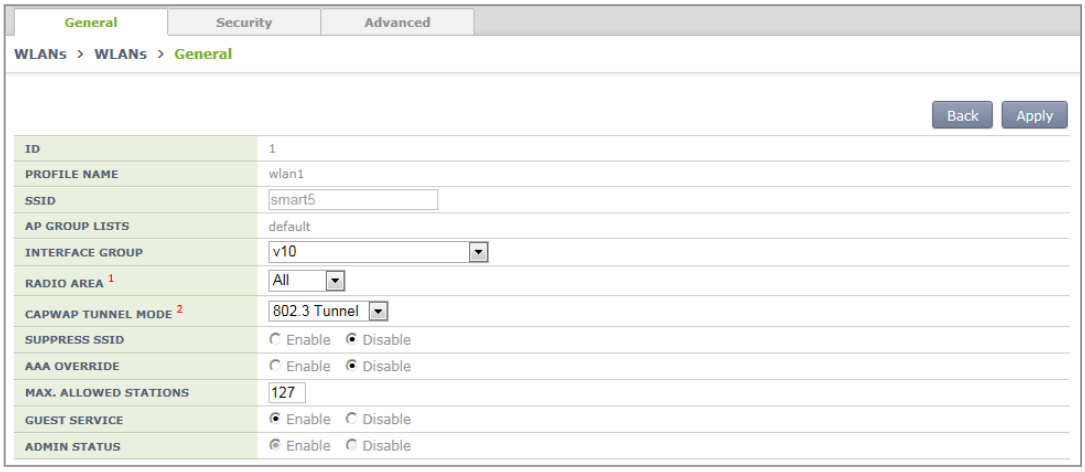
```
WEC8500/configure/security/captive-portal # web-auth
WEC8500/configure/security/captive-portal/web-auth#auth-type external
WEC8500/configure/security/captive-portal/web-auth#external-url
http://90.90.100.120/pc/zero_page.jsp
```

Configuration using Web UI

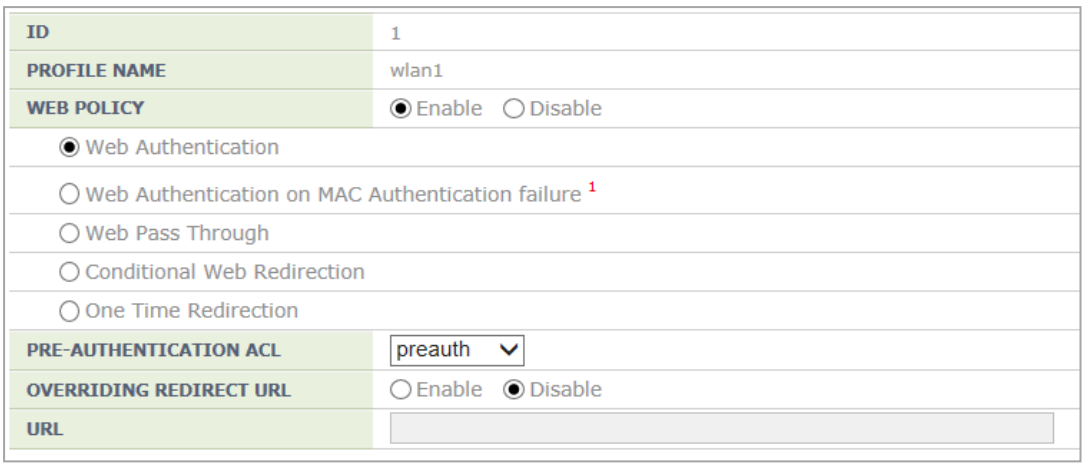
1) Configuring PreAuthentication ACL
PRE-AUTH ACL must have the basic permit rules for the HTTP port to DNS and web servers.



2) Configuring WLAN
To create WLAN to use for guests, the guest service must be enabled.

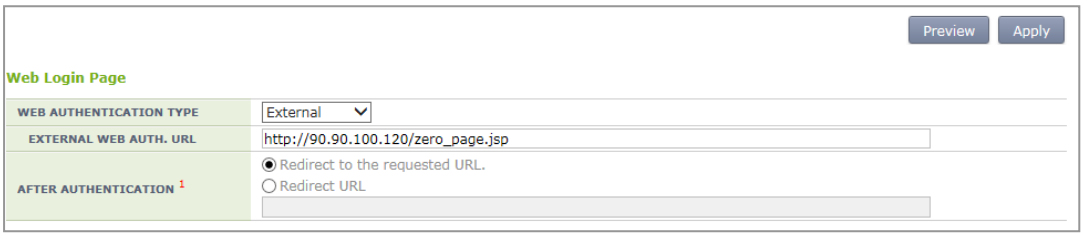


To use the Captive Portal function, enable a web policy in Security of WLAN > L3 tab and select Web Authentication. Designate the pre-set ACL for Captive Portal as PRE-AUTHENTICATION ACL on the bottom.



3) Configuring Web Authentication Type

To use the External BYOD function, External Web Auth must be configured. Designate the type as External in Security > Captive Portal > Web Authentication and designate the external BYOD server as URL.



CHAPTER 9. IP Application

In this chapter, the IP application functions available in the APC and each configuration method are described.

9.1 DNS

The DNS is a network service that interprets a domain or host name into an IP address. The APC gets DNS information from a DNS server and provides the DNS relay function that relays the DNS server and a client. If a wireless terminal connected to the APC configures the APC as a DNS server, it can receive the DNS service.
If a DNS server is connected to the APC and a DNS proxy is configured, a station connected to the APC can receive the DNS service by configuring the APC as a DNS server.

9.1.1 DNS Client Configuration

Configuration using CLI

1) Go to configure mode of CLI.

```
WEC8500# configure terminal
```

2) Configure a DNS client.
   - ip dns client enable: Enable
   - no ip dns client enable: Disable

3) Configure a DNS server to which DNS will be requested. You can enter maximum 3 DNS server addresses.
   - ip dns name-server [A.B.C.D]: Configures a DNS server.
   - no ip dns name-server [A.B.C.D]: Deletes a configured DNS server.
   - no ip dns name-server all: Deletes all the DNS servers.

Configuration using Web UI

In the menu bar of <**WEC Main window**>, select <**Configuration**> and then select the <**DNS**> menu in the sub-menus.

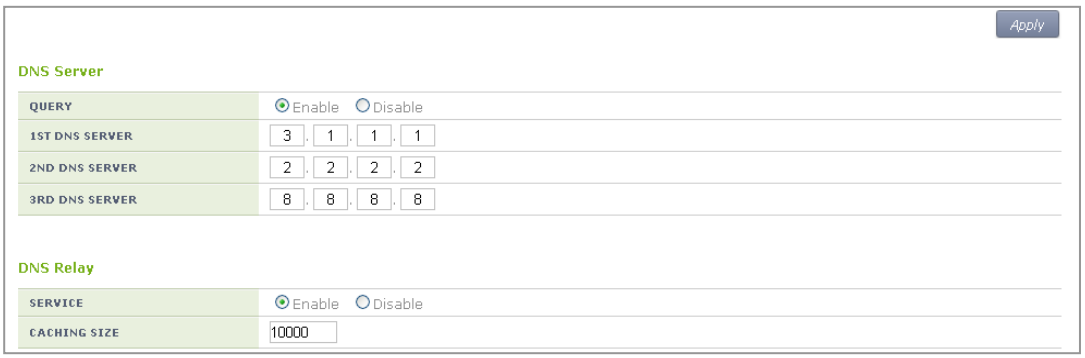


Figure 226. DNS client

You can enable or disable a DNS client using the QUERY of a DNS SERVER item.
In the 1ST DNS SERVER, 2ND DNS SERVER, and 3RD DNS SERVER boxes, you can configure 3 name servers.

9.1.2 DNS Proxy Configuration

You can configure the DNS relay function or a cache for relay. The cache is a temporary space where the APC saves the DNS information obtained from a DNS server.
You can configure maximum number of entries as 10000-100000. The DNS relay is related to the DNS client configuration. If you disable the DNS client function or delete all the name servers, the DNS relay function is not working.

Configuration using CLI

1) Go to configure mode of CLI.

```
WEC8500# configure terminal
```

2) Configure a DNS relay. Configure the cache to a default, i.e. 10000.
   - ip dns relay enable: Enables a relay.
   - no ip dns relay enable: Disables a relay.

3) To change cache configuration, enter as follows:
   - ip dns relay enable cache: Configures a DNS relay and configures the cache to a default, i.e. 10000.
   - ip dns relay enable cache 20000: Configures a DNS relay and configures the cache to 20000.
   - ip dns relay enable no-cache: Configures a DNS relay and disables the cache settings.

Configuration using Web UI

In the menu bar of **<WEC Main window>**, select <**Configuration**> and then select the <**DNS**> menu in the sub-menus.

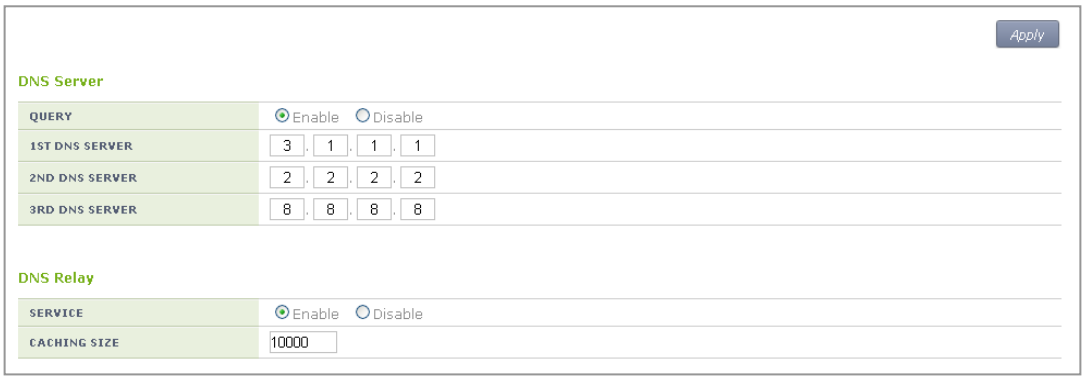


Figure 227. DNS proxy

The DNS Relay item supports DNS Proxy configuration. In the SERVICE, you can enable or disable a DNS proxy and configure the cache size of the DNS proxy in the CACHING SIZE. If the cache size is 0, disable the cache.

9.2 NTP

The Network Time Protocol (NTP) is a protocol used to receive time from a configured server and synchronize the local time.
The APC can operate as a NTP server and a client. If you configure the APC as a NTP client, it receives the Coordinated Universal Time (UTC) information from the configured NTP server and synchronizes the local time. In addition, if you configure the APC as a NTP server, it transmits a local time when it receives a NTP request from a NTP client.

Configuration using CLI

[Configuring NTP Client]
The time server that is referred to when the APC is working as a NTP client can be used based on a domain name and IP address. But, if it is working based on a domain name, there must be a configured DNS server.

1) Go to configure mode of CLI.

```
WEC8500# configure terminal
```

2) Enable or disable a NTP client.
   - ntp client enable: Enable
   - no ntp client enable: Disable

3) Configure the interval of a NTP client.
   - ntp client interval [INTERVAL]: Configures an interval.
   - no ntp client interval: Disables an interval.

Parameter	Description
INTERVAL	Interval (range: 3-14)

4) Configure a server that a NTP client will refer to.

[Configuring based on a domain name]
Enables or disables.

- ntp client server-addr hostname <WORD>: Enable
- no ntp client server-addr hostname <WORD>: Disable

Configure the index of a server that a NTP client will refer to. (Use a default value 1 if it is not configured.)

- ntp client server-addr hostname <WORD> index [INDEX]: Enable
- no ntp client server-addr hostname <WORD> index [INDEX]: Disable

Parameter	Description
INDEX	Server index (range: 1-5)

Configure the version of a server that a NTP client will refer to. (Use a default value 1 if it is not configured.)

- ntp client server-addr hostname <WORD> version [1-4]: Enable
- no ntp client server-addr hostname <WORD> version [1-4]: Disable

[Configuring based on IP address]
Enable or disable.

- ntp client server-addr ip <A.B.C.D>: Enable
- no ntp client server-addr ip <A.B.C.D>: Disable

Configure the index of a server that a NTP client will refer to. (Use a default value 1 if it is not configured.)

- ntp client server-addr ip <A.B.C.D> index [1-5]: Enable
- no ntp client server-addr ip <A.B.C.D> index [1-5]: Disable

Configure the version of a server that a NTP client will refer to. (Use a default value 1 if it is not configured.)

- ntp client server-addr ip <A.B.C.D> version [1-4]
- no ntp client server-addr ip <A.B.C.D> version [1-4]

You can proceed with configurations simultaneously as shown below.

- ntp client server-addr hostname <WORD> index [1-5] version [1-4]
- ntp client server-addr hostname <WORD> version [1-4] index [1-5]
- ntp client server-addr ip <A.B.C.D> index [1-5] version [1-4]
- ntp client server-addr ip <A.B.C.D> version [1-4] index [1-5]
- no ntp client server-addr hostname <WORD> index [1-5] version [1-4]
- no ntp client server-addr hostname <WORD> version [1-4] index [1-5]
- no ntp client server-addr ip <A.B.C.D> index [1-5] version [1-4]
- no ntp client server-addr ip <A.B.C.D> version [1-4] index [1-5]

[NTP Server Configuration]
The NTP server configuration is as follows:

1) Go to configure mode of CLI.

```
WEC8500# configure terminal
```

2) Configure a NTP server.
   - ntp server enable: Configures a NTP server.
   - no ntp server enable: Disables a NTP server.

[Checking NTP Configuration Status]
To check the status of a NTP client or server, enter the 'show ntp' command.

Configuration using Web UI

In the menu bar of **<WEC Main window>**, select **<Configuration>** and then select the **<NTP>** menu in the sub-menus.

The NTP initial window is shown below.

Figure 228. NTP client configuration

The Enable/Disable of a NTP server can be performed using a radio box.
You can configure polling interval enable/disable of a NTP client and also configure the polling interval during enabling. The range of polling interval is 3-14.

Click the **<Add>** or **<Delete>** button to add or delete a NTP proxy server. Click the **<Add>** button to configure a specific 'Server IP' or 'Server DOMAIN NAME' that will be used by a NTP proxy.

9.3 FTP/sFTP

The FTP is a network service for file transmission. The APC support the client and server function for FTP and sFTP (Secure FTP).

Configuration using CLI

[SFTP Server Configuration]

The secure FTP server configuration is as follows:

1) Go to configure mode of CLI.

```
WEC8500# configure terminal
```

2) Enable or disable the sFTP server.
   - sftp-server enable: Enable
   - no sftp-server enable: Disable

3) Enter as follows to change a user's ID and password.
   - sftp-server chguser [ID] [PASSWORD]

Parameter	Description
ID	User ID of a server
PASSWORD	User password of a server

4) To check the status of sFTP server, enter the 'show sftp-server' command.

[FTP Server Configuration]

1) Go to configure mode of CLI.

```
WEC8500# configure terminal
```

2) Enable or disable the sFTP server.
   - ftp-server enable: Enable
   - no ftp-server enable: Disable

3) Enter as follows to change a user's ID and password.
   - ftp-server chguser [ID] [PASSWORD]

Parameter	Description
ID	User ID of a server
PASSWORD	User password of a server

4) To change the idle timeout, enter the command below. The unit of timeout is minutes and the default value is 15 minutes.
   - ftp-server idle-timeout [timeout]

5) To check the status of FTP server, enter the 'show ftp-server' command.

[Using as Client]

Using the following commands, you can download or upload a file using a FTP/sFTP client.

- file download
- file upload

A usage example is provided below.

- File download using a sFTP client

```
WEC8500# file download samsung Samsung 90.90.21.108 wec8500 wec8500
sftp
```

- File upload using a sFTP client

```
WEC8500# file upload samsung Samsung 90.90.21.108 wec8500 wec8500 sftp
```

- File download using a FTP client

```
WEC8500# file download samsung Samsung 90.90.21.108 wec8500 wec8500
```

- File upload using a FTP client

```
WEC8500# file upload samsung Samsung 90.90.21.108 wec8500 wec8500
```

Configuration using Web UI

To configure the FTP/SFTP server configuration, in the menu bar of **<WEC Main window>**, select **<Administrator>** and then select the **<FTP-SFTP>** menu in the sub-menus.

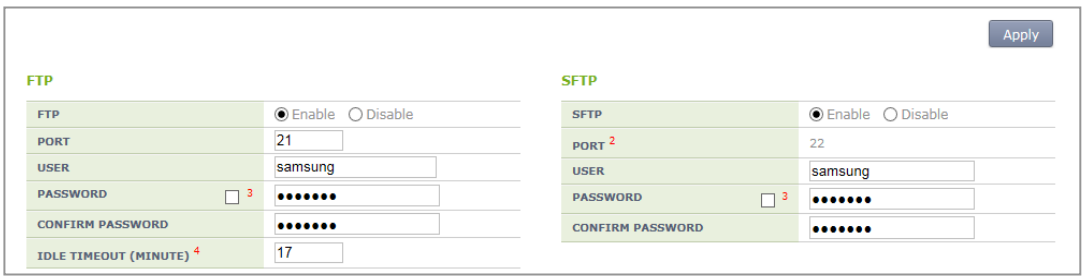


Figure 229. FTP/SFTP server configuration

The FTP and SFTP can be configured using the Enable/Disable radio box.
For FTP, you can configure a port number that will be used for FTP by using 'PORT' and can change the user name and password of a FTP server by entering 'USER', 'PASSWORD', or 'CONFIRM PASSWORD'. Enter an idle timeout value in 'IDLE TIMEOUT'.
Also for SFTP, you can change the user name and password of a SFTP server by entering 'USER', 'PASSWORD', or 'CONFIRM PASSWORD'.

9.4 Telnet/SSH

The telnet or Secure Shell (SSH) is an Internet protocol that helps login to another computer in a network or connects to a virtual remote system. Using telnet or SSH, you can connect to another computer while staying at a current computer.
Because the SSH can access a remote system and transmit an encrypted message by using public key-based encryption method, it provides better security.

Configuration using CLI

[Telnet Server Configuration]
The Telnet server configuration is as follows:

1) Go to configure mode of CLI.

```
WEC8500# configure terminal
```

2) Enable or disable the telnet service. If you configure the telnet service, you can use the APC as a telnet server.
   - telnet-server enable: Enable
   - no telnet-server enable: Disable

3) If you configure the telnet service, specify the port number of telnet server.
   - telnet-server port [PORT_NUMBER]

Parameter	Description
PORT_NUMBER	Port number to configure (range: 1-65535)

[SSH Server Configuration]
The SSH server configuration is as follows:

1) Go to configure mode of CLI.

```
WEC8500# configure terminal
```

2) Enable or disable the SSH server.
   - ssh-server enable: Enable
   - no ssh-server enable: Disable

3) Specify the port number of SSH server.
   - ssh-server port [PORT_NUMBER]

Parameter	Description
PORT_NUMBER	Port number to configure (range: 1-65535)

[Checking Server Configuration Status]
To check the status of telnet or ssh server, enter the following command. You can retrieve the configured port number as well as server status.

- show ssh-server: Retrieves the status of SSH server
- show telnet-server: Retrieves the status of telnet server

[Using as Client]
By using the APC as a telnet or SSH client, you can connect to a server.
Enter as follows in CLI.

- telnet [IP_ADDRESS] [PORT_NUMBER]
- ssh [IP_ADDRESS] [ID] [PORT_NUMBER]

Parameter	Description
IP_ADDRESS	IP address or domain name of a server to connect
ID	login ID
PORT_NUMBER	Port number (range: 1-65535) If the port number is not entered, its default is shown below. - telnet: 23 - ssh: 22

Configuration using Web UI

To configure the Telnet/SSH server configuration, in the menu bar of **<WEC Main window>**, select **<Administrator>** and then select the **<Telnet-SSH>** menu in the sub-menus.

Figure 230. Telnet/SSH server configuration

You can configure the service by using the Enable/Disable radio box of ‘TELNET SERVICE’ or ‘SSH SERVICE’.
You can configure the port number of service by using ‘TELNET PORT’ or ‘SSH PORT’.
By using ‘SESSION TIMEOUT’, you can configure the session timeout of TELNET or SSH in min. and can also configure maximum number of sessions by using ‘MAXIMUM NUMBER OF SESSIONS’.

9.5 Utilities

The APC provides the functions such as ping, traceroute, or tcpdump to check a network and its problems.

[ping]
Used to check network connection status.

- ping [IP_ADDRESS]

[traceroute]
Used to check a route path.

- traceroute [IP_ADDRESS]

[tcpdump]
Used to check the packet of a specific interface.

- tcpdump [INTERFACE_NAME]

CHAPTER 10. System Management

In this chapter, the various functions used by an operator to manage the system and troubleshooting method are described. In addition, the configurations required for system operation such as system configuration management, resource management, alarm management, and package management, etc. and checking methods are described.

10.1 SNMP Configuration

10.1.1 SNMP Community

To use an external management server or to manage the system through a web server after initial system installation, you must configure the SNMP community using CLI.
When creating the SNMP community, you can restrict configuration privilege by allocating the access right such as read-only or read-write and can also restrict an IP to connect.
You can configure maximum 10 SNMP communities.

Configuration using CLI

To add a SNMP community, execute the command as follows:

1) Go to configure mode of CLI.

```
WEC8500# configure terminal
WEC8500/configure#
```

2) Use the ‘snmp community’ command to add a SNMP community.
   - snmp community [COMMUNITY_NAME] [ACCESS] [IP_VERSION] [IP_ADDRESS] [NET MAST]

Parameter	Description
COMMUNITY_NAME	Name of a community to add
ACCESS	Access privilege (rw/ro) - rw: read-write privilege - ro: read-only privilege
IP_VERSION	IP address version type (v4/v6)
IP_ADDRESS, NETMAST	IP address area that can be connected

3) To check the created SNMP community, use the ‘show snmp community’ command.

Configuration using Web UI

In the menu bar of <**WEC Main window**>, select <**Administrator**> and then select the <**SNMP**> → <**Community**> menu in the sub-menus. When you click the <**Add**> button in the Community window, the community creation window is displayed. When you enter a configuration value and click the <**Apply**> button, the configuration is applied.

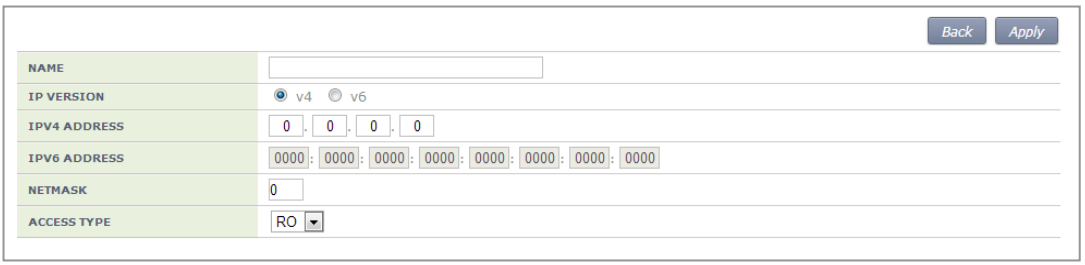


Figure 231. Adding SNMP community

10.1.2 SNMP Trap

All the alarms of the APC system are basically transmitted to outside through the SNMP trap. Therefore, to receive a system alarm from an external management server, the server address must be registered as a trap target. The trap supports v1/v2.

Configuration using CLI

To add a SNMP trap target, execute the command as follows:

1) Go to configure mode of CLI.

```
WEC8500# configure terminal
WEC8500/configure#
```

2) Add a SNMP trap target.
   - snmp trap [TRAP_VERSION] [COMMUNITY_NAME] [IP_VERSION] [IP_ADDRESS] [PORT_NUMBER]

Parameter	Description
TRAP_VERSION	Trap version (v1/v2)
COMMUNITY_NAME	Name of a community to be transmitted
IP_VERSION	IP address type (v4/v6)
IP_ADDRESS	IP address to which a trap will be transmitted
PORT_NUMBER	Port number to which a trap will be transmitted (default: 162)

3) To check the added trap target, use the ‘show snmp trap’ command.

Configuration using Web UI

In the menu bar of **<WEC Main window>**, select **<Administrator>** and then select the **<SNMP>** → **<Trap Receiver>** menu in the sub-menus.
When you click the **<Add>** button in the Trap Receiver window, the trap creation window is displayed. When you enter a configuration value and click the **<Apply>** button, the configuration is applied.

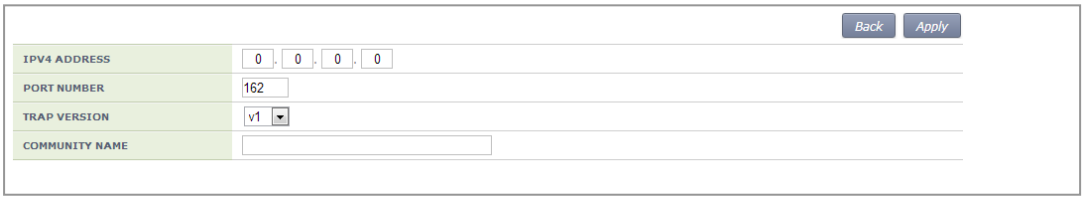


Figure 232. SNMP trap configuration

10.2 System Management

10.2.1 Retrieving System Information

Retrieving with CLI

By using the 'show system info' command, you can check the system configuration information of the APC system such as version information, memory information, disk information, temperature sensor and fan status, etc.

The execution results of the command in WEC8500 are as follows:

```
WEC8500/configure# show system info
 ------------------------------------------------------
 Item                          System Info
 ------------------------------------------------------
 System Info :
  model type                   WEC8500
  system description           Samsung AP Controller
  board version                0.1
  cpld version                 0.5
  system mac address           00:7e:37:00:1e:70
  system total memory          16046580 KBytes
  system total disk            13520032 KBytes

 Temperature Sensor Status  :
  cpu upside sensor            OK
  cpu downside sensor          OK
  board sensor                 OK

 Fan Status :
  fan[0]                       OK
  fan[1]                       OK
  fan[2]                       OK
  fan[3]                       OK

 Power Supply Status :
  Power Supply[0]              Equipped
   Status                      OK
  Power Supply[1]              Not Equipped
   Status                      -
 ------------------------------------------------------
```

The execution results of the command in WEC8050 are as follows:

```
WEC8050# show system info
 ------------------------------------------------------
 Item                        System Info
 ------------------------------------------------------
 System Info :
  model type                 WEC8050
  system description         Samsung AP Controller
  board version              0.0
  cpld version               0.1
  serial number
  system mac address         00:7e:37:00:21:d4
  system total memory        4855272 KBytes
  system total disk          12191593 KBytes

 Temperature Sensor Status :
  CPU sensor1                OK
  CPU sensor2                OK

 Fan Status :
  fan[0]                     OK
  fan[1]                     OK
 ------------------------------------------------------
```

The descriptions of the output parameters are as follows:

[System Info]

Parameter	Description
model type	Product model name
system description	Product type
board version	Hardware version of a board
cpld version	System cpld version
system mac address	System MAC address
system total memory	System total memory capacity
system total disk	System total disk capacity

[Temperature Sensor Status]

Parameter	Description
cpu upside sensor	CPU upside sensor status (OK, NOK)
cpu downside sensor	CPU downside sensor status (OK, NOK)
board sensor	Board sensor status (OK, NOK)

[Fan Status]

For WEC8500:

Parameter	Description
Fan [0]~[3]	Fan operation status (OK, NOK)

For WEC8050:

Parameter	Description
Fan [0]~[1]	Fan operation status (OK, NOK)

[Power Supply Status]

The WEC8500 has dual detachable power module as shown below.

Parameter	Description
Power Supply [0]~[1]	Whether a power module is equipped (Equipped, Not Equipped)
Status	Power module operation status (OK, NOK)

The WEC8050 has only one power module as shown below.

Parameter	Description
Power Supply Status	Power module operation status (OK, NOK)

Retrieving with Web UI

In the menu bar of **<WEC Main window>,** select **<Monitor>** and then select the **<Summary>** menu in the sub-menus. It provides a wide range of information, status retrieving event and alarm retrieving function of the WEC8500 system.

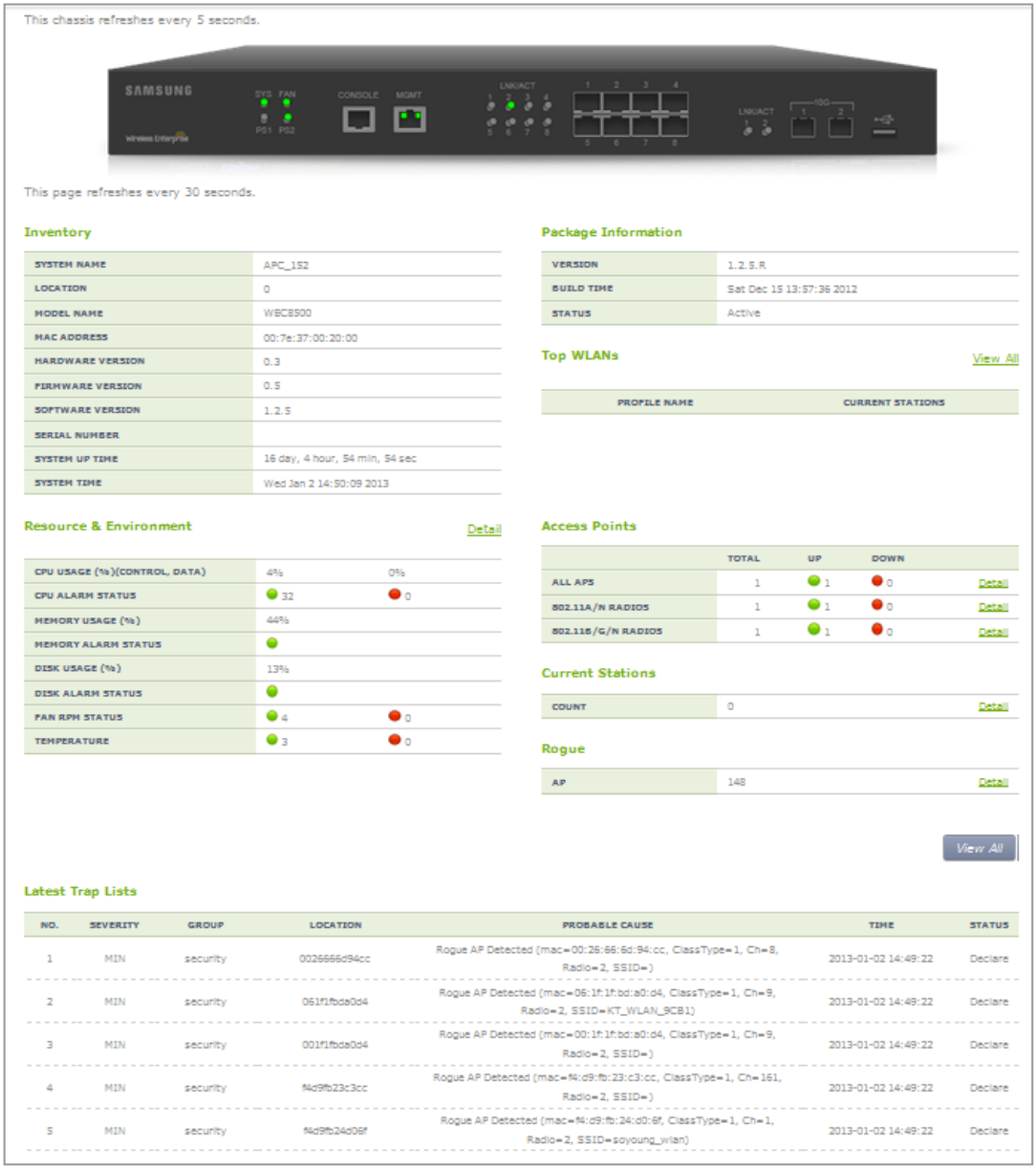
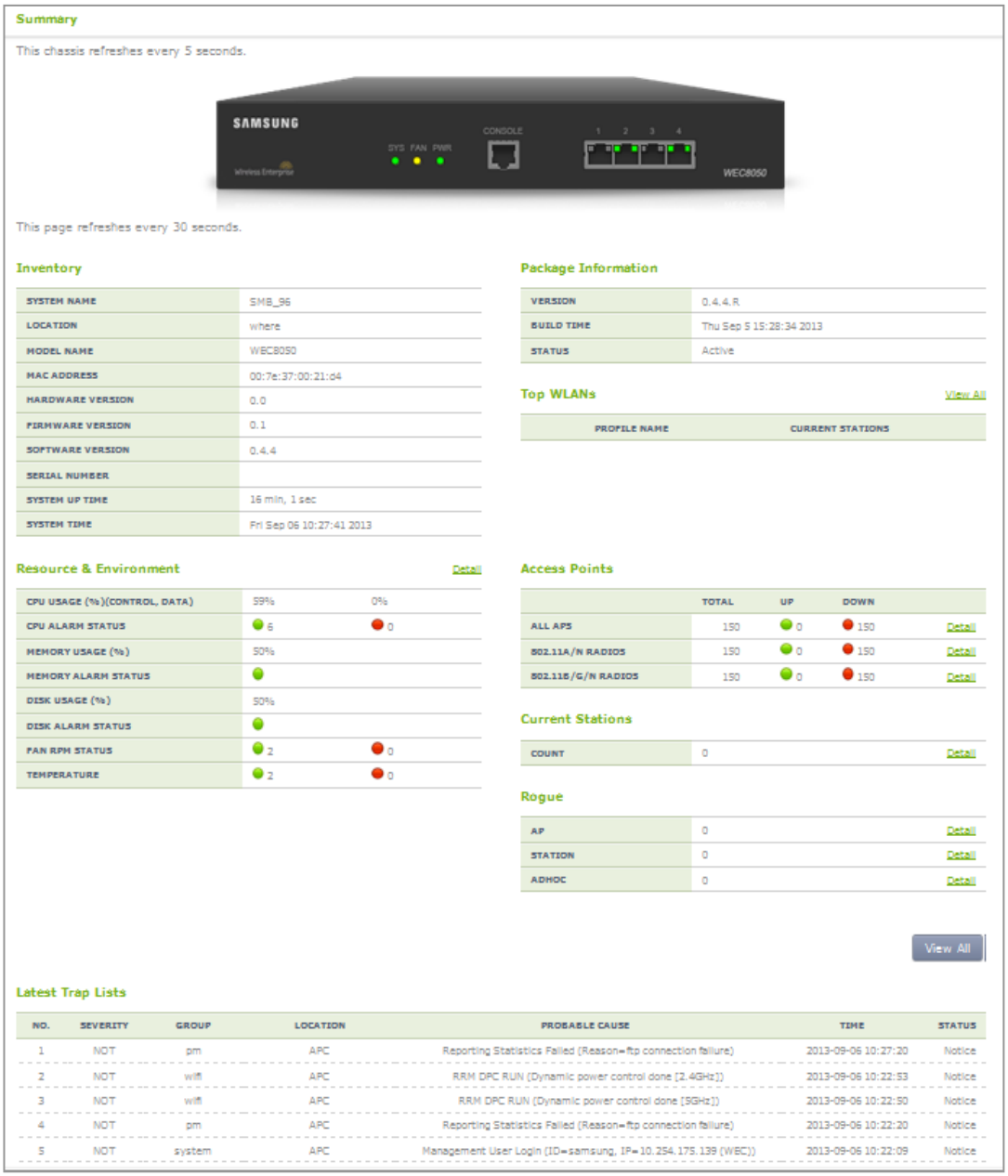


Figure 233. System information

It provides various information, status retrieving event and alarm retrieving function of the WEC8050 system.



10.2.2 System Reboot

There is a command that can reboot the system. Rebooting can be reserved and you can cancel or retrieve the reservation.

Configuration using CLI

Use the ‘reboot’ command to reboot the system.

```
WEC8500# reboot
```

Use the ‘reboot in HH:MM:SS’ command to reserve system reboot. Once the reservation is completed, the system is rebooted after a specified time (HH:MM:SS).

```
WEC8500# reboot in 12:00:00

       Do you want to save the configuration? (y/n): y

       Do you want to restart the system? (y/n): y
Notice: The system WILL reboot in 12:00:00.
WEC8500# show reboot schedule
The reboot has scheduled in 11:58:41.
```

To cancel the reservation, enter the ‘no reboot’ command.

```
WEC8500# no reboot
```

Configuration using Web UI

To configure a reboot related function, in the menu bar of **<WEC Main window>**, select **<Administrator>** and then select the **<Reboot>** menu in the sub-menus.

The Reboot window is shown below.

[APC]

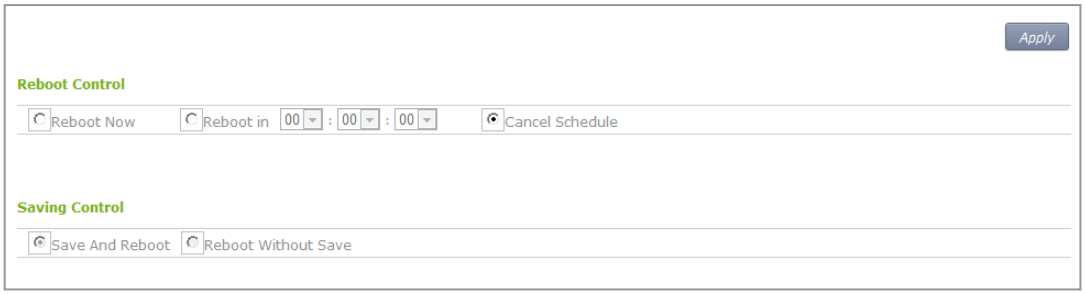


Figure 234. Reboot (APC)

[AP]

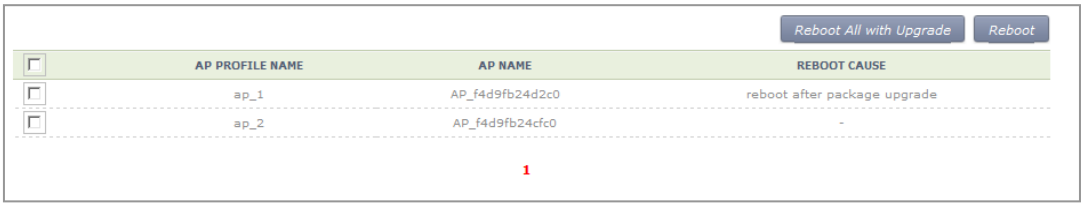


Figure 235. Reboot (AP)

10.3 System Resource Management

10.3.1 Retrieving System Status

Retrieving with CLI

By using the 'show system' command, you can check the status of each system resource such as CPU load, memory usage, disk usage, Fan RPM level, or system temperature, etc.

- show system cpu: Retrieves CPU load. If there are several cores, the CPU load of each core is displayed.
- show system memory: Retrieves memory usage.
- show system disk: Retrieves disk usage.
- show system fan: Retrieves system fan speed (RPM level range: 0-3)
- show system temp: Retrieves system temperature (℃).

The result of system status retrieval using each command is as follows:

[CPU Load]
The retrieving CLI execution result of WEC8500 is as follows:

```
WEC8500# show system cpu
 Average CPU usage  (%)
  control plane   :  3.84
  data plane      :  0.00
WEC8500# show system cpu detail
 ------------------------------------------------------------------
 Average CPU usage                                          (%)
  control plane                                            2.12
  data plane                                               0.00
 ------------------------------------------------------------------
 Detail CPU usage                                           (%)
  control plane
   [10.00] [04.23] [00.00] [02.74] [00.00] [00.00] [00.00] [00.00]
  data plane
   [00.00] [00.00] [00.00] [00.00] [00.00] [00.00] [00.00] [00.00]
   [00.00] [00.00] [00.00] [00.00] [00.00] [00.00] [00.00] [00.00]
```

The retrieving CLI execution result of WEC8050 is as follows:

```
WEC8050# show system cpu
 Average CPU usage  (%)
  control plane   : 39.43
  data plane      :  0.01
WEC8050# show system cpu  detail
 ------------------------------------------------------------------
 Average CPU usage                                          (%)
  control plane                                           21.97
  data plane                                               0.01
```

```
 ------------------------------------------------------------------
 Detail CPU usage                                            (%)
  control plane
   [23.29] [25.71] [16.90]
  data plane
   [00.01] [00.00] [00.00]
```

[Memory usage]

```
WEC8500# show system memory
 Total      Memory :  7657960 KBytes
 Used       Memory :  3341868 KBytes
 Available  Memory :  4316092 KBytes
 Reserved   Memory :  8900608 Kbytes
```

[Disk usage]

```
WEC8500# show system disk
 Total   Disk   :  13520032 KBytes
 Used    Disk   :   4338296 KBytes
 Free    Disk   :   9181736 KBytes
```

[Fan RPM Level]

The retrieving CLI execution result of WEC8500 is as follows:

```
WEC8500# show system fan
 FAN ID   rpm Level(0-3)
 -------  --------------
 FAN[0]      1 level
 FAN[1]      1 level
 FAN[2]      1 level
 FAN[3]      1 level
```

The retrieving CLI execution result of WEC8050 is as follows:

```
WEC8050# show system fan
 FAN ID   rpm Level(0-3)
 -------  --------------
 FAN[0]      1 level
 FAN[1]      1 level
```

[System Temperature (°C)]

The retrieving CLI execution result of WEC8500 is as follows:

```
WEC8500# show system temp
 Sensor Location   Temperature
 ---------------   -----------
CPU sensor 1          33
CPU sensor 2          38
Board                 29
```

The retrieving CLI execution result of WEC8050 is as follows:

```
WEC8050# show system temp
 Sensor Location   Temperature('C)
 ---------------   ---------------
 CPU sensor 1         45
 CPU sensor 2         52
```

Retrieving with Web UI

In the menu bar of **<WEC Main window>,** select **<Monitor>** and then select the **<Summary>** menu in the sub-menus. For more information about detail window, see '10.2.1 Retrieving System Information'.

10.3.2 Retrieving and Configuring Threshold

If each resource of the system exceeds its configured threshold, there occurs an alarm. The APC helps an operator check and configure each threshold.

Configuration using CLI

To check each threshold, use the below command.

- show system threshold cpu: CPU load (%)
- show system threshold memory: Memory usage (%)
- show system threshold disk: Disk usage (%)
- show system threshold fan: Fan RPM level
- show system threshold temp: Retrieves system temperature (℃).

To change a threshold related to CPU load or memory usage, enter the command as follows:

- system monitor cpu threshold [THRESHOLD]: Configures the CPU load threshold.
- system monitor memory threshold [THRESHOLD]: Configures the memory usage threshold.

Parameter	Description
THRESHOLD	Threshold to configure (%)

Configuration using Web UI

In the menu bar of <WEC Main window>, select <Administrator> and then select the <SNMP> → <Trap Control> → <Alarm Threshold> menu in the sub-menus.
You can retrieve and configure a threshold at which CPU load, disk usage, temperature alarm, memory usage, or fan alarm occurs. Enter a value for each item, and click the **<Apply>** button to make the configuration applied.

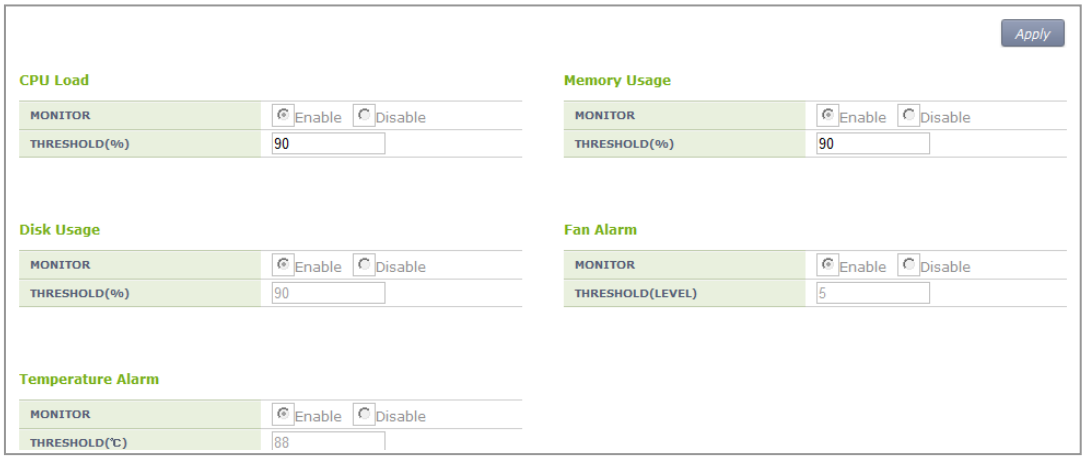


Figure 236. Configuring SNMP alarm threshold

10.4 Managing Alarm and Event

The system alarms and events are saved into a system log and transmitted to an external server according to the filtering policy. An alarm is managed in terms of occurrence and release and an event is managed in the report format.

The alarm and event are managed according to group or level. Each group or level is classified into the following item. You can select an item to retrieve.

Alarm, event group

Group	Description
system	Retrieves system alarm or event.
pm	Retrieves performance monitoring alarm or event.
ap	Retrieves AP related alarm or event.
wlan	Retrieves WLAN related alarm or event.
wifi	Retrieves WI-FI related alarm or event.
security	Retrieves security related alarm or event.
network	Retrieves network related alarm or event.
interface	Retrieves interface related alarm or event.
se	Retrieves system engine related alarm or event.
list	Retrieves alarm or event list information.

Alarm level

Level	Description
critical	Retrieves a critical alarm. A critical alarm is a system log that could give a critical effect to a service.
major	Retrieves a major alarm. A major alarm is a system log that could give a major effect to a service.
minor	Retrieves a minor alarm. A minor alarm is a system log that could give a minor effect to a service.

10.4.1 Retrieving Current Alarm

All the system alarms are basically recorded into a system log. The procedure of retrieving current alarms is as follows:

Retrieving with CLI

To retrieve current alarms, execute the command as follows:

```
WEC8500# show alarm list all
1 network    2012-12-17 09:56:13 MAJ APC ge8 1301 NET Link dn
AdminStatus[up] OperStatus[down]
2 network    2012-12-17 09:56:13 MAJ APC xe1 1301 NET Link dn
AdminStatus[up] OperStatus[down]
3 network    2012-12-17 09:56:13 MAJ APC xe2 1301 NET Link dn
AdminStatus[up] OperStatus[down]
…
```

To selectively retrieve a group or level, execute the command as follows:

```
WEC8500# show alarm list group network
1 network    2012-12-17 09:56:13 MAJ APC ge8 1301 NET Link dn
AdminStatus[up] OperStatus[down]
```

```
WEC8500# show alarm history level major
1 network    2012-12-17 09:56:13 MAJ APC ge8 1301 NET Link dn
AdminStatus[up] OperStatus[down]
```

Retrieving with Web UI

To retrieve the list of current alarms, in the menu bar of **<WEC Main window>**, select **<Monitor>** and then select the **<Active Alarm>** menu in the sub-menus.

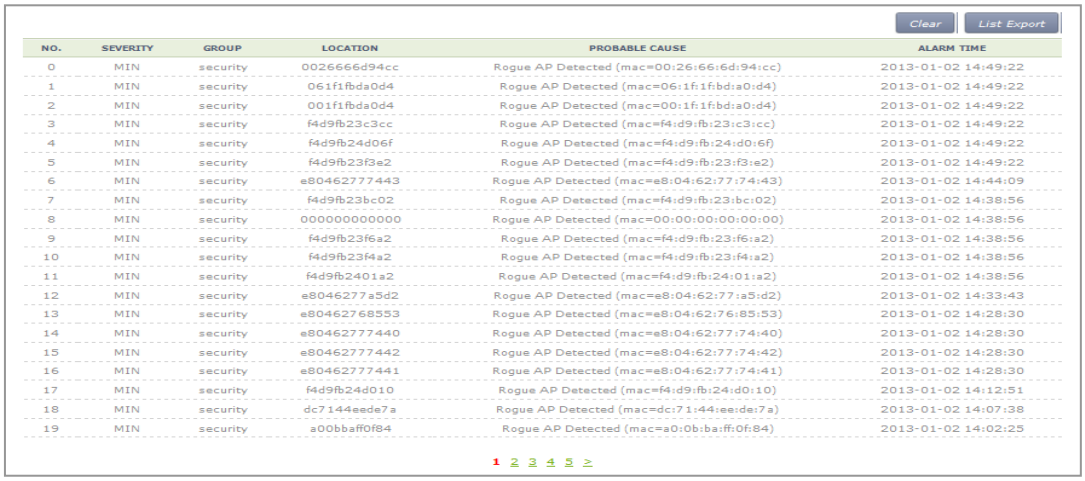


Figure 237. Current alarm

10.4.2 Retrieving History

Retrieving with CLI

The APC retrieves the history of alarm and event using the following command.

[Alarm History]

```
WEC8500# show alarm history all
1 ap        2012-12-20 13:13:25 MAJ AP_f4:d9:fb:24:cf:80 r=1 AP RADIO
CARD TX FAIL Clear radio(1)
2 ap        2012-12-20 13:13:25 MAJ AP_f4:d9:fb:24:cf:80 r=2 AP RADIO
CARD TX FAIL Clear radio(2)
3 ap        2012-12-20 13:13:25 MAJ AP_f4:d9:fb:24:cf:80 r=1,w=1 BSS
…
```

Because all the alarms are managed per group or level, you can retrieve it selectively using the following command.

```
WEC8500# show alarm history group system
1 system    2012-12-21 17:49:45 MAJ APC core2 CPU Load Alarm Declare
LOAD(100.00)
…
```

```
WEC8500# show alarm history level major
1 system    2012-12-21 17:49:45 MAJ APC core 2 CPU Load Alarm Declare
LOAD(100.00)
…
```

[Event History]

You can retrieve event information using the following command.

```
WEC8500# show event
1 system  2012-08-31 13:59:46 NOT APC MGMT User Login ID=samsung,
IP=192.168.0.91
2 system  2012-08-31 13:48:33 NOT SWM:system Boot Complete -
…
```

An event is managed per group and you can retrieve it selectively using the following command.

```
WEC8500# show event group interface
1 interface  2012-08-31 13:48:32 NOT APC Index[1] Name[ge1] IF Admin No
Shut AdminStatus[up] OperStatus[up]
…
```

Configuration using Web UI

In the menu bar of **<WEC Main window>,** select **<Monitor>** and then select the **<Summary>** menu in the sub-menus. It provides status retrieving event and alarm retrieving function.

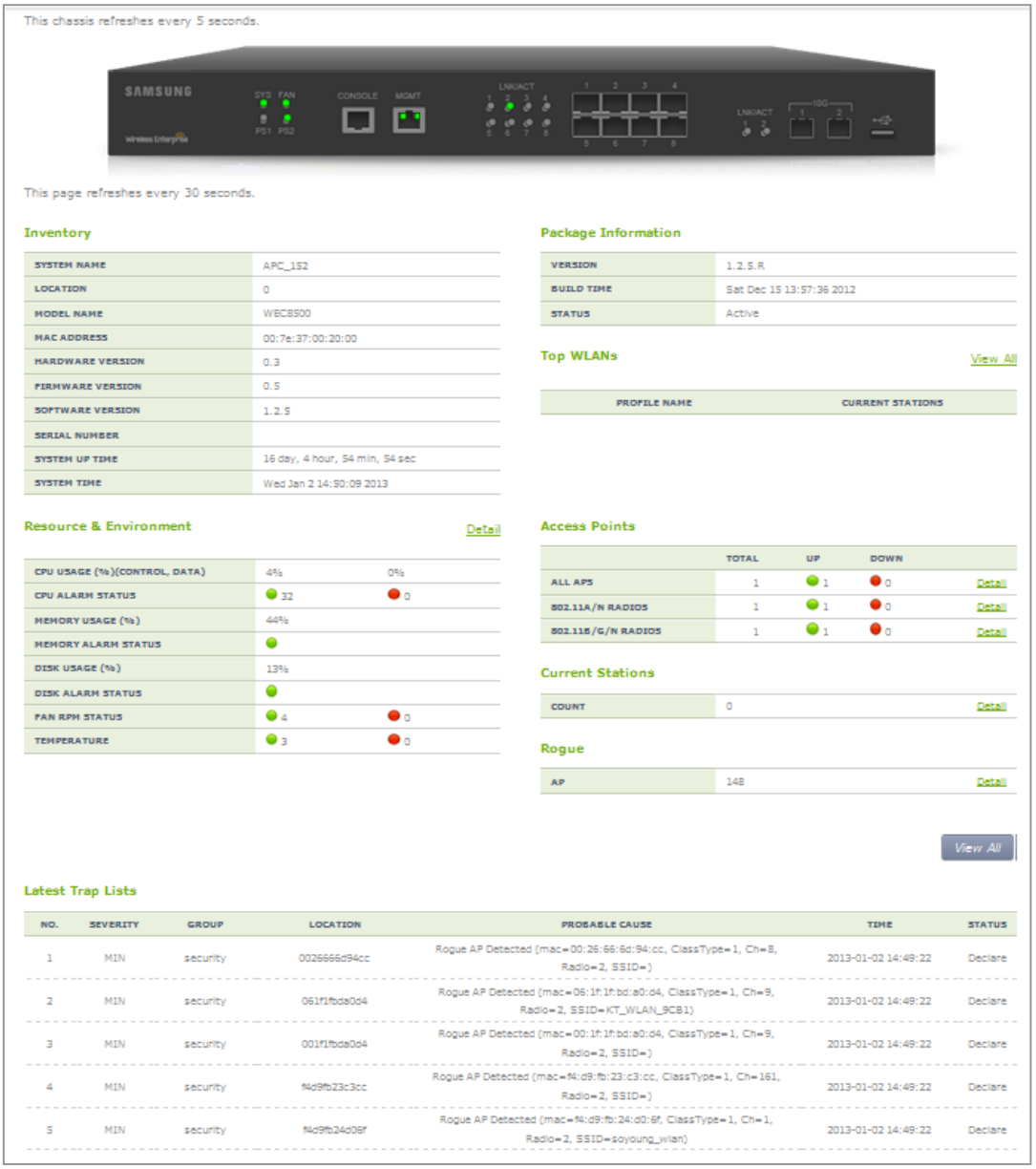


Figure 238. History

10.4.3 External Transmission Configuration

All the alarms and events in the system are transmitted to outside through the SNMP trap and syslog. If the alarm filter information is configured, only filtered alarm is transmitted to an external management server.

10.4.4 Alarm Filter and Level Configuration

An alarm filter can be configured per group or level (severity). The filtered alarms are transmitted to an external server through the SNMP trap and syslog.

Configuration using CLI

The procedure of alarm filter configuration is as follows:

1) Go to configure mode of CLI.

```
WEC8500# configure terminal
```

2) Configure group information.

```
WEC8500/configure# alarm group system
```

3) Configure level information.

```
WEC8500/configure# alarm level major
```

4) To check the configured alarm filter information, use the ‘show alarm conf’ command.

Configuration using Web UI

In the menu bar of <**WEC Main window**>, select <**Administrator**> and then select the <**SNMP**> → <**Trap Control**> → <**Alarm Information**> menu in the sub-menus.

You can retrieve the configuration related to alarm filter and alarm level.

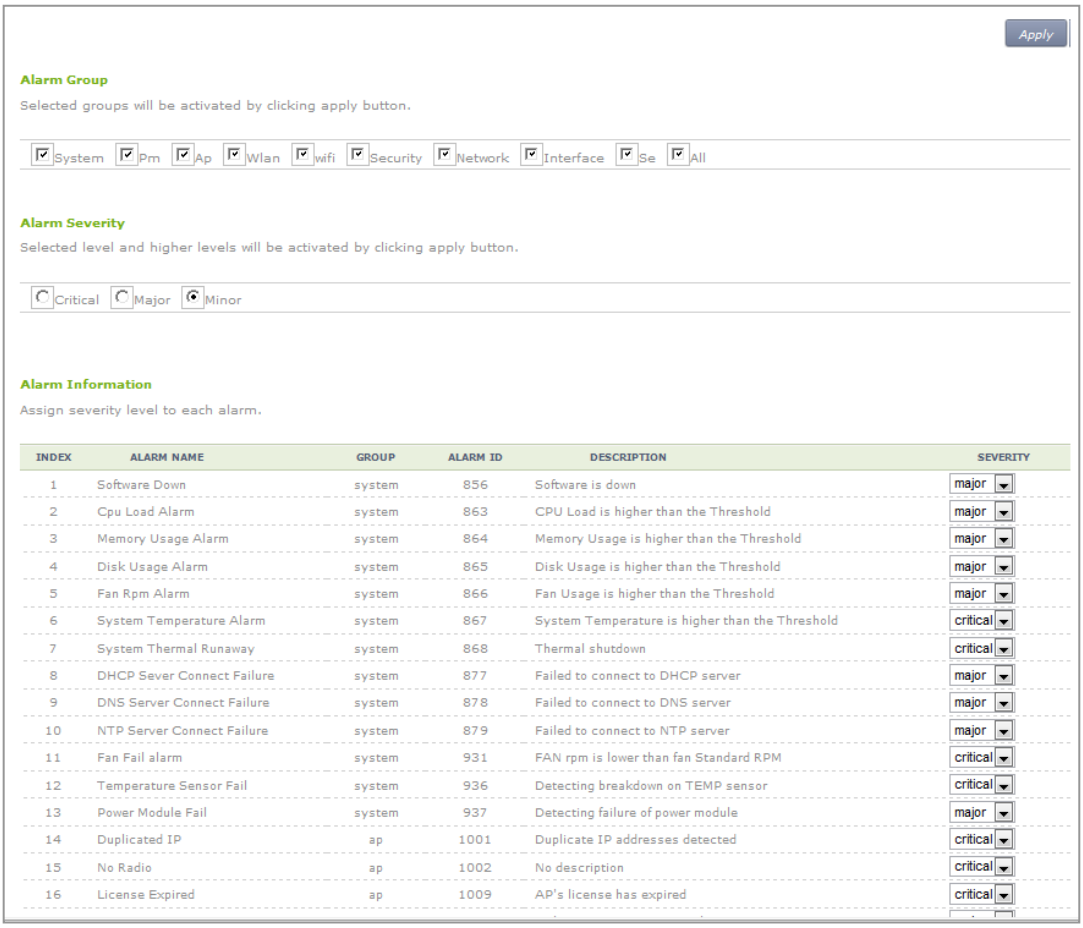


Figure 239. Configuring alarm filter and level

10.5 Managing Traffic Performance

You can manage the traffic performance statistics information and accumulated data for the APC system and the interface of each AP.

10.5.1 Managing History Information

When the traffic performance information management is enabled, the APC system creates history information at every 5 minute. But, if the FTP server information is not configured, the history information is not transmitted to outside although it is created.

Collecting information

1) Go to configure mode of CLI.

```
WEC8500# configure terminal
WEC8500/configure#
```

2) Configure the traffic performance information.

```
WEC8500/configure# stats-report enable
```

3) Configure a FTP server to transmit history information.
   - stats-report target ip [IP_ADDRESS] port [PORT_NUMBER] id [ID] password [PASSWORD] path [PATH]

Parameter	Description
IP_ADDRESS	IP address of a target server
PORT_NUMBER	Port number of a target server
ID	User ID of a target server
PASSWORD	User password of a target server
PATH	File storage path of a target server

4) To check the information of traffic performance information management, use the ‘show stats-report conf’ command.

5) Configure so that the performance information is uploaded to the FTP server. But, because the default is the ‘start’ status, this step may be skipped.

```
WEC8500/configure# stats-report upload start
```

Stopping information collection

1) Go to configure mode of CLI.

```
WEC8500# configure terminal
```

2) 'Disable' the traffic performance information management.

```
WEC8500/configure# no stats-report enable
```

3) To check the configured information, use the 'show stats-report conf' command.

10.5.2 Managing Real-time Information Collection

1) Go to configure mode of CLI.

```
WEC8500# configure terminal
WEC8500/configure#
```

2) To collect real-time information, execute the following command. At this time, you must specify the name and status of an interface whose information will be collected.
   - stats-report current-stats [INTERFACE_NAME] [STATE]

Parameter	Description
INTERFACE_NAME	Name of an interface to collect or stop collection
STATE	Status of real-time information (start/stop) - start: Starts real-time information collection - stop: Stops or initializes the real-time information collection.

3) To check the entered information, use the 'show stats-report conf' command.

4) To check the information of a configured interface when the real-time information collection is configured, execute the following command.
   - show stats-report current-stats [INTERFACE_NAME]

   If the real-time information collection is suspended or initialized, you cannot check the real-time information of the interface.

```
WEC8500/configure# show stats-report current-stats ge3
Error: This interface was not configured to gather statistics.
```

10.6 Managing License Key

The Samsung Electronics Common License Method (SLM) is applied to Version 1.5 or newer of the APC system.
Therefore, SLM licensing is applied to new websites that are installed using Version 1.5 or later.
However, if Version 1.4 is upgraded to Version 1.5, the existing license key is used without any modification. The existing license which is not SLM must be installed and used also in the case of expanding or reissuing the APC system.

In this document, license keys supported by Version 1.4 or later are referred to as 'old license keys' and license keys supported by Version 1.5 or later are referred to as 'Activation keys'.

These details are summarized in the table below.

Initially installed version	Reinstalling the license	Expanding/reissuing	After an upgrade
APC Version 1.4 or below	Install the old license	Install the old license	Re-use the old license
APC 1.5 or higher	Install the SLM license	Install the SLM license	Re-use the SLM license

If an APC system is shipped out without a license installed, only the following services are offered:

System Model	Number of APs	VQM	Firewall
WEC8050	5 units connected	Not provided	Not provided
WEC8500	2 units connected	Not provided	Not provided

10.6.1 Managing SLM License (Activation) Key

An SLM activation key can have differences in regard to the number of manageable APs, whether to support the VQM function, whether to support the firewall function, and the period of use of a function.
Every system has a unique activation key and activation keys are provided in the form of encrypted files.
To clear an SLM activation key installed in a system, the deactivation command needs to be executed and after the execution of the command, a deactivation key is issued to notify that clearing has been completed successfully.

NOTE

Installation

Only two activation keys can be installed/registered in an APC system.
If two unexpired activation keys co-exist, available services are offered as shown in the following example:

(Example)
- Activation Key 1: AP (100 units), VQM (Disable), Firewall (Disable)
- Activation Key 2: AP (50 units), VQM (Enable), Firewall (Disable)
- result: AP (100 units), VQM (Enable), Firewall (Disable)

NOTE

Period of Use

Each activation key has its own information regarding the start and end times, and if the current time is not within the set period, the activation key expires.

NOTE

Application

An activation key only functions correctly after the system is rebooted after deletion or installation of a key.

Configuration using CLI

To configure an activation key, first execute the following commands and enter license mode:

```
WEC8500# configure terminal
WEC8500/configure# system license
WEC8500/configure/system/license#
```

[Installing Activation Key]

When the system is shipped out, there is no registered license key. Therefore, you must install the license key you received immediately after the first system installation. You can install a license key directly or remotely using CLI.

- activate-key [Fullpath filename]
  Registers an activation key file. If a license key file exists in a specified folder, use the license key file for registration.
  When entering the file name of an activation key, you must enter the file name including its full path.

[Clearing Activation Key]

- no activate-key [the activation key's license key]
  Clears an activation key registered in the system.
  You can view the license key information of an activation key in the 'License' field of the activation key by executing the 'show system license-key' command.
  After clearance, you can view information about the deactivation key in the 'License Key' of the key after executing the 'show system license-key' command.

Configuration using Web UI

In the menu bar of **<WEC Main window>**, select **<Configuration>** and then select the **<License>** menu in the sub-menus.

In the figure below, the 'SLM License Key Status' shows the installation and application statuses of SLM activation keys.
In the 'License Control' section, the operator can select an activation key stored in their PC and install it in the system.
In addition, the operator can also deactivate an installed activation key. The operator can clear an installed activation key by selecting Deactivation in 'License Control' and then entering the license key shown in 'SLM License Key Status'.

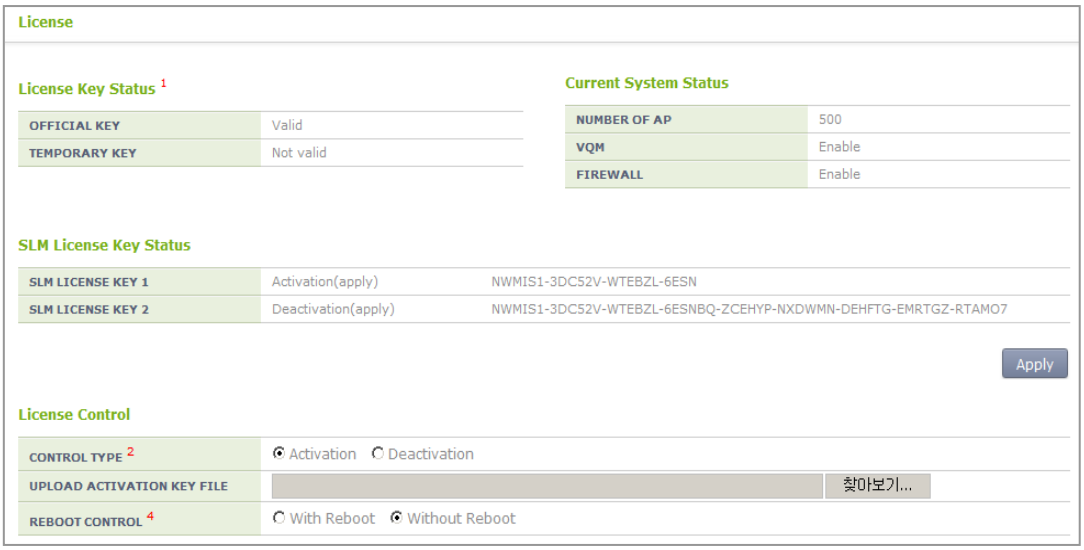


Figure 240. SLM License Search and Configuration Window

10.6.2 Managing Old License Key

An old license key can differ in regard to the number of manageable APs, whether to support the VQM function, whether to support the firewall function, and the period of use of a function.
A license key is unique for each system and it consists of encrypted 53 characters.
A license key is distributed in a file or text format.

Installation

APC system can install/register only one official license key and one temporary license key. A license key (temporary license Key) with time duration can be installed only 3 times.

Use period

An official license key has no restriction on use period.
A temporary license key has a restriction on use period and the period can be 1, 30, or 60-day.

Apply

A license key becomes active only after system rebooting after the key is installed or deleted.

Configuration using CLI

To configure a license key related function, go to license mode by executing the following command.

```
WEC8500# configure terminal
WEC8500/configure# system license
WEC8500/configure/system/license#
```

[Installing License Key]

When the system is shipped out, basically there is no registered license key. Therefore, you must install the license key you received right after the first system installation. You can install a license key directly or remotely using CLI.

- install-key: Registers a file. If a license key file exists in a specified folder, use the license key file for registration. Once it is installed, the license key file is deleted from the system.
- install-key [LICENSE_KEY]: Direct registration
- install-key [IP_ADDRESS] [PORT_NUMBER] [ID] [PASSWORD] [PATH]: Remote registration

Parameter	Description
LICENSE_KEY	Issued license key
IP_ADDRESS	IP address
PORT_NUMBER	Port number
ID	login ID
PASSWORD	Password
PATH	Server path

[Deleting License Key]

You can delete a license key directly.

- no install-key [LICENSE_KEY]

Parameter	Description
LICENSE_KEY	License key to delete

[Retrieving License Key Information]

To check the license key information, use the ‘show system license-key’ command.

```
===== Current System Status ======
Number of APs               : 2
VQM                         : Disabled
Firewall                    : Disabled

===== License Information ======
* Old License - Official License Key
   License Key              : YNHSHPWP-5MNMTE04-UJHKDO4U-A2WGSBGX-
OJZ2MJ5R-7Z5DBYMT
   MAC Address              : F4D9FB236C01
   System Model             : Any
   Lifetime                 : Permanet
   Number of APs            : 75
   VQM                      : Eanbed
   Firewall                 : Eanbed
   Installation Time        : 00
```

[Analyzing License Key]

Before registering a license key to the system, you can check the functions supported by the license key.

- analyze-key [LICENSE-KEY]

Parameter	Description
LICENSE_KEY	License key

Configuration using Web UI

In the menu bar of <**WEC Main window**>, select <**Configuration**> and then select the <**License**> menu in the sub-menus.

From the APC Version 1.5 and later, in respect of old license keys, the web UI does not provide input/deletion functions and shows only whether they are installed properly.

In the figure below, 'License Key Status' is the section that shows whether old license keys are installed properly and 'Current System Status' shows license information currently applied to the system.

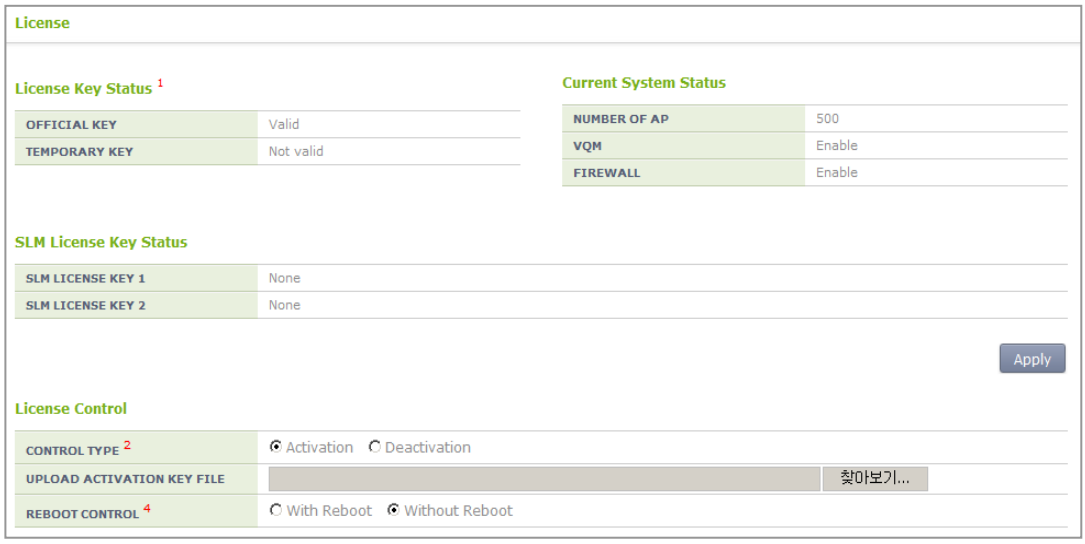


Figure 241. Old License Installation Check Window

10.7 Syslog Configuration

The system log (syslog) configuration is required to transmit an event, alarm, and system log information to a target syslog server. You can configure maximum two target syslog servers in the system and you can configure the IP address and port number independently. In addition, because you can configure a filter level, only filtered log information is transmitted to the syslog server.

Configuration using CLI

To transmit an alarm, event, and system log to the syslog server, executes the command as follows:

1) Go to configure mode of CLI.

```
WEC8500# configure terminal
```

2) To transmit an alarm, event, and system log information to the syslog server, specify ‘enable’ as a parameter.

```
WEC8500/configure# syslog enable
```

3) Configure the IP address and UDP port of a target syslog server (The default of the UDP port is ‘514’.).

```
WEC8500/configure# syslog add 192.168.0.91
WEC8500/configure# syslog add 192.168.0.99 udpport 510
```

4) Configure a log level to filter.

```
WEC8500/configure# syslog level information
```

5) To check the configured syslog information, use the ‘show syslog conf’ command.

Configuration using Web UI

In the menu bar of <**WEC Main window**>, select <**Administrator**> and then select the <**Logs**> → <**SysLog Configuration**> menu in the sub-menus.
It provides syslog related configuration and retrieving function.

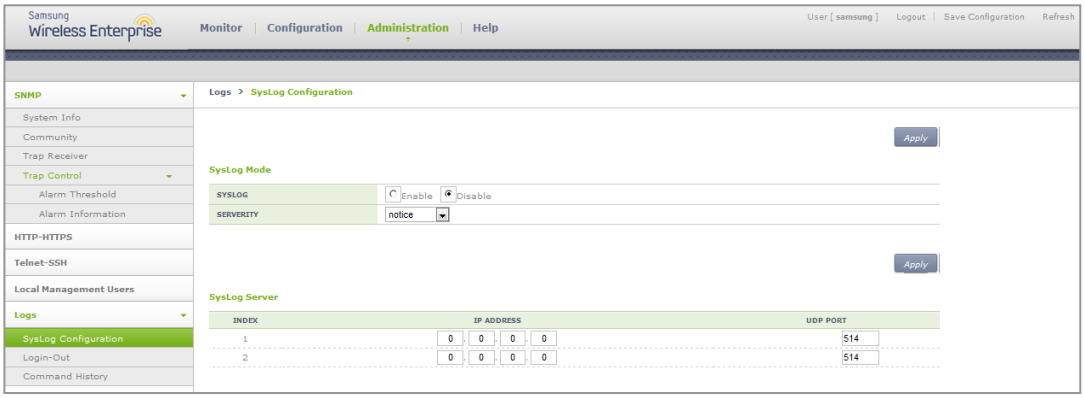


Figure 242. Syslog window

10.8 Upgrade

The APC provides the upgrade function and version checking function that applies a new version of package when it is distributed.

10.8.1 Checking Package Version

You can check the version of a current system by using the following command.

- show version

The following shows the execution results of the command:

```
WEC8500# show version
Samsung package version information
Primary (currently running)
  ver           : 1.4.4.R
  buildTime     : Fri Sep  6 06:08:35 2013
  builder       : apcbuild
  buildDir      : /home2/apcbuild/release/wec8500_1.4.4
Backup
  ver           : 1.4.4.R
  buildTime     : Fri Sep  6 06:08:35 2013
  builder       : apcbuild
  buildDir      : /home2/apcbuild/release/wec8500_1.4.4

Boot rom version information
  ver           : GC15
```

10.8.2 System Upgrade

The APC does system upgrade using CLI and Web UI.

Configuration using CLI

Apply a new package to the system by using the following command.

1) Go to configure mode of CLI.

```
WEC8500# configure terminal
WEC8500/configure#
```

2) Perform upgrade by using a package.
   - package upgrade [FILE_NAME]

Parameter	Description
FILE_NAME	Package file to upgrade The package must be located in the /user/package directory.

A usage example is provided below. When the upgrade is completed, the system is rebooted to apply the package.
When executing the package upgrade command, the message recommending to save the configuration file is displayed.
If you save the current configuration, operator can use it for any future version downgrade.
If there is a configuration file saved during previous upgrade, the message asking whether you are going to use the file is displayed.

```
WEC8500/configure# package upgrade wec8500_1.4.4.R.bin
Notice: It is recommended that you save the configuration before
upgrade.
       You can reapply the configuration, if you need to downgrade.

       Do you want to save the configuration? (y/n): y

       Previous configuration file is existed. Do you want to use it?
(y/n): y
Package Validation check ... success
Package Upgrade ..................................................... done
Success
```

3) If package upgrade fails, upgrade is cancelled.
Possible causes and the troubleshooting methods are described below.

Possible Cause	Error Message	Troubleshooting
File does not exist	Error: no exist 'wec8500_ 1.3.11.R.bin' file	Download the package to be upgraded again as the package error has occurred during the package downloading.
Checksum error on the file	Error: Package validation check	
Upgrade terminated due to an internal error	Error: Internal error	1) Execute the 'show process status' command to check the process status. 2) Execute the 'show system cpu detail' command to check the CPU status. 3) Transmit the logs above to the Samsung Technical Support.
Upgrade terminated due to timeout	saving the configuration-failed (time-out)	1) Execute the 'show process status' command to check the process status. 2) Execute the 'show system cpu detail' command to check the CPU status. 3) Transmit the logs above to the Samsung Technical Support.

4) After system rebooting, check if the new package is applied to the system.

```
WEC8500# show reboot cause
 Reboot Cause: Block: Upgrade/ Code: Package Upgrade

WEC8500# show version
Samsung package version information
Primary (currently running)
  ver             : 0.7.1.R
  buildTime       : Mon Aug 20 11:35:43 2012
  builder         : gampul
  buildDir        : /data/nome/ymkim/apc_0817
Backup
  ver             : 0.7.1.R
  buildTime       : Mon Aug 20 11:35:43 2012
  builder         : gampul
  buildDir        : /data/nome/ymkim/apc_0817

Boot rom version information
  ver             : unknown
```

Configuration using Web UI

In the menu bar of **<WEC Main window>**, select **<Administrator>** and then select the **<Package Upgrade>** → **<APC>** menu in the sub-menus.

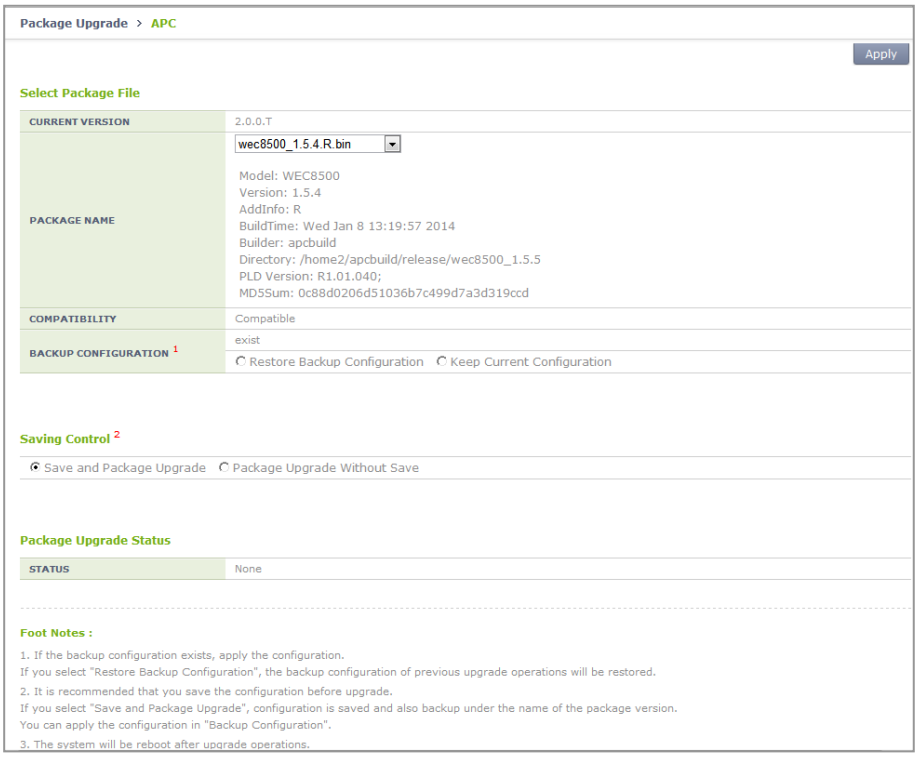


Figure 243. Package upgrade (APC)

10.9 Configuration Management

The APC supports the following functions for configuration management.

- Saves the current configuration information.
- Exports/imports the current configuration information (import/export).
- Initializes system

Configuration using CLI

To save the current configuration information in the system, execute the command as follows:

```
WEC8500# save local
```

To transmit the current configuration information in the system to outside, execute the command as follows: When you execute the command, the configuration information is compressed into the entered ‘FILENAME’ as a file.

```
WEC8500# export [FILENAME]
```

In addition, to apply a file (‘FILENAME’) from outside to the current system, execute the command as follows:

```
WEC8500# import [FILENAME]
```

To initialize the current configuration information to the factory default, execute the command as follows: If the ‘full-erase’ parameter is not entered, only the configuration information is initialized.

```
WEC8500# factory-reset (full-erase)
```

Configuration using Web UI

In the menu bar of **<WEC Main window>**, select **<Administrator>** and then select the **<DB backup/restore>** menu in the sub-menus.

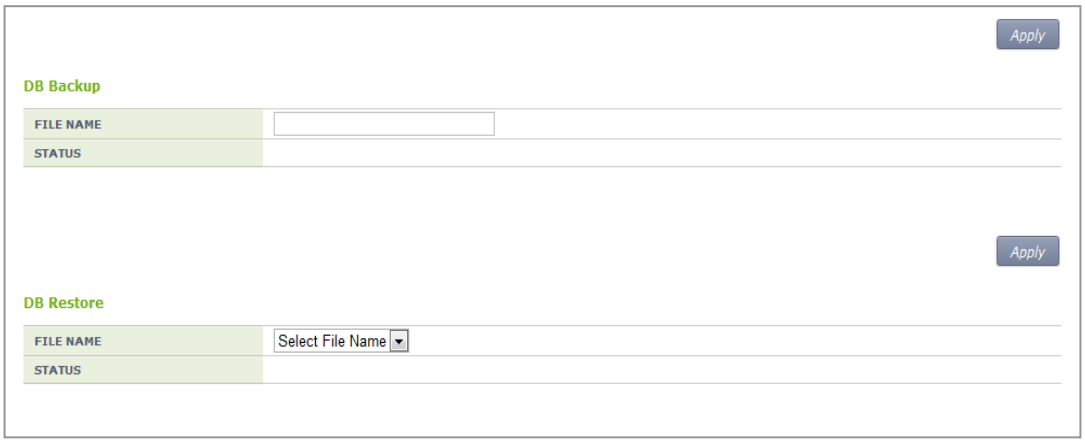


Figure 244. DB Backup/Restore

In the DB backup/restore window, enter FILE NAME and click the **<Apply>** button to create the configuration information as a file or apply an external configuration information file. The STATUS shows the execution results of backup/restore function.

10.10 Debug and Diagnosis

10.10.1 Process

The APC can retrieve the status of an active process in the system and an error associated with each process.

Retrieving the Process Status

```
WEC8500# show processes
Processes Info.
Status: D - usually IO, R - Running, S - Sleep
        T - Stop, X - Dead, Z - Zombie
        up - Active, down - Inactive
        dis - Disable

id        name      pid     activationTime      status  reStart
--      --------    ----    ---------------     ------  ------
 0        swmmon    6222   2012-08-31 14:38:21    up(S)   0
 1        evm       1759   2012-08-31 13:47:08    up(S)   0
 2        evmlogd   1760   2012-08-31 13:47:08    up(S)   0
 3        db        1807   2012-08-31 13:47:14    up(S)   0
 4        license   1838   2012-08-31 13:47:34    up(S)   0
 5        pcap      1839   2012-08-31 13:47:34    up(S)   0
 6        filemgr   1840   2012-08-31 13:47:34    up(S)   0
 7        filemib   1841   2012-08-31 13:47:34    up(S)   0
 8        cm        1846   2012-08-31 13:47:34    up(S)   0
 9        iim       1847   2012-08-31 13:47:34    up(S)   0
10        iimp      1850   2012-08-31 13:47:34    up(S)   0
11        nsm       1902   2012-08-31 13:47:35    up(S)   0
12        mstpd     1903   2012-08-31 13:47:35    up(S)   0
13        pimd      1904   2012-08-31 13:47:35    up(S)   0
14        ripd      1905   2012-08-31 13:47:35    up(S)   0
15        ospfd     1906   2012-08-31 13:47:35    up(S)   0
16        lacpd     1907   2012-08-31 13:47:35    up(S)   0
17        fqm       1909   2012-08-31 13:47:35    up(S)   0
18        imi       1942   2012-08-31 13:47:35    up(S)   0
19        zebosm    2188   2012-08-31 13:47:55    up(S)   0
20        awmb      2226   2012-08-31 13:48:00    up(S)   0
21        apm       2385   2012-08-31 13:48:30    up(S)   0
22        capwap    2386   2012-08-31 13:48:30    up(S)   0
23        hostapd   2387   2012-08-31 13:48:30    up(S)   0
24        eqm       2388   2012-08-31 13:48:30    up(S)   0
```

Checking process error log

You can check the log of errors that occurred in a current process

```
WEC8500# show processes log
   id date                 name         pid   signal       backtrace    reason
 ----- -------------------- ------------ ---- ------------ -----------  ---------
 2509. 2012-12-21 15:59:50  iimp         1800 SIGTERM(15)   traced       signal
 2510. 2012-12-21 15:59:50  sipalg       2377 SIGTERM(15)   traced       signal
 2511. 2012-12-21 15:59:50  apclt        2375 SIGTERM(15)   traced       signal
 2511. 2012-12-21 15:59:50  apccluster   2217 SIGTERM(15)   traced       signal
 2512. 2012-12-21 15:59:50  evmlogd      1766 SIGTERM(15)   traced       signal
 2513. 2012-12-21 15:59:50  imi          1893 SIGTERM(15)   traced       signal
 2514. 2012-12-21 15:59:50  wids         2293 SIGTERM(15)   traced       signal
 2515. 2012-12-21 15:59:50  ipwlogd      2416 SIGTERM(15)   traced       signal
 2516. 2012-12-21 15:59:50  nfm          2417 SIGTERM(15)   traced       signal
 2517. 2012-12-21 15:59:50  httprd       2379 SIGTERM(15)   traced       signal
 2518. 2012-12-21 15:59:50  fqm          1882 SIGTERM(15)   traced       signal
 2519. 2012-12-21 15:59:50  irfm         2297 SIGTERM(15)   traced       signal
 2520. 2012-12-21 15:59:50  filemib      1770 SIGTERM(15)   traced       signal
 2520. 2012-12-21 15:59:50  pm           2376 SIGTERM(15)   traced       signal
 2521. 2012-12-21 15:59:50  salh         2415 SIGTERM(15)   traced       signal
 2522. 2012-12-21 15:59:50  guestService 2294 SIGTERM(15)
```

In addition, you can check the detail information corresponding to the ‘id’ of each error log by using the following command.

```
WEC8500# show processes log id 15
   id date                 name         pid   signal       backtrace    reason
 ----- -------------------- ------------ ----- ------------ ------------ ---------
  15. 2012-08-02 18:39:08   eqm          2311  NONE(0)      -            coredump

 detail (additional info.)
  → core_dump (comm:eqm, signr:11, pid:2311)
  → detected unixtime: 1343900344 -> Thu Aug  2 18:39:04 2012


   id date                 name         pid   signal       backtrace    reason
 ----- -------------------- ------------ ----- ------------ ------------ ---------
  15. 2012-08-09 12:37:09   eqm         30103  NONE(0)       -           coredump

 detail (additional info.)
  → core_dump (comm:eqm, signr:11, pid:30103)
```

10.10.2 Retrieving Crash Information

When a critical problem occurs in the system platform during operation, the APC saves important system information at that time to provide the crash information that can be used for post mortem analysis. The crash information includes the Crash Detect and Report (CDR) information that has the context about the crash status and the core dump information that has the memory dump about the crash status of a user process.

10.10.2.1 Managing CDR Information

To manage the CDR information, the system provides the following function.

- Retrieving CDR Information
- Exports CDR history information
- Deletes CDR history information

[Retrieving Summarized CDR History Information]

To retrieve the entire history information for all the rebooting including rebooting due to a crash, enter the 'show debug reboot summary' command.

- show debug reboot summary

```
WEC8500# show debug reboot summary
================================================================================
====================================
ID   EVENT_NAME      EVENT_DESCRIPTION
REBOOT_TIME
================================================================================
====================================
0001 DIE             DIE_VAL[1] - Unhandled kernel unaligned access
03:56:00, Aug 22 2012
0000 PANIC           softlockup: hung tasks
03:51:51, Aug 22 2012
```

[Retrieving Detail CDR History Information]

To check the detail crash information, execute the 'show debug reboot info [id/all]' command. By using this command, you can view the key information including a kernel log that exists before the system is rebooted due to a critical crash. The description of each parameter is shown below.

- show debug reboot info [DATA]

Parameter	Description
DATA	Selects crash information (id/all) - id: A specific CDR ID value to view - all: Retrieve all the CDR histories

If no parameter is entered, the most recent reboot information is retrieved.

```
WEC8500# show debug reboot info

########################################################################

[REBOOT_SUMMARY]=======================================================

ID              : 0001
EVENT NAME      : DIE
EVENT DESC      : DIE_VAL[1] - Unhandled kernel unaligned access
REBOOT TIME     : 03:56:00, Aug 22 2012

[KERNEL_LOG]===========================================================

console [cdr-1] enabled
Creating 1 MTD partitions on "nor0":
0x000000dc0000-0x000000fc0000 : "crash_raw"
CDR connector initialized (ID = {8.1})
…
…
```

[Exporting CDR history information]

The crash information of system can be extracted to text file for post analysis.
By entering the 'show debug reboot export' command, you can send the system crash information created in a text file to outside using the 'transfer' command.

- show debug reboot export

[Deleting CDR history information]

To delete CDR information remaining in a device, execute the following command.

- debug reboot erase [DATA]

Parameter	Description
DATA	If there is no reboot information selection (id/all) option, the most recent system reboot information is deleted. - id: A specific CDR ID value to delete - all: Delete all the CDR histories

10.10.2.2 Retrieving Core Dump Information

Use the ‘show debug coredump summary’ command to retrieve the status of core dump.

```
WEC8500# show debug coredump summary

CORE_DUMP      :    enable
DUMP_QUOTA     :      1024 (MB)
CORE_SIZE      :    204800 (KB)
POLL_PERIOD    :        60 (sec)
THRESHOLD      :        80 (%)
-------------------------------------------------------------------------
-------------------------------------------------
   PROCESS    |           SIGNAL           |          TIME          |
CORE_FILE
-------------------------------------------------------------------------
-------------------------------------------------
eqm            Segmentation fault   Wed Aug 22 03:05:16 2012 core-eqm-
11-1345572316-2437.gz
hostapd        Aborted Wed Aug 22 03:06:02 2012 core-hostapd-6-
1345572362-2436.gz
nsm            Bus error Wed Aug 22 03:07:21 2012 core-nsm-10-
1345572441-2013.gz
```

10.11 File Management

The APC provides the file management functions of copying, moving, or retrieving a file and also file download and upload. In addition, it checks the integrity of a package file and provides version retrieving method.

To use a file related command, go to the file mode first. The command is basically used as follows:

1) Go to the file mode of CLI.

```
WEC8500# file
WEC8500/file#
```

2) Use each command. The following commands are used in the file mode.

Command	Description
cd	Changes the current directory.
copy	Copies a file.
df	Retrieves the brief information of a storage media connected to the system.
download	Downloads a file using FTP protocol.
dump	Shows the content of a file.
ls	Retrieves the list of files or directories in a specified path.
move	Changes the name of a file.
pwd	Shows the current directory.
remove	Deletes a file.
upload	Uploads a file using FTP protocol.
verify	Checks the integrity of a package file and shows the result.
version	Shows the information of a package file.

10.11.1 Retrieving Configuration of Current Directory

The file management command supports both a relative path and an absolute path based on the current (working) directory. The current directory is a path that is a reference of a relative path. For example, if the current directory is ‘disk:/’, the ‘copy test1 test2’ is the same as the ‘copy disk:/test1 disk:/test2’ command.

To retrieve a current directory, enter the ‘pwd’ command.

```
WEC8500/file# pwd

 disk:/
```

To change a directory, use the ‘cd [TARGET_DIR]’ command.

```
WEC8500/file# cd etc
WEC8500/file# pwd

 disk:/etc
```

Parameter	Description
TARGET_DIR	Name of a directory to change

10.11.2 Retrieving Directory List

To retrieve a file or directory in a specific directory, use the ‘ls’ command. If you enter only ‘ls’, all the contents in the current directory are displayed.
To check only a specific directory, enter the ‘ls [TARGET_DIR]’ command.

A usage example is provided below.

```
WEC8500/file# ls
Current working directory: disk:/
 directory       4.0K     Jul   5  13:49:49  etc
 directory      16K       Jan   1  09:00:39  lost+found
 directory       4.0K     Jun   9  15:36:02  opt
 directory       4.0K     Jun   9  16:46:59  stats
 directory       4.0K     Jun  12  01:11:01  var
WEC8500/file# ls etc
Current working directory: disk:/
 directory       4.0K     Jun   9  15:36:02  ap
 directory       4.0K     Jun   9  15:36:02  config
 directory       4.0K     Jun   9  15:36:02  db
 file          168        Jul   5  13:49:49  PKG_INFO_STANDBY
WEC8500/file# ls disk:/etc
Current working directory: disk:/
 directory       4.0K     Jun   9  15:36:02  ap
 directory       4.0K     Jun   9  15:36:02  config
 directory       4.0K     Jun   9  15:36:02  db
 file          168        Jul   5  13:49:49 P KG_INFO_STANDBY
WEC8500/file#
```

10.11.3 Revising File

To copy a file, use the ‘copy [SRC_FILENAME] [DES_FILENAME]’ command.
The below command copies the ‘test’ file into ‘disk:/test2’.

```
WEC8500/file# copy test disk:/test2
```

To delete a file, use the ‘remove [FILENAME]’ command. If you enter the below command and enter ‘y’, the ‘test2’ file is deleted.

```
WEC8500/file# remove test2
‘disk:/test2’ Do you really want to remove it ? (y/n)
y
```

To change a filename, use the ‘move [SRC_FILENAME] [DES_FILENAME]’ command. If you enter the below command, the ‘test’ file is changed to ‘test2’.

```
WEC8500/file# move test test2
```

10.11.4 Retrieve File Content

To retrieve the content of a file, use the ‘dump’ command. It can be displayed in the hexa or ascii format.

```
WEC8500/file# dump test2
0000000 7f45 4c46 0202 0100 0000 0000 0000 0000  |.ELF............ |
0000010 0002 0008 0000 0001 0000 0001 2000 4950  |............ .IP |
0000020 0000 0000 0000 0040 0000 0000 0002 9600  |.......@........ |
0000030 808d 0007 0040 0038 0007 0040 001e 001d  |.....@.8...@.... |
0000040 0000 0006 0000 0005 0000 0000 0000 0040  |...............@ |
0000050 0000 0001 2000 0040 0000 0001 2000 0040  |.... ..@.... ..@ |
0000060 0000 0000 0000 0188 0000 0000 0000 0188  |................ |
0000070 0000 0000 0000 0008 0000 0003 0000 0004  |................ |
0000080 0000 0000 0002 5b40 0000 0001 2002 5b40  |......[@.... .[@ |
0000090 0000 0001 2002 5b40 0000 0000 0000 000f  |.... .[@........ |
```

10.11.5 File Download and Upload

A file is downloaded or uploaded through FTP protocol.

To download a file, use the ‘download’ command. An example of downloading the ‘test’ file from ‘192.168.1.1’ to ‘disk:/test’ is shown below.

```
WEC8500/file# download  guest guest 192.168.1.1 test disk:/test
```

To upload a file, use the ‘upload’ command.
An example of uploading the ‘disk:/uploadtest’ file to ‘192.168.1.1’ is shown below.

```
WEC8500/file# upload  guest guest 192.168.1.1 disk:/uploadtest
uploadtest
```

10.11.6 Package File

You can use a package file by downloading it from a network or copying it from a USB memory. The APC checks the integrity of a package file and provides the information retrieving function.

Checking the integrity of a package file

Checking if a package file is damaged is called integrity checking. An example of checking integrity using the ‘verify’ command is shown below.

[Checking APC package file]

```
WEC8500/file# verify package/wec8500_0.3.0.R.bin
 Verify: success!!
```

[Checking AP package file]

```
WEC8500/file# verify package/ap/wea302.img
 Verify: success!!
```

Retrieving the information of a package file

A package file includes the information such as version information, model information, package build information, etc. To check the content of a package file, use the 'version' command.

[Retrieving the information of APC package file]

```
WEC8500/file# version package/wec8500_0.3.0.R.bin
=====================================================
 Model          :   WEC8500
 Version        :   0.3.0.R
 Build Date     :   Sat Jun 30 15:57:09 2012
 Builder        :   apcbuild
 Build Path     :   /home2/apcbuild/release/apc
 MD5SUM         :   b715450abf1be81616fd7e6391e12cee
```

[Retrieving the information of AP package file]

```
WEC8500/file# version package/ap/wea302.img
=====================================================
 Model          :   wea302
 Version        :   0.1.0.R
 Build Date     :   Fri Apr 13 18:41:26 KST 2012
 Sisze          :   31998080
 CRC            :   d5aa76ad
```

10.11.7 Retrieving Storage Media

The WEC8500 supports a disk and USB memory as a storage media. And the WEC8050 supports only a disk as a storage media. Both current directory-based relative path and absolute path are all supported during command execution and the path of each device is shown in the below table.

Device	Path	Description
Disk	disk:/	Uses the system disk as a storage media. (basic path)
USB memory	usb [N]:/	Uses a USB memory as a storage media. ('N' represents a partition number in a USB memory.)

The check the information of a storage media connected to the APC, use the 'df' command.

```
WEC8500/file# df
Device        : disk
Filesystem    : ext4
Total size    : 12.9G Free space:  11.3G

Device        : usb1
Filesystem    : vfat
Total size    : 7.4G Free space:   7.0G
```

Using the results of entering the above command, an operator can check the below information.

- The disk and USB memory are connected.
- Disk free space: 11.3 GB
- USB memory free space: 7 GB

10.11.8 Managing File in Web UI

10.11.8.1 File Uploading and Downloading

In the menu bar of <**WEC Main window**>, select < **Administration** > and then select the <**File Management**> → <**APC-Local PC**> menu in the sub-menus.

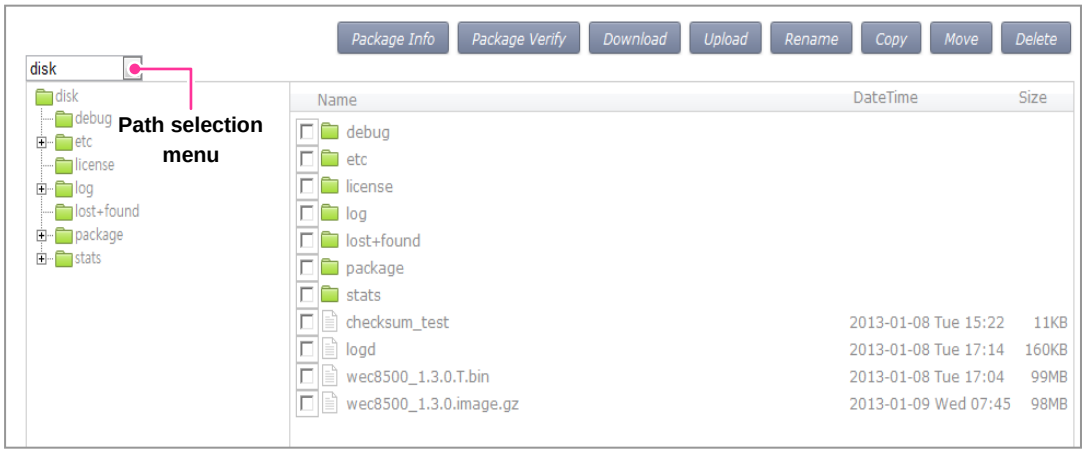


Figure 245. File management window

The File Management window provides the following functions:

Retrieving a file list

Select a desired path in the path selection menu, which is categorized based on the following criteria:

- disk: Select this to retrieve the entire files in the SSD disk of APC.
- APC Package: Select this to retrieve an APC package file.
- AP Package: Select this to retrieve an AP package file.
- Log: Select this to retrieve a log file.
- Stats: Select this to retrieve a statistics file.
- USBN: Select this to retrieve a file in a USB memory connected to the APC. (The N represents a partition number in a USB memory.)

Copying a file

After selecting the checkbox of a file to copy, click the <**Copy**> button. Then a popup window is displayed. In the popup window, specify a location where the file will be copied.

Moving a file

After selecting the checkbox of a file to move, click the <**Move**> button. Then a popup window is displayed. In the popup window, specify a location where the file will be moved.

Deleting a file

After selecting the checkbox of a file to delete, click the **<Delete>** button.

Changing a filename

After selecting the checkbox of a file to change its name, click the **<Rename>** button. Then a popup window is displayed. In the popup window, enter a file name to change.

Downloading a file

After selecting the checkbox of a file to download, click the **<Download>** button.

Uploading a file

When you click the **<Upload>** button, the popup window where you can select a file to upload is displayed. After selecting a file in the upload window, click the **<Upload>** button.

Retrieving a package file

In the path selection menu, select **<APC Package>**. After selecting the checkbox of a package file to retrieve, click the **<Package Info>** button. The package file information is displayed in the popup window.

Checking the integrity of a package file

In the path selection menu, select **<APC Package>**. After selecting the checkbox of a package file to retrieve, click the **<Package Verify>** button. The result of checking the integrity of a package file is displayed in the popup window.

10.11.8.2 Configuring Language for Imported and Exported Files

The APC system provides a function of exporting information set in the APC to a PC or importing from a PC to the system by using the WEC. The operator can export and import the following information in an Excel file.

- Local Net User List
- Captive Portal User List
- Mac Filter List

If the language encoding method of the PC is different from that of the APC system, some characters, however, cannot be read.
For example, if the encoding method of the PC is Korean (EUC-KR), and the information on the configuration of the APC system is exported to the WEC, Korean cannot be seen as unidentifiable characters. Because the APC system use the UTF-8 method and the encoded file in the UTF-8 method cannot be displayed in the PC which uses EUC-KR.
To correct such problem, it provides a function of configuring a method for encoding in the PC.

When the operator configures an encoding method, the APC system automatically converts the encoding method of the file and allows the exported file to the WEC to be properly displayed in the PC. In addition, if the file stored in the PC is imported to the system through the WEC, it is properly processed in the system.
To configure an encoding method, it is possible to select <**Administration**> in the menu bar of <**WEC Main window**> and then configure in <**File Management**> → <**Character Encoding**> in the sub-menus.

10.11.9 Statistics Function

It provides the statistics calculation function for statistics for group optimization.
It collects statistics for each statistical item by AP/radio, radio, WLAN (SSID), device type, and RF and again by time interval. The time intervals include 5 minutes, one hour, and 24 hours and the statistical value calculated by time is displayed when the statistics items are retrieved in WEC and CLI.

VoIP Statistics

It shows relevant statistics if VoIP is used with the SIP FMC terminal.

Configuration using CLI

1) Enable VoIP Statistics.

```
WEC8500/configure/network-stats/statistics/voip# enable
```

2) If the call setup, call drop, and MoS values of specific APs are monitored for a specific time and such values fail to reach the reference values, an event can be generated.
ex.) call-setup: If the call setup success rate is less than 50%, an event is generated.

```
../network-stats/alert/voip/call-setup# enable
../network-stats/alert/voip/call-setup# threadhold 50
```

3) Retrieve the status of configuration of the VoIP statistics.

```
WEC8500# show network-stats statistics voip configuration
```

4) Retrieve the status of configuration of the VoIP alert.

```
WEC8500# show network-stats alert voip configuration
```

5) Retrieve call statistics by radio.

```
WEC8500# show network-stats statistics voip radio
```

6) Retrieve call statistics by AP.

```
WEC8500# show network-stats statistics voip ap
```

7) Retrieve call statistics by WLAN.

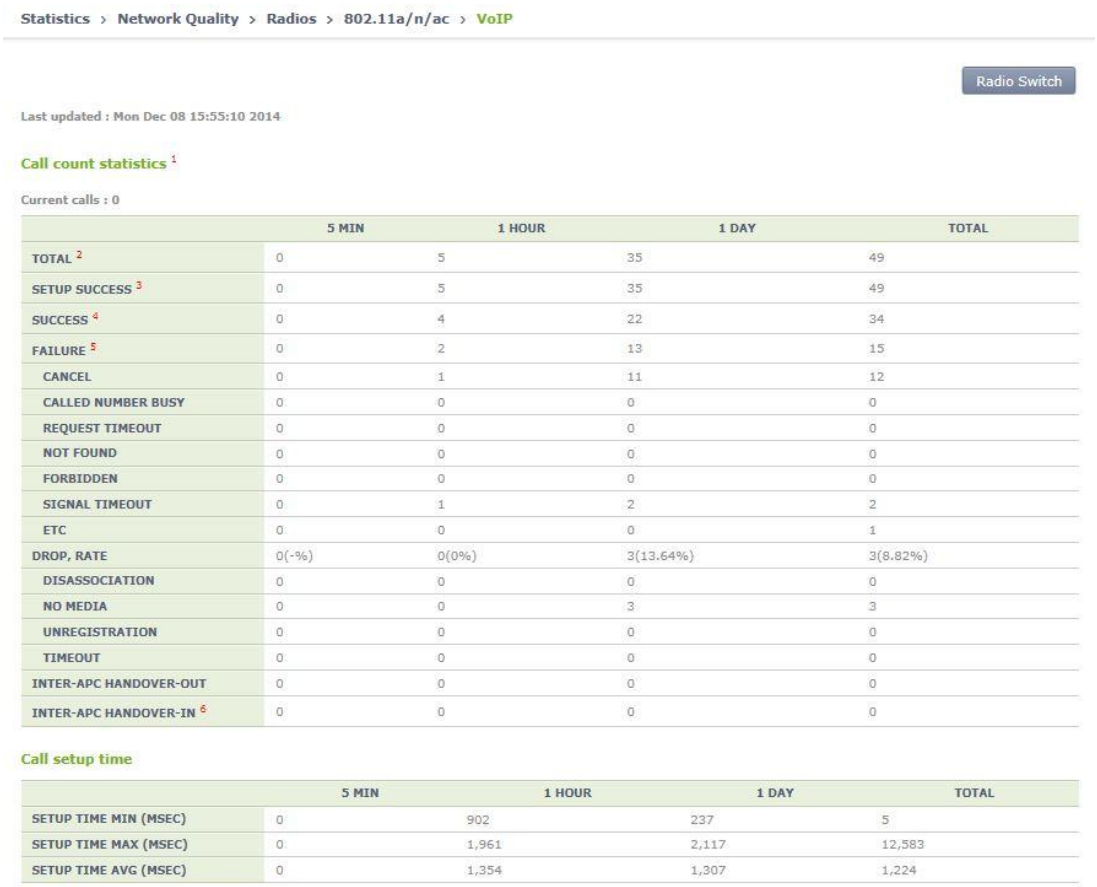
```
WEC8500# show network-stats statistics voip wlan
```

8) Retrieve call statistics by device type.

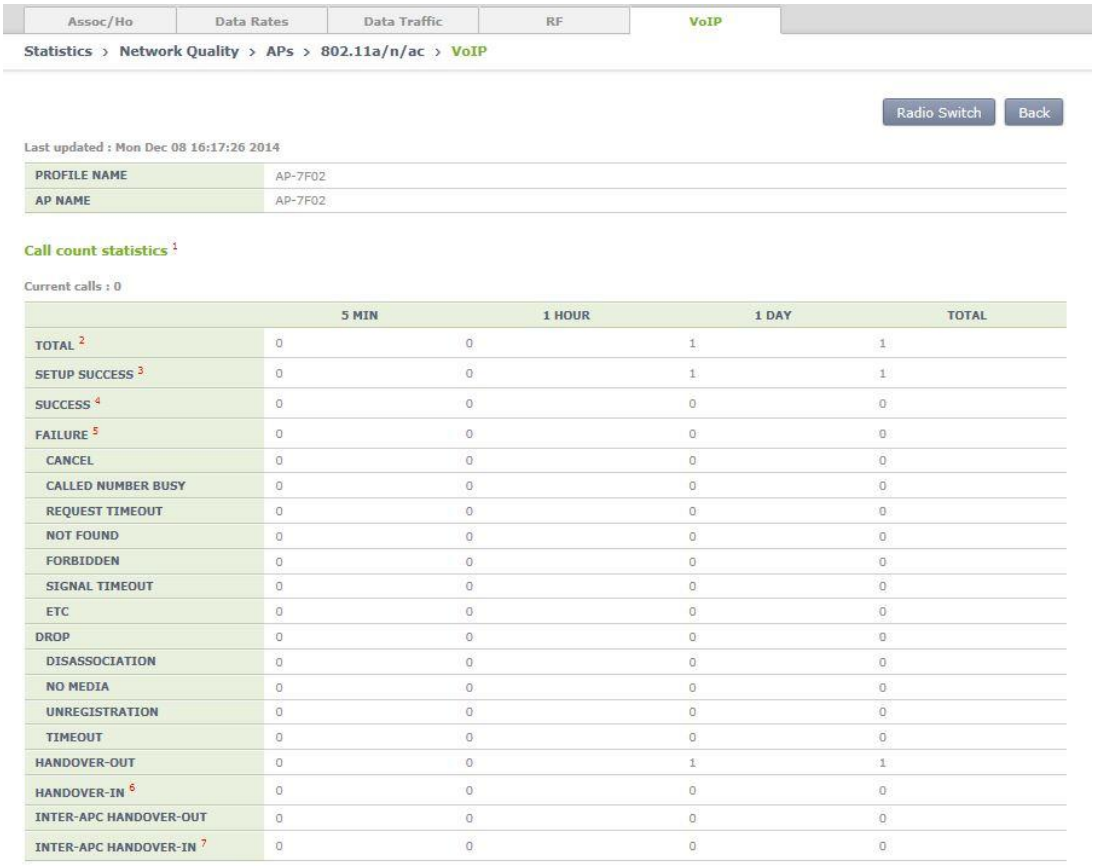
```
WEC8500# show network-stats statistics voip device
```

Configuration using Web UI

In the menu bar of **<WEC Main window>**, select **<Monitoring>** and then select **<Statistics>** → **<Network Quality>** → **<by Radio>** → **<802.11a/n/ac>** → **<VoIP>** in the sub-menus.



In the menu bar of <**WEC Main window**>, select <**Monitoring**> and then select <**Statistics**> → <**Network Quality**> → <**by AP**> → <**802.11a/n/ac**> → <**VoIP**> in the sub-menus.



	5 MIN	1 HOUR	1 DAY	TOTAL
TOTAL 2	0	0	1	1
SETUP SUCCESS 3	0	0	1	1
SUCCESS 4	0	0	0	0
FAILURE 5	0	0	0	0
CANCEL	0	0	0	0
CALLED NUMBER BUSY	0	0	0	0
REQUEST TIMEOUT	0	0	0	0
NOT FOUND	0	0	0	0
FORBIDDEN	0	0	0	0
SIGNAL TIMEOUT	0	0	0	0
ETC	0	0	0	0
DROP	0	0	0	0
DISASSOCIATION	0	0	0	0
NO MEDIA	0	0	0	0
UNREGISTRATION	0	0	0	0
TIMEOUT	0	0	0	0
HANDOVER-OUT	0	0	1	1
HANDOVER-IN 6	0	0	0	0
INTER-APC HANDOVER-OUT	0	0	0	0
INTER-APC HANDOVER-IN 7	0	0	0	0

Radio Frequency (RF) Statistics

The statistics of RF show the statistics by channel for Channel-Utilization and Air-Quality and by radio for Rx(Tx)-Utilization and Noise-Level.
They show the minimum, maximum, and average values and error count exceeding the threshold by 5 min., one hour, 24 hours, and total period.
If the error count exceeds the threshold by each period, an alert occurs.

Configuration using CLI

1) Enable/Disable: Configure whether to operate RF Statistics.
(Enable: Function operation, Disable: No function operation)

```
WEC8500/configure/network-stats/statistics/rf-value# enable
```

2) enable-alert: Configure whether an alert occurs regarding Channel-Utilization, Air-Quality, and Noise-Level.
ex.) air-quality alert

```
../network-stats/alert/rf-value/enable-alert# air-quality enable
../network-stats/alert/rf-value/enable-alert# no air-quality enable
```

3) threshold: Configure the alert threshold of each RF value by radio.
ex.) air-quality 5G threshold → 90

```
../network-stats/alert/rf-value/threshold/80211a# air-quality 90
```

4) count-alert: An error count threshold to generate an alert in RF Statistics
If the error count is greater than the threshold by statistical period due to the RF values exceeding the threshold,
an alert occurs. If the value is 0, the alert of the corresponding period does not occur.
ex.) error count threshold per day → 720

```
../network-stats/alert/rf-value/count-alert# day1-threshold 720
```

5) Retrieve the status of configuration of the RF statistics.

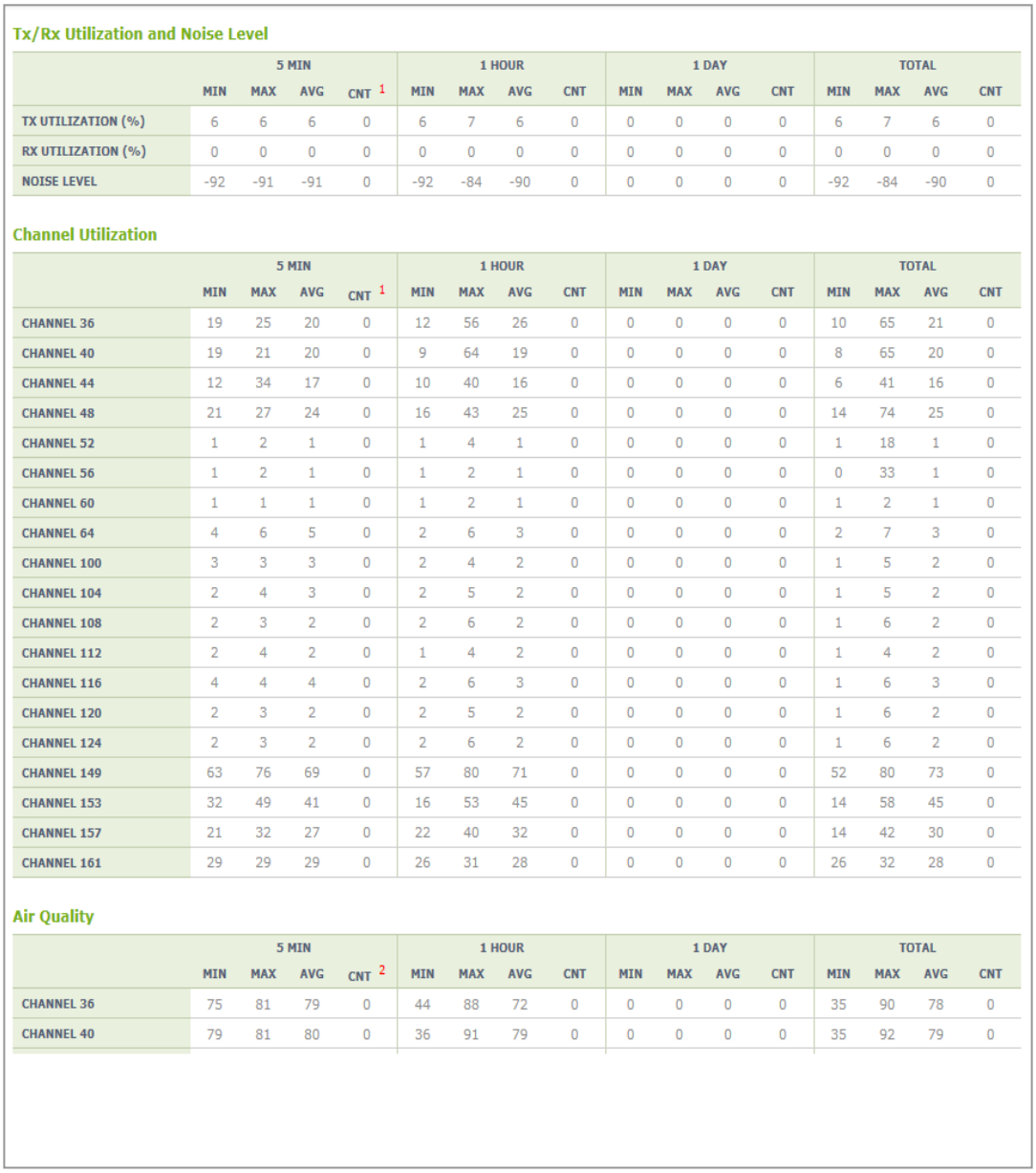
```
WEC8500# show network-stats statistics rf-value summary
```

6) Retrieve the RF statistics of the RF values by AP.
ex.) Statistics of air-quality of AP 43

```
WEC8500# show network-stats statistics rf-value air-quality 43
```

Configuration using Web UI

In the menu bar of <**WEC Main window**>, select <**Configuration**> and then select <**Statistics**> → <**Network Quality**> → <**APs**> → <**802.11a/n/ac**> → <**RF**> in the sub-menus.



Tx/Rx Utilization and Noise Level

	5 MIN				1 HOUR				1 DAY				TOTAL			
	MIN	MAX	AVG	CNT [1]	MIN	MAX	AVG	CNT	MIN	MAX	AVG	CNT	MIN	MAX	AVG	CNT
TX UTILIZATION (%)	6	6	6	0	6	7	6	0	0	0	0	0	6	7	6	0
RX UTILIZATION (%)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NOISE LEVEL	-92	-91	-91	0	-92	-84	-90	0	0	0	0	0	-92	-84	-90	0

Channel Utilization

	5 MIN				1 HOUR				1 DAY				TOTAL			
	MIN	MAX	AVG	CNT [1]	MIN	MAX	AVG	CNT	MIN	MAX	AVG	CNT	MIN	MAX	AVG	CNT
CHANNEL 36	19	25	20	0	12	56	26	0	0	0	0	0	10	65	21	0
CHANNEL 40	19	21	20	0	9	64	19	0	0	0	0	0	8	65	20	0
CHANNEL 44	12	34	17	0	10	40	16	0	0	0	0	0	6	41	16	0
CHANNEL 48	21	27	24	0	16	43	25	0	0	0	0	0	14	74	25	0
CHANNEL 52	1	2	1	0	1	4	1	0	0	0	0	0	1	18	1	0
CHANNEL 56	1	2	1	0	1	2	1	0	0	0	0	0	0	33	1	0
CHANNEL 60	1	1	1	0	1	2	1	0	0	0	0	0	1	2	1	0
CHANNEL 64	4	6	5	0	2	6	3	0	0	0	0	0	2	7	3	0
CHANNEL 100	3	3	3	0	2	4	2	0	0	0	0	0	1	5	2	0
CHANNEL 104	2	4	3	0	2	5	2	0	0	0	0	0	1	5	2	0
CHANNEL 108	2	3	2	0	2	6	2	0	0	0	0	0	1	6	2	0
CHANNEL 112	2	4	2	0	1	4	2	0	0	0	0	0	1	4	2	0
CHANNEL 116	4	4	4	0	2	6	3	0	0	0	0	0	1	6	3	0
CHANNEL 120	2	3	2	0	2	5	2	0	0	0	0	0	1	6	2	0
CHANNEL 124	2	3	2	0	2	6	2	0	0	0	0	0	1	6	2	0
CHANNEL 149	63	76	69	0	57	80	71	0	0	0	0	0	52	80	73	0
CHANNEL 153	32	49	41	0	16	53	45	0	0	0	0	0	14	58	45	0
CHANNEL 157	21	32	27	0	22	40	32	0	0	0	0	0	14	42	30	0
CHANNEL 161	29	29	29	0	26	31	28	0	0	0	0	0	26	32	28	0

Air Quality

	5 MIN				1 HOUR				1 DAY				TOTAL			
	MIN	MAX	AVG	CNT [2]	MIN	MAX	AVG	CNT	MIN	MAX	AVG	CNT	MIN	MAX	AVG	CNT
CHANNEL 36	75	81	79	0	44	88	72	0	0	0	0	0	35	90	78	0
CHANNEL 40	79	81	80	0	36	91	79	0	0	0	0	0	35	92	79	0

Data Traffic Statistics

Data traffic statistics on the air section. Possible to retrieve in a unit of AP. The statistics provide information on Control, User Data, Tx/Rx, Unicast/Muticast/Broadcast, Background/Best Effort/Video/Voice, and Peak-rate (Kbps) as detailed items. They also provide statistical information on Real-time Transport Protocol (RTP) as voice traffic as well.

Configuration using CLI

1) Check the configuration of the data traffic statistics and if the status is set to be disabled, set to be enabled.

```
WEC8500# show network-stats statistics data current-config
WEC8500/configure/network-stats/statistics/data# enable
```

2) To retrieve the statistical information of a specific AP, enter as follows:

```
WEC8500# show network-stats statistics data ap-stat 1
```

3) To retrieve the statistical information of RTP of a specific AP, give a RTP option as follows:

```
WEC8500# show network-stats statistics data ap-stat 1 rtp
```

4) To retrieve the statistical information of all APs, enter as follows:

```
WEC8500# show network-stats statistics data apc-stat
```

5) To retrieve the statistical information of RTP of all APs, give a RTP option as follows:

```
WEC8500# show network-stats statistics data apc-stat rtp
```

6) To generate a packet loss alert from the AP, enter as follows:

```
WEC8500/configure/network-stats/alert/data# packet-loss-alert enable
```

7) To generate a packet retry alert from the AP, enter as follows:

```
WEC8500/configure/network-stats/alert/data# packet-retry-alert enable
```

Configuration using Web UI

In the menu bar of **<WEC Main window>**, select **<Configuration>** and then select < Statistics> → **<Network Quality>** → **<APs>** → <802.11a/n/ac> → <Data Traffic> in the sub-menus.

Station Statistics

They provide the statistics of the network optimization to check service, tracking, debugging, status transition, etc. of a station. Main statistics items provided include station latency upon connection and handover, attempt count, statistics by failure reason, RSSI, success rate, data rate by AP, Disassoc/Deauth statistics, statistics by reason, handover path statistics, kickout statistics by AP, number of users, scanning statistics by AP, etc. and provide such statistics by 5 min., one hour, 24 hours, and total period by WLAN, AP, Radio, and Device Type.

Configuration using CLI

1) Enable or disable station network statistics.
   - network-stats statistics station [MODE]

Parameter	Description
Mode	Whether to configure network statistics - enable: Setting - disable: Release (by default)

```
APC# configure terminal
APC/configure# network-stats statistics station enable

Enabled Station Net-Stats
APC/configure# no network-stats statistics station enable

Disabled Station Net-Stat
```

2) Enable or disable station statistics alert.
   - network-stats alert station [MODE]

Parameter	Description
Mode	Whether to configure network statistics alert - enable: Set (by default) - disable: Cleared

```
APC/configure# network-stats alert station enable

Enabled Station Net-Stats Alert
APC/configure# no network-stats alert station enable

Disabled Station Net-Stats Alert
```

3) Configure the alert period (Duration).
   - network-stats alert station alert-duration [VALUE]

Parameter	Description
VALUE	30~60 Min. (default: 30 min)

```
APC/configure# network-stats alert station alert-duration 40

Alert Duration: 40
```

4) Configure the alert boundary value of the assoc. success rate.
   - network-stats alert station alert-assoc-rate [VALUE]

Parameter	Description
VALUE	10-90 % (default: 30 %)

```
APC/configure# network-stats alert station alert-assoc-rate 50

Assoc. Success Rate Alert Threshold: 50 %
```

5) Configure the alert boundary value of the assoc. RSSI.
   - network-stats alert station alert-assoc-rssi [VALUE]

Parameter	Description
VALUE	-100~-50 dBm (default: -85 dBm)

```
APC/configure# network-stats alert station alert-assoc-rssi -90

Assoc & Reassoc RSSI Alert Threshold: -90 %
```

6) Configure the alert boundary value of the disassoc. attempt count.
   - network-stats alert station alert-assoc-try [VALUE]

Parameter	Description
VALUE	10~1000 (default: 30)

```
APC/configure# network-stats alert station alert-assoc-try 40

Assoc Try Alert Threshold: 40
```

7) Configure the alert boundary value of the disassoc. attempt count.
   - network-stats alert station alert-disassoc-try [VALUE]

Parameter	Description
VALUE	2~1000 (default: 30)

```
APC/configure# network-stats alert station alert-disassoc-try 40

Disassoc Try Alert Threshold: 40
```

8) Configure the alert boundary value of the handover success rate.
   - network-stats alert station alert-handover-rate [VALUE]

Parameter	Description
VALUE	10-90 % (default: 50 %)

```
APC/configure# network-stats alert station alert-handover-rate 50

Handover Rate Alert Threshold: 50 %
```

9) Configure the alert boundary value of the handover attempt count.
   - network-stats alert station alert-handover-try [VALUE]

Parameter	Description
VALUE	10~1000 (default: 30)

```
APC/configure# network-stats alert station alert-handover-try 40

Handover Try Alert Threshold: 40
```

10) Configure the max entry value of the target in the station network statistics.
   - network-stats alert station alert-max-db [MODE]

Parameter	Description
VALUE	1000~50000 (default: 10000)

```
APC/configure# network-stats alert station alert-max-db 5000

Max Alert DB Number : 5000
```

Checking Statistical Information Using CLI

1) Check the station association latency (by AP/Device/Radio/WLAN).
ex.) by WLAN

```
APC# show network-stats statistics station association latency wlan 1

Station Association Latency [WLAN ID (1)]:

[Total]
   Station Association Latency Minimum..... 0 ms
   Station Association Latency Maximum..... 0 ms
   Station Association Latency Average..... 0 ms
   Station Association Latency Total Count..... 0
[5 Min]
   Station Association Latency Minimum..... 0 ms
   Station Association Latency Maximum..... 0 ms
   Station Association Latency Average..... 0 ms
   Station Association Latency Total Count..... 0
[1 Hour]
   Station Association Latency Minimum..... 0 ms
   Station Association Latency Maximum..... 0 ms
   Station Association Latency Average..... 0 ms
   Station Association Latency Total Count..... 0
[1 Day]
   Station Association Latency Minimum..... 0 ms
   Station Association Latency Maximum..... 0 ms
   Station Association Latency Average..... 0 ms
   Station Association Latency Total Count..... 0
```

2) Check the station association attempt count (by AP/Device/Radio/WLAN).
ex.) by WLAN

```
APC# show network-stats statistics station association num-of-attempt-
assoc wlan 1

[WLAN ID (1)]
Reason Total 5Min 1Hour 1Day
================================================================================
========
AssocAttempt 0 0 0 0
```

3) Check the statistics by station association failure reason (by AP/Device/Radio/WLAN). ex.) by WLAN

```
APC# show network-stats statistics station association num-of-fail-by-
reason wlan 1

[WLAN ID (1)]
Reason                          Total     5Min      1Hour     1Day
================================================================================
========
UNSPECIFIED                       0         0         0         0
PREV_AUTH_NOT_VALID               0         0         0         0
DEAUTH_LEAVING                    0         0         0         0
DISASSOC_DUE_TO_INACTIVITY        0         0         0         0
DISASSOC_AP_BUSY                  0         0         0         0
CLASS2_FRAME_FROM_NONAUTH_STA     0         0         0         0
CLASS3_FRAME_FROM_NONASSOC_STA    0         0         0         0
DISASSOC_STA_HAS_LEFT             0         0         0         0
STA_REQ_ASSOC_WITHOUT_AUTH        0         0         0         0
PWR_CAPABILITY_NOT_VALID          0         0         0         0
SUPPORTED_CHANNEL_NOT_VALID       0         0         0         0
INVALID_IE                        0         0         0         0
MICHAEL_MIC_FAILURE               0         0         0         0
4WAY_HANDSHAKE_TIMEOUT            0         0         0         0
GROUP_KEY_UPDATE_TIMEOUT          0         0         0         0
IE_IN_4WAY_DIFFERS                0         0         0         0
GROUP_CIPHER_NOT_VALID            0         0         0         0
PAIRWISE_CIPHER_NOT_VALID         0         0         0         0
AKMP_NOT_VALID                    0         0         0         0
UNSUPPORTED_RSN_IE_VERSION        0         0         0         0
INVALID_RSN_IE_CAPAB              0         0         0         0
IEEE_802_1X_AUTH_FAILED           0         0         0         0
CIPHER_SUITE_REJECTED             0         0         0         0
TDLS_TEARDOWN_UNREACHABLE         0         0         0         0
TDLS_TEARDOWN_UNSPECIFIED         0         0         0         0
TOO_MANY                          0         0         0         0
STAION_RETRY_THRESHOLD            0         0         0         0
ACL_KICKOUT                       0         0         0         0
AUTH_IDLE_TIMEOUT                 0         0         0         0
AUTH_IN_ASSOC_STATE               0         0         0         0
WRONG_STA                         0         0         0         0
EXPIRED_SERVICE_TIME              0         0         0         0
MAC_AUTH_TIMEOUT                  0         0         0         0
MAC_AUTH_REJECT                   0         0         0         0
MANUAL_KICKOUT                    0         0         0         0
MALICIOUS_STA_STATISTICS          0         0         0         0
KICKOUT_MAC_FILTER                0         0         0         0
KICKOUT_INVALID_IP                0         0         0         0
KICKOUT_ACL                       0         0         0         0
INTER_APC_HO                      0         0         0         0
CLUSTER_DOWN                      0         0         0         0
VAP_DOWN                          0         0         0         0
```

4) Check the station association RSSI MIN/MAX/AVG statistics (by AP/Device/Radio/WLAN).
ex.) by WLAN

```
APC# show network-stats statistics station association rssi wlan 1

[WLAN ID (1)]
Reason                        Total     5Min      1Hour     1Day
================================================================================
========
Minimum                       0         0         0         0
Maximum                       0         0         0         0
Average                       0         0         0         0
```

5) Check the station association success rate statistics (by AP/Device/Radio/WLAN).
ex.) by WLAN

```
APC# show network-stats statistics station association success-rate
wlan 1

Station Association Success Rate [WLAN ID (1)]:

[Total]
   Station Association Succ Try..................... 0
   Station Association Succ Success................. 0
   Station Association Succ Failure................. 0
   Station Association Succ Rate(%)................. 0.000000 %
[5 Min]
   Station Association Succ Try..................... 0
   Station Association Succ Success................. 0
   Station Association Succ Failure................. 0
   Station Association Succ Rate(%)................. 0.000000 %
[1 Hour]
   Station Association Succ Try..................... 0
   Station Association Succ Success................. 0
   Station Association Succ Failure................. 0
   Station Association Succ Rate(%)................. 0.000000 %
[1 Day]
   Station Association Succ Try..................... 0
   Station Association Succ Success................. 0
   Station Association Succ Failure................. 0
   Station Association Succ Rate(%)................. 0.000000 %
```

6) Check the statistics of station data rate (by AP/Radio).
ex.) by AP/Radio

```
APC# show network-stats statistics station data-rate 1

[AP ID (1), Radio 5-GHz]
802.11b/g_TxCount
```

```
Reason                        Total      5Min       1Hour      1Day
================================================================================
========
802.11b/g_1M                    0          0          0          0
802.11b/g_2M                    0          0          0          0
802.11b/g_5.5M                  0          0          0          0
802.11b/g_11M                   0          0          0          0

802.11b/g_TxFailedCount
Reason                        Total      5Min       1Hour      1Day
================================================================================
========
802.11b/g_1M                    0          0          0          0
802.11b/g_2M                    0          0          0          0
802.11b/g_5.5M                  0          0          0          0
802.11b/g_11M                   0          0          0          0

802.11b/g_RxCount
Reason                        Total      5Min       1Hour      1Day
================================================================================
========
802.11b/g_1M                    0          0          0          0
802.11b/g_2M                    0          0          0          0
802.11b/g_5.5M                  0          0          0          0
802.11b/g_11M                   0          0          0          0

802.11g_TxCount
Reason                        Total      5Min       1Hour      1Day
================================================================================
========
802.11g_6M                      0          0          0          0
802.11g_9M                      0          0          0          0
802.11g_12M                     0          0          0          0
802.11g_18M                     0          0          0          0
802.11g_24M                     0          0          0          0
802.11g_36M                     0          0          0          0
802.11g_48M                     0          0          0          0
802.11g_54M                     0          0          0          0


802.11g_TxFailedCount
Reason                        Total      5Min       1Hour      1Day
================================================================================
========
802.11g_6M                      0          0          0          0
802.11g_9M                      0          0          0          0
802.11g_12M                     0          0          0          0
802.11g_18M                     0          0          0          0
802.11g_24M                     0          0          0          0
802.11g_36M                     0          0          0          0
802.11g_48M                     0          0          0          0
802.11g_54M                     0          0          0          0
```

```
802.11g_RxCount
Reason                          Total      5Min       1Hour      1Day
=================================================================
========
802.11g_6M                        0          0          0          0
802.11g_9M                        0          0          0          0
802.11g_12M                       0          0          0          0
802.11g_18M                       0          0          0          0
802.11g_24M                       0          0          0          0
802.11g_36M                       0          0          0          0
802.11g_48M                       0          0          0          0
802.11g_54M                       0          0          0          0

TxHtMcs
Reason                          Total      5Min       1Hour      1Day
=================================================================
========
MCS_0                             0          0          0          0
MCS_1                             0          0          0          0
MCS_2                             0          0          0          0
MCS_3                             0          0          0          0
MCS_4                             0          0          0          0
MCS_5                             0          0          0          0
MCS_6                             0          0          0          0
MCS_7                             0          0          0          0
MCS_8                             0          0          0          0
MCS_9                             0          0          0          0
MCS_10                            0          0          0          0
MCS_11                            0          0          0          0
MCS_12                            0          0          0          0
MCS_13                            0          0          0          0
MCS_14                            0          0          0          0
MCS_15                            0          0          0          0
MCS_16                            0          0          0          0
MCS_17                            0          0          0          0
MCS_18                            0          0          0          0
MCS_19                            0          0          0          0
MCS_20                            0          0          0          0
MCS_21                            0          0          0          0
MCS_22                            0          0          0          0
MCS_23                            0          0          0          0

TxHtMcsFailed
Reason                          Total      5Min       1Hour      1Day
=================================================================
========
MCS_0                             0          0          0          0
MCS_1                             0          0          0          0
MCS_2                             0          0          0          0
MCS_3                             0          0          0          0
MCS_4                             0          0          0          0
MCS_5                             0          0          0          0
```

```
MCS_6                          0         0         0         0
MCS_7                          0         0         0         0
MCS_8                          0         0         0         0
MCS_9                          0         0         0         0
MCS_10                         0         0         0         0
MCS_11                         0         0         0         0
MCS_12                         0         0         0         0
MCS_13                         0         0         0         0
MCS_14                         0         0         0         0
MCS_15                         0         0         0         0
MCS_16                         0         0         0         0
MCS_17                         0         0         0         0
MCS_18                         0         0         0         0
MCS_19                         0         0         0         0
MCS_20                         0         0         0         0
MCS_21                         0         0         0         0
MCS_22                         0         0         0         0
MCS_23                         0         0         0         0

RxHtMcs
Reason                        Total     5Min      1Hour     1Day
================================================================================
========
MCS_0                          0         0         0         0
MCS_1                          0         0         0         0
MCS_2                          0         0         0         0
MCS_3                          0         0         0         0
MCS_4                          0         0         0         0
MCS_5                          0         0         0         0
MCS_6                          0         0         0         0
MCS_7                          0         0         0         0
MCS_8                          0         0         0         0
MCS_9                          0         0         0         0
MCS_10                         0         0         0         0
MCS_11                         0         0         0         0
MCS_12                         0         0         0         0
MCS_13                         0         0         0         0
MCS_14                         0         0         0         0
MCS_15                         0         0         0         0
MCS_16                         0         0         0         0
MCS_17                         0         0         0         0
MCS_18                         0         0         0         0
MCS_19                         0         0         0         0
MCS_20                         0         0         0         0
MCS_21                         0         0         0         0
MCS_22                         0         0         0         0
MCS_23                         0         0         0         0

TxVhtMcs
Reason                        Total     5Min      1Hour     1Day
================================================================================
========
```

```
11AC_MCS[0][0]                0         0         0         0
11AC_MCS[0][1]                0         0         0         0
11AC_MCS[0][2]                0         0         0         0
11AC_MCS[0][3]                0         0         0         0
11AC_MCS[0][4]                0         0         0         0
11AC_MCS[0][5]                0         0         0         0
11AC_MCS[0][6]                0         0         0         0
11AC_MCS[0][7]                0         0         0         0
11AC_MCS[0][8]                0         0         0         0
11AC_MCS[0][9]                0         0         0         0
11AC_MCS[1][0]                0         0         0         0
11AC_MCS[1][1]                0         0         0         0
11AC_MCS[1][2]                0         0         0         0
11AC_MCS[1][3]                0         0         0         0
11AC_MCS[1][4]                0         0         0         0
11AC_MCS[1][5]                0         0         0         0
11AC_MCS[1][6]                0         0         0         0
11AC_MCS[1][7]                0         0         0         0
11AC_MCS[1][8]                0         0         0         0
11AC_MCS[1][9]                0         0         0         0
11AC_MCS[2][0]                0         0         0         0
11AC_MCS[2][1]                0         0         0         0
11AC_MCS[2][2]                0         0         0         0
11AC_MCS[2][3]                0         0         0         0
11AC_MCS[2][4]                0         0         0         0
11AC_MCS[2][5]                0         0         0         0
11AC_MCS[2][6]                0         0         0         0
11AC_MCS[2][7]                0         0         0         0
11AC_MCS[2][8]                0         0         0         0
11AC_MCS[2][9]                0         0         0         0

TxVhtMcsFailed
Reason                       Total     5Min      1Hour     1Day
=================================================================
========
11AC_MCS[0][0]                0         0         0         0
11AC_MCS[0][1]                0         0         0         0
11AC_MCS[0][2]                0         0         0         0
11AC_MCS[0][3]                0         0         0         0
11AC_MCS[0][4]                0         0         0         0
11AC_MCS[0][5]                0         0         0         0
11AC_MCS[0][6]                0         0         0         0
11AC_MCS[0][7]                0         0         0         0
11AC_MCS[0][8]                0         0         0         0
11AC_MCS[0][9]                0         0         0         0
11AC_MCS[1][0]                0         0         0         0
11AC_MCS[1][1]                0         0         0         0
11AC_MCS[1][2]                0         0         0         0
11AC_MCS[1][3]                0         0         0         0
11AC_MCS[1][4]                0         0         0         0
11AC_MCS[1][5]                0         0         0         0
11AC_MCS[1][6]                0         0         0         0
```

```
11AC_MCS[1][7]                  0         0         0         0
11AC_MCS[1][8]                  0         0         0         0
11AC_MCS[1][9]                  0         0         0         0
11AC_MCS[2][0]                  0         0         0         0
11AC_MCS[2][1]                  0         0         0         0
11AC_MCS[2][2]                  0         0         0         0
11AC_MCS[2][3]                  0         0         0         0
11AC_MCS[2][4]                  0         0         0         0
11AC_MCS[2][5]                  0         0         0         0
11AC_MCS[2][6]                  0         0         0         0
11AC_MCS[2][7]                  0         0         0         0
11AC_MCS[2][8]                  0         0         0         0
11AC_MCS[2][9]                  0         0         0         0

RxVhtMcs
Reason                        Total     5Min      1Hour     1Day
================================================================================
========
11AC_MCS[0][0]                  0         0         0         0
11AC_MCS[0][1]                  0         0         0         0
11AC_MCS[0][2]                  0         0         0         0
11AC_MCS[0][3]                  0         0         0         0
11AC_MCS[0][4]                  0         0         0         0
11AC_MCS[0][5]                  0         0         0         0
11AC_MCS[0][6]                  0         0         0         0
11AC_MCS[0][7]                  0         0         0         0
11AC_MCS[0][8]                  0         0         0         0
11AC_MCS[0][9]                  0         0         0         0
11AC_MCS[1][0]                  0         0         0         0
11AC_MCS[1][1]                  0         0         0         0
11AC_MCS[1][2]                  0         0         0         0
11AC_MCS[1][3]                  0         0         0         0
11AC_MCS[1][4]                  0         0         0         0
11AC_MCS[1][5]                  0         0         0         0
11AC_MCS[1][6]                  0         0         0         0
11AC_MCS[1][7]                  0         0         0         0
11AC_MCS[1][8]                  0         0         0         0
11AC_MCS[1][9]                  0         0         0         0
11AC_MCS[2][0]                  0         0         0         0
11AC_MCS[2][1]                  0         0         0         0
11AC_MCS[2][2]                  0         0         0         0
11AC_MCS[2][3]                  0         0         0         0
11AC_MCS[2][4]                  0         0         0         0
11AC_MCS[2][5]                  0         0         0         0
11AC_MCS[2][6]                  0         0         0         0
11AC_MCS[2][7]                  0         0         0         0
11AC_MCS[2][8]                  0         0         0         0
11AC_MCS[2][9]                  0         0         0         0

[AP ID (1), Radio 2.4-GHz]
802.11b/g_TxCount
Reason                        Total     5Min      1Hour     1Day
```

```
================================================================================
========
802.11b/g_1M                    0         0         0         0
802.11b/g_2M                    0         0         0         0
802.11b/g_5.5M                  0         0         0         0
802.11b/g_11M                   0         0         0         0

802.11b/g_TxFailedCount
Reason                       Total     5Min      1Hour     1Day
================================================================================
========
802.11b/g_1M                    0         0         0         0
802.11b/g_2M                    0         0         0         0
802.11b/g_5.5M                  0         0         0         0
802.11b/g_11M                   0         0         0         0

802.11b/g_RxCount
Reason                       Total     5Min      1Hour     1Day
================================================================================
========
802.11b/g_1M                    0         0         0         0
802.11b/g_2M                    0         0         0         0
802.11b/g_5.5M                  0         0         0         0
802.11b/g_11M                   0         0         0         0

802.11g_TxCount
Reason                       Total     5Min      1Hour     1Day
================================================================================
========
802.11g_6M                      0         0         0         0
802.11g_9M                      0         0         0         0
802.11g_12M                     0         0         0         0
802.11g_18M                     0         0         0         0
802.11g_24M                     0         0         0         0
802.11g_36M                     0         0         0         0
802.11g_48M                     0         0         0         0
802.11g_54M                     0         0         0         0


802.11g_TxFailedCount
Reason                       Total     5Min      1Hour     1Day
================================================================================
========
802.11g_6M                      0         0         0         0
802.11g_9M                      0         0         0         0
802.11g_12M                     0         0         0         0
802.11g_18M                     0         0         0         0
802.11g_24M                     0         0         0         0
802.11g_36M                     0         0         0         0
802.11g_48M                     0         0         0         0
802.11g_54M                     0         0         0         0
```

```
802.11g_RxCount
Reason                          Total      5Min       1Hour      1Day
================================================================================
========
802.11g_6M                       0          0          0          0
802.11g_9M                       0          0          0          0
802.11g_12M                      0          0          0          0
802.11g_18M                      0          0          0          0
802.11g_24M                      0          0          0          0
802.11g_36M                      0          0          0          0
802.11g_48M                      0          0          0          0
802.11g_54M                      0          0          0          0

TxHtMcs
Reason                          Total      5Min       1Hour      1Day
================================================================================
========
MCS_0                            0          0          0          0
MCS_1                            0          0          0          0
MCS_2                            0          0          0          0
MCS_3                            0          0          0          0
MCS_4                            0          0          0          0
MCS_5                            0          0          0          0
MCS_6                            0          0          0          0
MCS_7                            0          0          0          0
MCS_8                            0          0          0          0
MCS_9                            0          0          0          0
MCS_10                           0          0          0          0
MCS_11                           0          0          0          0
MCS_12                           0          0          0          0
MCS_13                           0          0          0          0
MCS_14                           0          0          0          0
MCS_15                           0          0          0          0
MCS_16                           0          0          0          0
MCS_17                           0          0          0          0
MCS_18                           0          0          0          0
MCS_19                           0          0          0          0
MCS_20                           0          0          0          0
MCS_21                           0          0          0          0
MCS_22                           0          0          0          0
MCS_23                           0          0          0          0

TxHtMcsFailed
Reason                          Total      5Min       1Hour      1Day
================================================================================
========
MCS_0                            0          0          0          0
MCS_1                            0          0          0          0
MCS_2                            0          0          0          0
MCS_3                            0          0          0          0
MCS_4                            0          0          0          0
```

```
MCS_5                          0         0         0         0
MCS_6                          0         0         0         0
MCS_7                          0         0         0         0
MCS_8                          0         0         0         0
MCS_9                          0         0         0         0
MCS_10                         0         0         0         0
MCS_11                         0         0         0         0
MCS_12                         0         0         0         0
MCS_13                         0         0         0         0
MCS_14                         0         0         0         0
MCS_15                         0         0         0         0
MCS_16                         0         0         0         0
MCS_17                         0         0         0         0
MCS_18                         0         0         0         0
MCS_19                         0         0         0         0
MCS_20                         0         0         0         0
MCS_21                         0         0         0         0
MCS_22                         0         0         0         0
MCS_23                         0         0         0         0

RxHtMcs
Reason                        Total     5Min      1Hour     1Day
================================================================================
========
MCS_0                          0         0         0         0
MCS_1                          0         0         0         0
MCS_2                          0         0         0         0
MCS_3                          0         0         0         0
MCS_4                          0         0         0         0
MCS_5                          0         0         0         0
MCS_6                          0         0         0         0
MCS_7                          0         0         0         0
MCS_8                          0         0         0         0
MCS_9                          0         0         0         0
MCS_10                         0         0         0         0
MCS_11                         0         0         0         0
MCS_12                         0         0         0         0
MCS_13                         0         0         0         0
MCS_14                         0         0         0         0
MCS_15                         0         0         0         0
MCS_16                         0         0         0         0
MCS_17                         0         0         0         0
MCS_18                         0         0         0         0
MCS_19                         0         0         0         0
MCS_20                         0         0         0         0
MCS_21                         0         0         0         0
MCS_22                         0         0         0         0
MCS_23                         0         0         0         0

TxVhtMcs
Reason                        Total     5Min      1Hour     1Day
```

```
================================================================================
========
11AC_MCS[0][0]                  0         0         0         0
11AC_MCS[0][1]                  0         0         0         0
11AC_MCS[0][2]                  0         0         0         0
11AC_MCS[0][3]                  0         0         0         0
11AC_MCS[0][4]                  0         0         0         0
11AC_MCS[0][5]                  0         0         0         0
11AC_MCS[0][6]                  0         0         0         0
11AC_MCS[0][7]                  0         0         0         0
11AC_MCS[0][8]                  0         0         0         0
11AC_MCS[0][9]                  0         0         0         0
11AC_MCS[1][0]                  0         0         0         0
11AC_MCS[1][1]                  0         0         0         0
11AC_MCS[1][2]                  0         0         0         0
11AC_MCS[1][3]                  0         0         0         0
11AC_MCS[1][4]                  0         0         0         0
11AC_MCS[1][5]                  0         0         0         0
11AC_MCS[1][6]                  0         0         0         0
11AC_MCS[1][7]                  0         0         0         0
11AC_MCS[1][8]                  0         0         0         0
11AC_MCS[1][9]                  0         0         0         0
11AC_MCS[2][0]                  0         0         0         0
11AC_MCS[2][1]                  0         0         0         0
11AC_MCS[2][2]                  0         0         0         0
11AC_MCS[2][3]                  0         0         0         0
11AC_MCS[2][4]                  0         0         0         0
11AC_MCS[2][5]                  0         0         0         0
11AC_MCS[2][6]                  0         0         0         0
11AC_MCS[2][7]                  0         0         0         0
11AC_MCS[2][8]                  0         0         0         0
11AC_MCS[2][9]                  0         0         0         0

TxVhtMcsFailed
Reason                        Total     5Min      1Hour     1Day
================================================================================
========
11AC_MCS[0][0]                  0         0         0         0
11AC_MCS[0][1]                  0         0         0         0
11AC_MCS[0][2]                  0         0         0         0
11AC_MCS[0][3]                  0         0         0         0
11AC_MCS[0][4]                  0         0         0         0
11AC_MCS[0][5]                  0         0         0         0
11AC_MCS[0][6]                  0         0         0         0
11AC_MCS[0][7]                  0         0         0         0
11AC_MCS[0][8]                  0         0         0         0
11AC_MCS[0][9]                  0         0         0         0
11AC_MCS[1][0]                  0         0         0         0
11AC_MCS[1][1]                  0         0         0         0
11AC_MCS[1][2]                  0         0         0         0
11AC_MCS[1][3]                  0         0         0         0
11AC_MCS[1][4]                  0         0         0         0
```

```
11AC_MCS[1][5]                0         0         0         0
11AC_MCS[1][6]                0         0         0         0
11AC_MCS[1][7]                0         0         0         0
11AC_MCS[1][8]                0         0         0         0
11AC_MCS[1][9]                0         0         0         0
11AC_MCS[2][0]                0         0         0         0
11AC_MCS[2][1]                0         0         0         0
11AC_MCS[2][2]                0         0         0         0
11AC_MCS[2][3]                0         0         0         0
11AC_MCS[2][4]                0         0         0         0
11AC_MCS[2][5]                0         0         0         0
11AC_MCS[2][6]                0         0         0         0
11AC_MCS[2][7]                0         0         0         0
11AC_MCS[2][8]                0         0         0         0
11AC_MCS[2][9]                0         0         0         0

RxVhtMcs
Reason                       Total     5Min      1Hour     1Day
=================================================================
========
11AC_MCS[0][0]                0         0         0         0
11AC_MCS[0][1]                0         0         0         0
11AC_MCS[0][2]                0         0         0         0
11AC_MCS[0][3]                0         0         0         0
11AC_MCS[0][4]                0         0         0         0
11AC_MCS[0][5]                0         0         0         0
11AC_MCS[0][6]                0         0         0         0
11AC_MCS[0][7]                0         0         0         0
11AC_MCS[0][8]                0         0         0         0
11AC_MCS[0][9]                0         0         0         0
11AC_MCS[1][0]                0         0         0         0
11AC_MCS[1][1]                0         0         0         0
11AC_MCS[1][2]                0         0         0         0
11AC_MCS[1][3]                0         0         0         0
11AC_MCS[1][4]                0         0         0         0
11AC_MCS[1][5]                0         0         0         0
11AC_MCS[1][6]                0         0         0         0
11AC_MCS[1][7]                0         0         0         0
11AC_MCS[1][8]                0         0         0         0
11AC_MCS[1][9]                0         0         0         0
11AC_MCS[2][0]                0         0         0         0
11AC_MCS[2][1]                0         0         0         0
11AC_MCS[2][2]                0         0         0         0
11AC_MCS[2][3]                0         0         0         0
11AC_MCS[2][4]                0         0         0         0
11AC_MCS[2][5]                0         0         0         0
11AC_MCS[2][6]                0         0         0         0
11AC_MCS[2][7]                0         0         0         0
11AC_MCS[2][8]                0         0         0         0
11AC_MCS[2][9]                0         0         0         0
```

7) Check the statistics by station disassoc./Deauth reason (by AP/Device/Radio/WLAN). ex.) by WLAN

```
APC# show network-stats statistics station disassoc-deauth wlan 1

[WLAN ID (1)]
number of In/Out
Reason                        Total     5Min      1Hour     1Day
================================================================================
========
DisassocIn                      0         0         0         0
DeauthIn                        0         0         0         0
DisassocOut                     0         0         0         0
DeauthOut                       0         0         0         0

DisassocInReason
Reason                        Total     5Min      1Hour     1Day
================================================================================
========
UNSPECIFIED                     0         0         0         0
PREV_AUTH_NOT_VALID             0         0         0         0
DEAUTH_LEAVING                  0         0         0         0
DISASSOC_DUE_TO_INACTIVITY      0         0         0         0
DISASSOC_AP_BUSY                0         0         0         0
CLASS2_FRAME_FROM_NONAUTH_STA   0         0         0         0
CLASS3_FRAME_FROM_NONASSOC_STA  0         0         0         0
DISASSOC_STA_HAS_LEFT           0         0         0         0
STA_REQ_ASSOC_WITHOUT_AUTH      0         0         0         0
PWR_CAPABILITY_NOT_VALID        0         0         0         0
SUPPORTED_CHANNEL_NOT_VALID     0         0         0         0
INVALID_IE                      0         0         0         0
MICHAEL_MIC_FAILURE             0         0         0         0
4WAY_HANDSHAKE_TIMEOUT          0         0         0         0
GROUP_KEY_UPDATE_TIMEOUT        0         0         0         0
IE_IN_4WAY_DIFFERS              0         0         0         0
GROUP_CIPHER_NOT_VALID          0         0         0         0
PAIRWISE_CIPHER_NOT_VALID       0         0         0         0
AKMP_NOT_VALID                  0         0         0         0
UNSUPPORTED_RSN_IE_VERSION      0         0         0         0
INVALID_RSN_IE_CAPAB            0         0         0         0
IEEE_802_1X_AUTH_FAILED         0         0         0         0
CIPHER_SUITE_REJECTED           0         0         0         0
TDLS_TEARDOWN_UNREACHABLE       0         0         0         0
TDLS_TEARDOWN_UNSPECIFIED       0         0         0         0
TOO_MANY                        0         0         0         0
STAION_RETRY_THRESHOLD          0         0         0         0
ACL_KICKOUT                     0         0         0         0
AUTH_IDLE_TIMEOUT               0         0         0         0
AUTH_IN_ASSOC_STATE             0         0         0         0
WRONG_STA                       0         0         0         0
EXPIRED_SERVICE_TIME            0         0         0         0
MAC_AUTH_TIMEOUT                0         0         0         0
```

```
MAC_AUTH_REJECT                0         0         0         0
MANUAL_KICKOUT                 0         0         0         0
MALICIOUS_STA_STATISTICS       0         0         0         0
KICKOUT_MAC_FILTER             0         0         0         0
KICKOUT_INVALID_IP             0         0         0         0
KICKOUT_ACL                    0         0         0         0
INTER_APC_HO                   0         0         0         0
CLUSTER_DOWN                   0         0         0         0
VAP_DOWN                       0         0         0         0

DeauthInReason
Reason                       Total     5Min      1Hour     1Day
================================================================================
========
UNSPECIFIED                    0         0         0         0
PREV_AUTH_NOT_VALID            0         0         0         0
DEAUTH_LEAVING                 0         0         0         0
DISASSOC_DUE_TO_INACTIVITY     0         0         0         0
DISASSOC_AP_BUSY               0         0         0         0
CLASS2_FRAME_FROM_NONAUTH_STA  0         0         0         0
CLASS3_FRAME_FROM_NONASSOC_STA 0         0         0         0
DISASSOC_STA_HAS_LEFT          0         0         0         0
STA_REQ_ASSOC_WITHOUT_AUTH     0         0         0         0
PWR_CAPABILITY_NOT_VALID       0         0         0         0
SUPPORTED_CHANNEL_NOT_VALID    0         0         0         0
INVALID_IE                     0         0         0         0
MICHAEL_MIC_FAILURE            0         0         0         0
4WAY_HANDSHAKE_TIMEOUT         0         0         0         0
GROUP_KEY_UPDATE_TIMEOUT       0         0         0         0
IE_IN_4WAY_DIFFERS             0         0         0         0
GROUP_CIPHER_NOT_VALID         0         0         0         0
PAIRWISE_CIPHER_NOT_VALID      0         0         0         0
AKMP_NOT_VALID                 0         0         0         0
UNSUPPORTED_RSN_IE_VERSION     0         0         0         0
INVALID_RSN_IE_CAPAB           0         0         0         0
IEEE_802_1X_AUTH_FAILED        0         0         0         0
CIPHER_SUITE_REJECTED          0         0         0         0
TDLS_TEARDOWN_UNREACHABLE      0         0         0         0
TDLS_TEARDOWN_UNSPECIFIED      0         0         0         0
TOO_MANY                       0         0         0         0
STAION_RETRY_THRESHOLD         0         0         0         0
ACL_KICKOUT                    0         0         0         0
AUTH_IDLE_TIMEOUT              0         0         0         0
AUTH_IN_ASSOC_STATE            0         0         0         0
WRONG_STA                      0         0         0         0
EXPIRED_SERVICE_TIME           0         0         0         0
MAC_AUTH_TIMEOUT               0         0         0         0
MAC_AUTH_REJECT                0         0         0         0
MANUAL_KICKOUT                 0         0         0         0
MALICIOUS_STA_STATISTICS       0         0         0         0
KICKOUT_MAC_FILTER             0         0         0         0
KICKOUT_INVALID_IP             0         0         0         0
KICKOUT_ACL                    0         0         0         0
```

```
INTER_APC_HO                    0         0         0         0
CLUSTER_DOWN                    0         0         0         0
VAP_DOWN                        0         0         0         0

DisassocOutReason
Reason                       Total     5Min      1Hour     1Day
================================================================================
========
UNSPECIFIED                     0         0         0         0
PREV_AUTH_NOT_VALID             0         0         0         0
DEAUTH_LEAVING                  0         0         0         0
DISASSOC_DUE_TO_INACTIVITY      0         0         0         0
DISASSOC_AP_BUSY                0         0         0         0
CLASS2_FRAME_FROM_NONAUTH_STA   0         0         0         0
CLASS3_FRAME_FROM_NONASSOC_STA  0         0         0         0
DISASSOC_STA_HAS_LEFT           0         0         0         0
STA_REQ_ASSOC_WITHOUT_AUTH      0         0         0         0
PWR_CAPABILITY_NOT_VALID        0         0         0         0
SUPPORTED_CHANNEL_NOT_VALID     0         0         0         0
INVALID_IE                      0         0         0         0
MICHAEL_MIC_FAILURE             0         0         0         0
4WAY_HANDSHAKE_TIMEOUT          0         0         0         0
GROUP_KEY_UPDATE_TIMEOUT        0         0         0         0
IE_IN_4WAY_DIFFERS              0         0         0         0
GROUP_CIPHER_NOT_VALID          0         0         0         0
PAIRWISE_CIPHER_NOT_VALID       0         0         0         0
AKMP_NOT_VALID                  0         0         0         0
UNSUPPORTED_RSN_IE_VERSION      0         0         0         0
INVALID_RSN_IE_CAPAB            0         0         0         0
IEEE_802_1X_AUTH_FAILED         0         0         0         0
CIPHER_SUITE_REJECTED           0         0         0         0
TDLS_TEARDOWN_UNREACHABLE       0         0         0         0
TDLS_TEARDOWN_UNSPECIFIED       0         0         0         0
TOO_MANY                        0         0         0         0
STAION_RETRY_THRESHOLD          0         0         0         0
ACL_KICKOUT                     0         0         0         0
AUTH_IDLE_TIMEOUT               0         0         0         0
AUTH_IN_ASSOC_STATE             0         0         0         0
WRONG_STA                       0         0         0         0
EXPIRED_SERVICE_TIME            0         0         0         0
MAC_AUTH_TIMEOUT                0         0         0         0
MAC_AUTH_REJECT                 0         0         0         0
MANUAL_KICKOUT                  0         0         0         0
MALICIOUS_STA_STATISTICS        0         0         0         0
KICKOUT_MAC_FILTER              0         0         0         0
KICKOUT_INVALID_IP              0         0         0         0
KICKOUT_ACL                     0         0         0         0
INTER_APC_HO                    0         0         0         0
CLUSTER_DOWN                    0         0         0         0
VAP_DOWN                        0         0         0         0
```

```
DeauthOutReason
Reason                        Total      5Min       1Hour      1Day
=================================================================
========
UNSPECIFIED                     0         0          0          0
PREV_AUTH_NOT_VALID             0         0          0          0
DEAUTH_LEAVING                  0         0          0          0
DISASSOC_DUE_TO_INACTIVITY      0         0          0          0
DISASSOC_AP_BUSY                0         0          0          0
CLASS2_FRAME_FROM_NONAUTH_STA   0         0          0          0
CLASS3_FRAME_FROM_NONASSOC_STA  0         0          0          0
DISASSOC_STA_HAS_LEFT           0         0          0          0
STA_REQ_ASSOC_WITHOUT_AUTH      0         0          0          0
PWR_CAPABILITY_NOT_VALID        0         0          0          0
SUPPORTED_CHANNEL_NOT_VALID     0         0          0          0
INVALID_IE                      0         0          0          0
MICHAEL_MIC_FAILURE             0         0          0          0
4WAY_HANDSHAKE_TIMEOUT          0         0          0          0
GROUP_KEY_UPDATE_TIMEOUT        0         0          0          0
IE_IN_4WAY_DIFFERS              0         0          0          0
GROUP_CIPHER_NOT_VALID          0         0          0          0
PAIRWISE_CIPHER_NOT_VALID       0         0          0          0
AKMP_NOT_VALID                  0         0          0          0
UNSUPPORTED_RSN_IE_VERSION      0         0          0          0
INVALID_RSN_IE_CAPAB            0         0          0          0
IEEE_802_1X_AUTH_FAILED         0         0          0          0
CIPHER_SUITE_REJECTED           0         0          0          0
TDLS_TEARDOWN_UNREACHABLE       0         0          0          0
TDLS_TEARDOWN_UNSPECIFIED       0         0          0          0
TOO_MANY                        0         0          0          0
STAION_RETRY_THRESHOLD          0         0          0          0
ACL_KICKOUT                     0         0          0          0
AUTH_IDLE_TIMEOUT               0         0          0          0
AUTH_IN_ASSOC_STATE             0         0          0          0
WRONG_STA                       0         0          0          0
EXPIRED_SERVICE_TIME            0         0          0          0
MAC_AUTH_TIMEOUT                0         0          0          0
MAC_AUTH_REJECT                 0         0          0          0
MANUAL_KICKOUT                  0         0          0          0
MALICIOUS_STA_STATISTICS        0         0          0          0
KICKOUT_MAC_FILTER              0         0          0          0
KICKOUT_INVALID_IP              0         0          0          0
KICKOUT_ACL                     0         0          0          0
INTER_APC_HO                    0         0          0          0
CLUSTER_DOWN                    0         0          0          0
VAP_DOWN                        0         0          0          0

DisassocStateInReason
Reason                        Total      5Min       1Hour      1Day
=================================================================
========
UNKNOWN                         0         0          0          0
```

```
AUTH                            0         0         0         0
AUTH_SUCCESS                    0         0         0         0
AUTH_FAILURE                    0         0         0         0
IPFAIL                          0         0         0         0
NORMAL                          0         0         0         0

DeauthStateInReason
Reason                       Total     5Min      1Hour     1Day
=============================================================================
========
UNKNOWN                         0         0         0         0
AUTH                            0         0         0         0
AUTH_SUCCESS                    0         0         0         0
AUTH_FAILURE                    0         0         0         0
IPFAIL                          0         0         0         0
NORMAL                          0         0         0         0

DsassocStateOutReason
Reason                       Total     5Min      1Hour     1Day
=============================================================================
========
UNKNOWN                         0         0         0         0
AUTH                            0         0         0         0
AUTH_SUCCESS                    0         0         0         0
AUTH_FAILURE                    0         0         0         0
IPFAIL                          0         0         0         0
NORMAL                          0         0         0         0

DeauthStateOutReason
Reason                       Total     5Min      1Hour     1Day
=============================================================================
========
UNKNOWN                         0         0         0         0
AUTH                            0         0         0         0
AUTH_SUCCESS                    0         0         0         0
AUTH_FAILURE                    0         0         0         0
IPFAIL                          0         0         0         0
NORMAL                          0         0         0         0
```

8) Check the station handover latency (by AP/Device/Radio/WLAN).
ex.) by WLAN

```
APC# show network-stats statistics station hand-over latency wlan 1

Station H/O Latency [WLAN ID (1)]:

[Total]
   Station H/O Latency Minimum..................... 0 ms
   Station H/O Latency Maximum..................... 0 ms
   Station H/O Latency Average..................... 0 ms
   Station H/O Latency Total Count................. 0
```

```
[5 Min]
   Station H/O Latency Minimum..................... 0 ms
   Station H/O Latency Maximum..................... 0 ms
   Station H/O Latency Average..................... 0 ms
   Station H/O Latency Total Count................. 0
[1 Hour]
   Station H/O Latency Minimum..................... 0 ms
   Station H/O Latency Maximum..................... 0 ms
   Station H/O Latency Average..................... 0 ms
   Station H/O Latency Total Count................. 0
[1 Day]
   Station H/O Latency Minimum..................... 0 ms
   Station H/O Latency Maximum..................... 0 ms
   Station H/O Latency Average..................... 0 ms
   Station H/O Latency Total Count................. 0
```

9) Check the station handover attempt count (by AP/Device/Radio/WLAN).
ex.) by WLAN

```
APC# show network-stats statistics station hand-over num-of-attempt-ho
wlan 1

[WLAN ID (1)]
Reason                       Total     5Min      1Hour     1Day
================================================================================
========
HandoverAttempt               0         0         0         0
```

10) Check the statistics by station handover failure reason (by AP/Device/Radio/WLAN).
ex.) by WLAN

```
APC# show network-stats statistics station hand-over num-of-fail-by-
reason wlan 1

[WLAN ID (1)]
Reason                       Total     5Min      1Hour     1Day
================================================================================
========
UNSPECIFIED                     0         0         0         0
PREV_AUTH_NOT_VALID             0         0         0         0
DEAUTH_LEAVING                  0         0         0         0
DISASSOC_DUE_TO_INACTIVITY      0         0         0         0
DISASSOC_AP_BUSY                0         0         0         0
CLASS2_FRAME_FROM_NONAUTH_STA   0         0         0         0
CLASS3_FRAME_FROM_NONASSOC_STA  0         0         0         0
DISASSOC_STA_HAS_LEFT           0         0         0         0
STA_REQ_ASSOC_WITHOUT_AUTH      0         0         0         0
```

```
PWR_CAPABILITY_NOT_VALID        0         0         0         0
SUPPORTED_CHANNEL_NOT_VALID     0         0         0         0
INVALID_IE                      0         0         0         0
MICHAEL_MIC_FAILURE             0         0         0         0
4WAY_HANDSHAKE_TIMEOUT          0         0         0         0
GROUP_KEY_UPDATE_TIMEOUT        0         0         0         0
IE_IN_4WAY_DIFFERS              0         0         0         0
GROUP_CIPHER_NOT_VALID          0         0         0         0
PAIRWISE_CIPHER_NOT_VALID       0         0         0         0
AKMP_NOT_VALID                  0         0         0         0
UNSUPPORTED_RSN_IE_VERSION      0         0         0         0
INVALID_RSN_IE_CAPAB            0         0         0         0
IEEE_802_1X_AUTH_FAILED         0         0         0         0
CIPHER_SUITE_REJECTED           0         0         0         0
TDLS_TEARDOWN_UNREACHABLE       0         0         0         0
TDLS_TEARDOWN_UNSPECIFIED       0         0         0         0
TOO_MANY                        0         0         0         0
STAION_RETRY_THRESHOLD          0         0         0         0
ACL_KICKOUT                     0         0         0         0
AUTH_IDLE_TIMEOUT               0         0         0         0
AUTH_IN_ASSOC_STATE             0         0         0         0
WRONG_STA                       0         0         0         0
EXPIRED_SERVICE_TIME            0         0         0         0
MAC_AUTH_TIMEOUT                0         0         0         0
MAC_AUTH_REJECT                 0         0         0         0
MANUAL_KICKOUT                  0         0         0         0
MALICIOUS_STA_STATISTICS        0         0         0         0
KICKOUT_MAC_FILTER              0         0         0         0
KICKOUT_INVALID_IP              0         0         0         0
KICKOUT_ACL                     0         0         0         0
INTER_APC_HO                    0         0         0         0
CLUSTER_DOWN                    0         0         0         0
VAP_DOWN                        0         0         0         0
```

11) Check the station handover RSSI MIN/MAX/AVG statistics (by AP/Device/Radio/ WLAN).
ex.) by WLAN

```
APC# show network-stats statistics station hand-over rssi wlan 1

[WLAN ID (1)]
Reason                        Total     5Min      1Hour     1Day
=================================================================
========
Minimum                       0         0         0         0
Maximum                       0         0         0         0
Average                       0         0         0         0
```

12) Check the statistics of the station handover success rate (by AP/Device/Radio/WLAN).
ex.) by WLAN

```
APC# show network-stats statistics station hand-over success-rate wlan
1

Station H/O Success Rate [WLAN ID (1)]:

[Total]
   Station H/O Succ Try.............................. 0
   Station H/O Succ Success.......................... 0
   Station H/O Succ Failure.......................... 0
   Station H/O Succ Rate(%).......................... 0.000000 %
[5 Min]
   Station H/O Succ Try.............................. 0
   Station H/O Succ Success.......................... 0
   Station H/O Succ Failure.......................... 0
   Station H/O Succ Rate(%).......................... 0.000000 %
[1 Hour]
   Station H/O Succ Try.............................. 0
   Station H/O Succ Success.......................... 0
   Station H/O Succ Failure.......................... 0
   Station H/O Succ Rate(%).......................... 0.000000 %
[1 Day]
   Station H/O Succ Try.............................. 0
   Station H/O Succ Success.......................... 0
   Station H/O Succ Failure.......................... 0
   Station H/O Succ Rate(%).......................... 0.000000 %
```

13) Check the statistics of station handover path tracking (by AP/Radio).
ex.) by AP/Radio

```
APC# show network-stats statistics station hand-over trace 1

[AP ID (1), Radio 5-GHz]
Reason                              Total     5Min      1Hour     1Day
================================================================================
========
destAp(1)[destAp/statsCnt]           0/   0    0/   0    0/   0    0/   0
destAp(2)[destAp/statsCnt]           0/   0    0/   0    0/   0    0/   0
destAp(3)[destAp/statsCnt]           0/   0    0/   0    0/   0    0/   0
destAp(4)[destAp/statsCnt]           0/   0    0/   0    0/   0    0/   0
destAp(5)[destAp/statsCnt]           0/   0    0/   0    0/   0    0/   0
destAp(6)[destAp/statsCnt]           0/   0    0/   0    0/   0    0/   0
destAp(7)[destAp/statsCnt]           0/   0    0/   0    0/   0    0/   0
destAp(8)[destAp/statsCnt]           0/   0    0/   0    0/   0    0/   0
destAp(9)[destAp/statsCnt]           0/   0    0/   0    0/   0    0/   0
destAp(10)[destAp/statsCnt]          0/   0    0/   0    0/   0    0/   0
destAp(11)[destAp/statsCnt]          0/   0    0/   0    0/   0    0/   0
destAp(12)[destAp/statsCnt]          0/   0    0/   0    0/   0    0/   0
destAp(13)[destAp/statsCnt]          0/   0    0/   0    0/   0    0/   0
destAp(14)[destAp/statsCnt]          0/   0    0/   0    0/   0    0/   0
```

```
destAp(15)[destAp/statsCnt]        0/   0     0/   0     0/   0     0/   0
destAp(16)[destAp/statsCnt]        0/   0     0/   0     0/   0     0/   0
destAp(17)[destAp/statsCnt]        0/   0     0/   0     0/   0     0/   0
destAp(18)[destAp/statsCnt]        0/   0     0/   0     0/   0     0/   0
destAp(19)[destAp/statsCnt]        0/   0     0/   0     0/   0     0/   0
destAp(20)[destAp/statsCnt]        0/   0     0/   0     0/   0     0/   0
destAp(21)[destAp/statsCnt]        0/   0     0/   0     0/   0     0/   0
destAp(22)[destAp/statsCnt]        0/   0     0/   0     0/   0     0/   0
destAp(23)[destAp/statsCnt]        0/   0     0/   0     0/   0     0/   0
destAp(24)[destAp/statsCnt]        0/   0     0/   0     0/   0     0/   0
destAp(25)[destAp/statsCnt]        0/   0     0/   0     0/   0     0/   0
destAp(26)[destAp/statsCnt]        0/   0     0/   0     0/   0     0/   0
destAp(27)[destAp/statsCnt]        0/   0     0/   0     0/   0     0/   0
destAp(28)[destAp/statsCnt]        0/   0     0/   0     0/   0     0/   0
destAp(29)[destAp/statsCnt]        0/   0     0/   0     0/   0     0/   0
destAp(30)[destAp/statsCnt]        0/   0     0/   0     0/   0     0/   0
destAp(31)[destAp/statsCnt]        0/   0     0/   0     0/   0     0/   0
destAp(32)[destAp/statsCnt]        0/   0     0/   0     0/   0     0/   0

[AP ID (1), Radio 2.4-GHz]
Reason                           Total      5Min       1Hour      1Day
================================================================================
========
destAp(1)[destAp/statsCnt]         0/   0     0/   0     0/   0     0/   0
destAp(2)[destAp/statsCnt]         0/   0     0/   0     0/   0     0/   0
destAp(3)[destAp/statsCnt]         0/   0     0/   0     0/   0     0/   0
destAp(4)[destAp/statsCnt]         0/   0     0/   0     0/   0     0/   0
destAp(5)[destAp/statsCnt]         0/   0     0/   0     0/   0     0/   0
destAp(6)[destAp/statsCnt]         0/   0     0/   0     0/   0     0/   0
destAp(7)[destAp/statsCnt]         0/   0     0/   0     0/   0     0/   0
destAp(8)[destAp/statsCnt]         0/   0     0/   0     0/   0     0/   0
destAp(9)[destAp/statsCnt]         0/   0     0/   0     0/   0     0/   0
destAp(10)[destAp/statsCnt]        0/   0     0/   0     0/   0     0/   0
destAp(11)[destAp/statsCnt]        0/   0     0/   0     0/   0     0/   0
destAp(12)[destAp/statsCnt]        0/   0     0/   0     0/   0     0/   0
destAp(13)[destAp/statsCnt]        0/   0     0/   0     0/   0     0/   0
destAp(14)[destAp/statsCnt]        0/   0     0/   0     0/   0     0/   0
destAp(15)[destAp/statsCnt]        0/   0     0/   0     0/   0     0/   0
destAp(16)[destAp/statsCnt]        0/   0     0/   0     0/   0     0/   0
destAp(17)[destAp/statsCnt]        0/   0     0/   0     0/   0     0/   0
destAp(18)[destAp/statsCnt]        0/   0     0/   0     0/   0     0/   0
destAp(19)[destAp/statsCnt]        0/   0     0/   0     0/   0     0/   0
destAp(20)[destAp/statsCnt]        0/   0     0/   0     0/   0     0/   0
destAp(21)[destAp/statsCnt]        0/   0     0/   0     0/   0     0/   0
destAp(22)[destAp/statsCnt]        0/   0     0/   0     0/   0     0/   0
destAp(23)[destAp/statsCnt]        0/   0     0/   0     0/   0     0/   0
destAp(24)[destAp/statsCnt]        0/   0     0/   0     0/   0     0/   0
destAp(25)[destAp/statsCnt]        0/   0     0/   0     0/   0     0/   0
destAp(26)[destAp/statsCnt]        0/   0     0/   0     0/   0     0/   0
destAp(27)[destAp/statsCnt]        0/   0     0/   0     0/   0     0/   0
destAp(28)[destAp/statsCnt]        0/   0     0/   0     0/   0     0/   0
destAp(29)[destAp/statsCnt]        0/   0     0/   0     0/   0     0/   0
```

```
destAp(30)[destAp/statsCnt]       0/   0     0/   0     0/   0     0/   0
destAp(31)[destAp/statsCnt]       0/   0     0/   0     0/   0     0/   0
destAp(32)[destAp/statsCnt]       0/   0     0/   0     0/   0     0/   0
```

14) Check the station kickout statistics (by AP/Radio).
ex.) by AP/Radio

```
APC# show network-stats statistics station kick-out 1

[AP ID (1), Radio 5-GHz]
Reason                        Total     5Min      1Hour     1Day
================================================================================
========
retryCount                      0         0         0         0
exceedConsecutiveRetryCount     0         0         0         0
stationKickOutCount             0         0         0         0

[AP ID (1), Radio 2.4-GHz]
Reason                        Total     5Min      1Hour     1Day
================================================================================
========
retryCount                      0         0         0         0
exceedConsecutiveRetryCount     0         0         0         0
stationKickOutCount             0         0         0         0
```

15) Check the number of users connecting with the station (MIN/MAX/AVG) (by AP/Radio/WLAN).
ex.) by WLAN

```
APC# show network-stats statistics station num-of-station wlan 1

[WLAN ID (1)]
Reason                        Total     5Min      1Hour     1Day
================================================================================
========
Minimum                         0         0         0         0
Maximum                         0         0         0         0
Average                         0         0         0         0
```

16) Check the station scanning count statistics (by AP/Radio).
ex.) by AP/Radio

```
APC# show network-stats statistics station scan 1

[AP ID (1), Radio 5-GHz]
Reason                       Total     5Min      1Hour     1Day
================================================================================
========
ScanStat                       0         0         0         0

[AP ID (1), Radio 2.4-GHz]
Reason                       Total     5Min      1Hour     1Day
================================================================================
========
ScanStat                       0         0         0
```

17) Check the AP packet loss statistics (by AP/Radio).
ex.) by AP/Radio

```
APC# show network-stats statistics station ap-packet-loss ap 1

Station Statistics for AP Packet Loss Data [AP ID (1)]:
[RADIO 5-GHz]
   AP Packet Loss Tx Failure Count.................. 0
   AP Packet Loss Tx Retry Succes Count............. 0
   AP Packet Loss Tx Success Count.................. 0
   AP Packet Loss Tx Fail Rate...................... 0.000000%
   AP Packet Loss Tx Retry Rate..................... 0.000000%

[RADIO 2.4-GHz]
   AP Packet Loss Tx Failure Count.................. 0
   AP Packet Loss Tx Retry Succes Count............. 0
   AP Packet Loss Tx Success Count.................. 0
   AP Packet Loss Tx Fail Rate...................... 0.000000%
   AP Packet Loss Tx Retry Rate..................... 0.000000%
```

18) Check the AP packet loss raw data statistics (by AP/Radio).
ex.) by AP/Radio

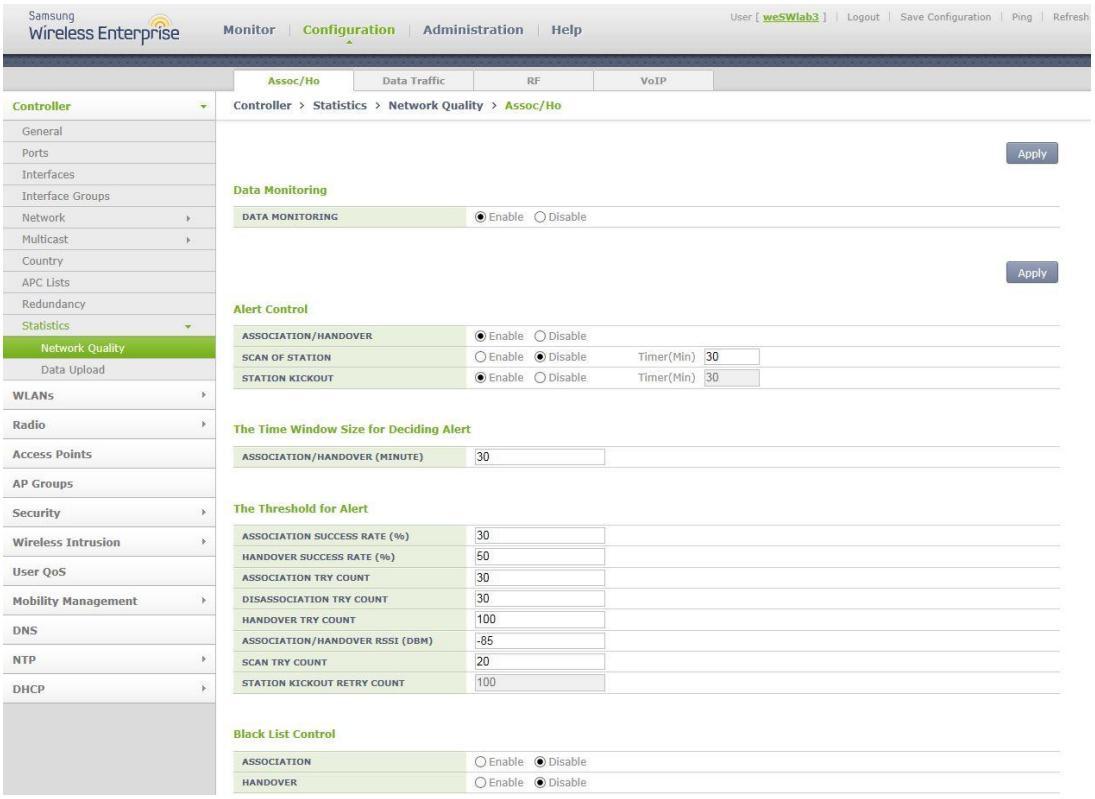
```
APC# show network-stats statistics station ap-packet-loss-raw ap 1

Station Statistics for AP Packet Loss Raw Data [AP ID (1)]:
[RADIO 5-GHz]
   AP Total Transmitted Success Data Frame Count .... 0
   AP Total Transmission Failure Data Frame Count ... 0
   AP Total Retry Success Data Frame Count ......... 0
   AP Total Transmitted Success Mgmt Frame Count .... 0
```

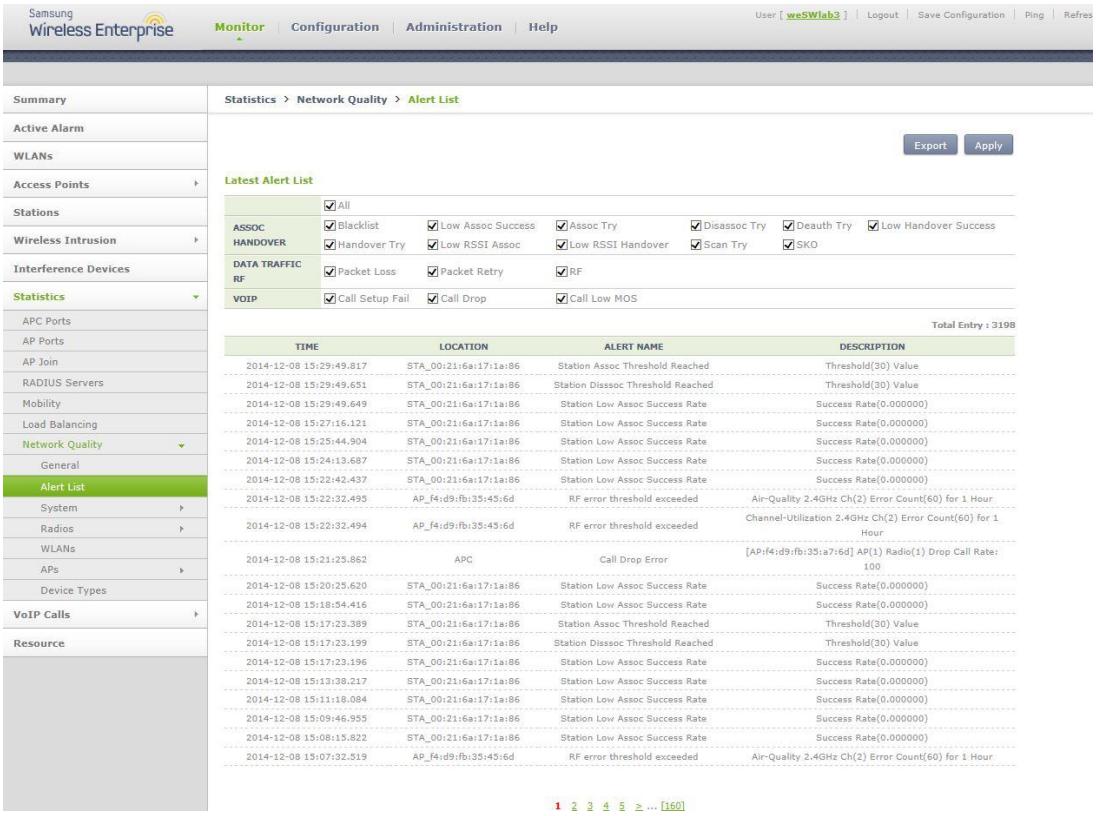
```
    AP Total Transmission Failure Mgmt Frame Count ... 0
    AP Total Retry Success Mgmt Frame Count ......... 0
[RADIO 2.4-GHz]
    AP Total Transmitted Success Data Frame Count .... 0
    AP Total Transmission Failure Data Frame Count ... 0
    AP Total Retry Success Data Frame Count ......... 0
    AP Total Transmitted Success Mgmt Frame Count .... 0
    AP Total Transmission Failure Mgmt Frame Count ... 0
    AP Total Retry Success Mgmt Frame Count ......... 0
```

Checking and Configuring Using Web UI

- Configure and check an alert.
  - Alert configuration: [Configuration Management] > [Statistics] > [Network Quality] > **Association/Handover**

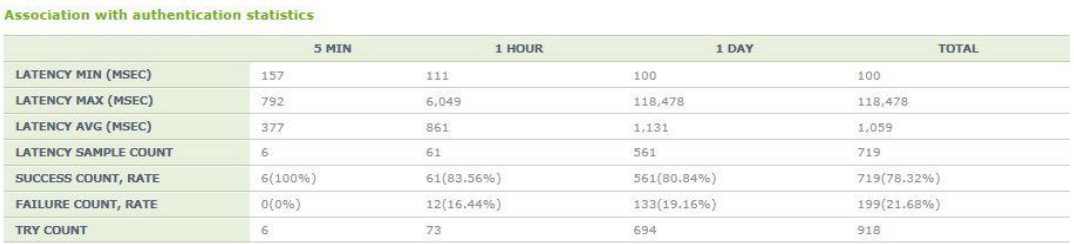


– Alert checking: [Monitoring] > [Network Quality] > **Alert List**



- Checking Statistical Value of Network
  Network Statistics Root Path: [Monitoring] > [Statistics] > [Network Quality]

1) Check the station association latency and success rate (by AP/Device/Radio/WLAN).
   ex.) by WLAN
   [Monitoring] > [Statistics] > [Network Quality] > [by WLAN] > [Association/Handover] > **General**



Association with authentication statistics

	5 MIN	1 HOUR	1 DAY	TOTAL
LATENCY MIN (MSEC)	157	111	100	100
LATENCY MAX (MSEC)	792	6,049	118,478	118,478
LATENCY AVG (MSEC)	377	861	1,131	1,059
LATENCY SAMPLE COUNT	6	61	561	719
SUCCESS COUNT, RATE	6(100%)	61(83.56%)	561(80.84%)	719(78.32%)
FAILURE COUNT, RATE	0(0%)	12(16.44%)	133(19.16%)	199(21.68%)
TRY COUNT	6	73	694	918

2) Check the station association and handover statistics (by AP/Device/Radio/WLAN).
ex.) by WLAN
[Monitoring] > [Statistics] > [Network Quality] > [by WLAN] > [Association/Handover] > **General**

Association and Handover Try Count

	5 MIN	1 HOUR	1 DAY	TOTAL
ASSOCIATION TRY	3	11	223	250
HANDOVER TRY	12	156	1,022	1,360

3) Check the station handover latency and success rate (by AP/Device/Radio/WLAN).
ex.) by WLAN
[Monitoring] > [Statistics] > [Network Quality] > [by WLAN] > [Association/Handover] > **General**

Handover with authentication statistics

	5 MIN	1 HOUR	1 DAY	TOTAL
LATENCY MIN (MSEC)	18	15	12	12
LATENCY MAX (MSEC)	401	2,467	2,467	2,467
LATENCY AVG (MSEC)	184	379	298	297
LATENCY SAMPLE COUNT	6	76	413	517
SUCCESS COUNT, RATE	6(100%)	76(91.57%)	413(93.02%)	517(94%)
FAILURE COUNT, RATE	0(0%)	7(8.43%)	31(6.98%)	33(6%)
TRY COUNT	6	83	444	550

4) Check the number of users connecting to the station (by AP/Radio/WLAN).
ex.) by WLAN
[Monitoring] > [Statistics] > [Network Quality] > [by WLAN] > [Association/Handover] > **General**

Station Count statistics

	5 MIN	1 HOUR	1 DAY	TOTAL
MIN	36	30	1	1
MAX	39	45	45	45
AVG	37	35	7	1

5) Check the minimum, maximum, and average statistics of station association and handover RSSI
(by AP/Device/Radio/WLAN).
ex.) by WLAN
[Monitoring] > [Statistics] > [Network Quality] > [by WLAN] > [Association/Handover] > **RSSI/SKO**

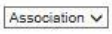
Association RSSI Statistics

	5 MIN	1 HOUR	1 DAY	TOTAL
MIN (DBM)	0	-78	-88	-88
MAX (DBM)	0	-47	-35	-35
AVG (DBM)	0	-63	-54	-50

Handover RSSI Statistics

	5 MIN	1 HOUR	1 DAY	TOTAL
MIN (DBM)	-58	-87	-87	-87
MAX (DBM)	-39	-37	-29	-29
AVG (DBM)	-50	-54	-50	-43

6) Check the statistics by cause of station association and handover failure (by AP/Device/Radio/WLAN).
ex.) by WLAN
[Monitoring] > [Statistics] > [Network Quality] > [by WLAN] > [Association/Handover] **> Cause of Failure**
※ Check the association/handover statistics by using the tab on the top of the right.



Association Failure count by reason

	5 MIN	1 HOUR	1 DAY	TOTAL
UNSPECIFIED	0	0	2	2
PREV AUTH NOT VALID	0	10	92	156
DEAUTH LEAVING	0	0	0	0
DISASSOC DUE TO INACTIVITY	0	0	0	0
DISASSOC AP BUSY	0	0	0	0
CLASS2 FRAME FROM NONAUTH STA	0	0	0	0
CLASS3 FRAME FROM NONASSOC STA	0	0	0	0
DISASSOC STA HAS LEFT	0	0	6	6
STA REQ ASSOC WITHOUT AUTH	0	0	0	0
PWR CAPABILITY NOT VALID	0	0	0	0
SUPPORTED CHANNEL NOT VALID	0	0	0	0
INVALID IE	0	0	0	0
MICHAEL MIC FAILURE	0	0	0	0
4WAY HANDSHAKE TIMEOUT	0	0	3	4
GROUP KEY UPDATE TIMEOUT	0	0	0	0
IE IN 4WAY DIFFERS	0	0	0	0
GROUP CIPHER NOT VALID	0	0	0	0
PAIRWISE CIPHER NOT VALID	0	0	0	0
AKMP NOT VALID	0	0	0	0
UNSUPPORTED RSN IE VERSION	0	0	0	0
INVALID RSN IE CAPAB	0	0	0	0
IEEE 802 1X AUTH FAILED	0	2	41	42
CIPHER SUITE REJECTED	0	0	0	0
TDLS TEARDOWN UNREACHABLE	0	0	0	0
TDLS TEARDOWN UNSPECIFIED	0	0	0	0
TOO MANY	0	0	0	0
STAION RETRY THRESHOLD	0	0	0	0
ACL KICKOUT	0	0	0	0
AUTH IDLE TIMEOUT	0	0	0	0
AUTH IN ASSOC STATE	0	0	0	0
WRONG STA	0	0	0	0
EXPIRED SERVICE TIME	0	0	0	0
MAC AUTH TIMEOUT	0	0	0	0
MAC AUTH REJECT	0	0	0	0
MANUAL KICKOUT	0	0	0	0
MALICIOUS STA STATISTICS	0	0	0	0
KICKOUT MAC FILTER	0	0	0	0
KICKOUT INVALID IP	0	0	0	0
KICKOUT ACL	0	0	0	0
INTER APC HO	0	0	0	0
CLUSTER DOWN	0	0	0	0
VAP DOWN	0	0	0	0

7) Check the statistics of disassoc. and deauth count (by AP/Device/Radio/WLAN).
ex.) by WLAN
[Monitoring] > [Statistics] > [Network Quality] > [by WLAN] > [Association/Handover] > **Disassoc/Deauth**
※ Check the disassoc/deauth statistics by station/system by using the tab on the top of the right.

8) Check the statistics of disassoc. count of the UE by cause (by AP/Device/Radio/WLAN).
ex.) by WLAN
[Monitoring] > [Statistics] > [Network Quality] > [by WLAN] > [Association/Handover] > **Disassoc/Deauth**
※ Check the disassoc/deauth statistics by station/system by using the tab on the top of the right.

Station Disassoc count by reason

	5 MIN	1 HOUR	1 DAY	TOTAL
UNSPECIFIED	0	0	7	7
PREV AUTH NOT VALID	0	0	0	0
DEAUTH LEAVING	0	0	0	0
DISASSOC DUE TO INACTIVITY	0	0	0	0
DISASSOC AP BUSY	0	0	0	0
CLASS2 FRAME FROM NONAUTH STA	0	0	0	0
CLASS3 FRAME FROM NONASSOC STA	0	0	0	0
DISASSOC STA HAS LEFT	0	7	74	88
STA REQ ASSOC WITHOUT AUTH	0	0	0	0
PWR CAPABILITY NOT VALID	0	0	0	0
SUPPORTED CHANNEL NOT VALID	0	0	0	0
INVALID IE	0	0	0	0
MICHAEL MIC FAILURE	0	0	0	0
4WAY HANDSHAKE TIMEOUT	0	0	0	0
GROUP KEY UPDATE TIMEOUT	0	0	0	0
IE IN 4WAY DIFFERS	0	0	0	0
GROUP CIPHER NOT VALID	0	0	0	0
PAIRWISE CIPHER NOT VALID	0	0	0	0
AKMP NOT VALID	0	0	0	0
UNSUPPORTED RSN IE VERSION	0	0	0	0
INVALID RSN IE CAPAB	0	0	0	0
IEEE 802 1X AUTH FAILED	0	0	0	0
CIPHER SUITE REJECTED	0	0	0	0
TDLS TEARDOWN UNREACHABLE	0	0	0	0
TDLS TEARDOWN UNSPECIFIED	0	0	0	0
TOO MANY	0	0	0	0
STAION RETRY THRESHOLD	0	0	0	0
ACL KICKOUT	0	0	0	0
AUTH IDLE TIMEOUT	0	0	0	0
AUTH IN ASSOC STATE	0	0	0	0
WRONG STA	0	0	0	0
EXPIRED SERVICE TIME	0	0	0	0
MAC AUTH TIMEOUT	0	0	0	0
MAC AUTH REJECT	0	0	0	0
MANUAL KICKOUT	0	0	0	0
MALICIOUS STA STATISTICS	0	0	0	0
KICKOUT MAC FILTER	0	0	0	0
KICKOUT INVALID IP	0	0	0	0
KICKOUT ACL	0	0	0	0
INTER APC HO	0	0	0	0
CLUSTER DOWN	0	0	0	0
VAP DOWN	0	0	0	0

9) Check the statistics of disassoc. count of the UE by status (by AP/Device/Radio/ WLAN).
ex.) by WLAN
[Monitoring] > [Statistics] > [Network Quality] > [by WLAN] > [Association/Handover] > **Disassoc/Deauth**
※ Check the disassoc/deauth statistics by station/system by using the tab on the top of the right.

Station Disassoc count by state

	5 MIN	1 HOUR	1 DAY	TOTAL
UNKNOWN	0	0	0	0
AUTH	0	2	32	37
AUTH SUCCESS	0	0	0	0
AUTH FAILURE	0	0	0	0
IPFAIL	0	0	11	11
NORMAL	0	5	38	47

10) Check the statistics of disassoc. count of the UE by status (by AP/Radio).

ex.) by AP/Radio

[Monitoring] > [Statistics] > [Network Quality] > [by AP] > [802.11a/n/ac] > **Transmission Speed**

※ To change a radio, press 'Convert Radio' button by using the tab on the top of the right.

Rx/Tx count by 802.11a data rates

	5 MIN			1 HOUR			1 DAY			TOTAL		
	RX	TX	TX FAIL	RX	TX	TX FAIL	RX	TX	TX FAIL	RX	TX	TX FAIL
6 MBPS	7,880	2	0	82,448	118	116	1,761,207	270	268	5,837,905	272	269
9 MBPS	0	0	0	0	0	0	0	0	0	0	0	0
12 MBPS	73,100	0	0	705,541	0	0	17,237,941	0	0	64,216,796	5,547	4,858
18 MBPS	4	0	0	52	0	0	1,223	0	0	3,841	0	0
24 MBPS	68,084	17,261	15,029	696,968	177,041	156,691	16,437,570	2,845,321	2,536,600	58,793,203	8,066,099	7,137,185
36 MBPS	0	0	0	3	0	0	27	0	0	90	0	0
48 MBPS	2	0	0	97	0	0	626	0	0	734	0	0
54 MBPS	183	0	0	1,483	0	0	25,539	0	0	84,596	0	0

Rx/Tx count by HT(802.11n) MCS

	5 MIN			1 HOUR			1 DAY			TOTAL		
	RX	TX	TX FAIL	RX	TX	TX FAIL	RX	TX	TX FAIL	RX	TX	TX FAIL
MCS 0 (7 MBPS)	0	371	271	1	5,203	4,955	57	14,183	13,436	57	15,236	14,157
MCS 1 (14 MBPS)	0	237	77	109	424	184	486	1,150	671	517	2,443	1,152
MCS 2 (21 MBPS)	0	100	55	129	344	188	542	1,614	903	562	2,514	1,350
MCS 3 (29 MBPS)	0	147	49	527	692	300	1,455	5,318	3,203	2,038	5,826	3,409
MCS 4 (43 MBPS)	389	355	120	1,259	2,433	705	4,773	54,911	7,296	6,276	55,824	7,759
MCS 5 (58 MBPS)	0	2,012	1,035	751	2,565	1,272	1,967	4,933	2,114	2,308	5,531	2,410
MCS 6 (65 MBPS)	4	4,124	865	1,355	5,190	1,087	2,610	7,599	1,722	2,821	7,932	1,870
MCS 7 (72 MBPS)	12,987	26,059	3,407	21,462	37,468	5,240	47,232	57,252	8,288	51,661	57,694	8,504
MCS 8 (14 MBPS)	0	0	0	0	0	0	1	0	0	3	0	0
MCS 9 (29 MBPS)	0	0	0	0	0	0	0	0	0	0	0	0
MCS 10 (43 MBPS)	0	0	0	0	0	0	0	0	0	2	0	0
MCS 11 (58 MBPS)	1	233	43	53	11,601	1,791	22,581	120,775	26,138	22,978	120,775	26,138
MCS 12 (87 MBPS)	14	344	200	4,887	22,375	5,745	31,716	72,678	29,846	35,474	72,678	29,846
MCS 13 (116 MBPS)	29	52	47	12,383	3,684	2,236	54,718	8,082	5,404	60,672	8,082	5,404
MCS 14 (130 MBPS)	114	0	0	8,127	86	64	41,049	239	178	44,484	239	178
MCS 15 (144 MBPS)	100	0	0	3,677	0	0	27,023	237	19	28,368	237	19
MCS 16 (22 MBPS)	0	0	0	0	0	0	0	0	0	0	0	0
MCS 17 (43 MBPS)	0	0	0	0	0	0	0	0	0	0	0	0
MCS 18 (65 MBPS)	0	0	0	0	0	0	0	0	0	0	0	0
MCS 19 (87 MBPS)	0	0	0	1	0	0	15	0	0	52	0	0
MCS 20 (130 MBPS)	0	0	0	1	0	0	168	0	0	327	0	0
MCS 21 (173 MBPS)	0	0	0	0	0	0	10	0	0	37	0	0
MCS 22 (195 MBPS)	0	0	0	0	0	0	0	0	0	0	0	0
MCS 23 (217 MBPS)	0	0	0	0	0	0	0	0	0	0	0	0

Rx/Tx count by VHT MCS(802.11ac)

	5 MIN			1 HOUR			1 DAY			TOTAL		
	RX	TX	TX FAIL	RX	TX	TX FAIL	RX	TX	TX FAIL	RX	TX	TX FAIL
SPATIAL STREAM1 0	0	0	0	0	0	0	0	0	0	0	0	0
SPATIAL STREAM1 1	0	0	0	0	0	0	0	0	0	0	0	0
SPATIAL STREAM1 2	0	0	0	0	0	0	0	0	0	0	0	0
SPATIAL STREAM1 3	0	0	0	0	0	0	0	0	0	0	0	0
SPATIAL STREAM1 4	0	0	0	0	0	0	0	0	0	0	0	0
SPATIAL STREAM1 5	0	0	0	0	0	0	0	0	0	0	0	0
SPATIAL STREAM1 6	0	0	0	0	0	0	0	0	0	0	0	0
SPATIAL STREAM1 7	0	0	0	0	0	0	0	0	0	0	0	0
SPATIAL STREAM1 8	0	0	0	0	0	0	0	0	0	0	0	0
SPATIAL STREAM1 9	0	0	0	0	0	0	0	0	0	0	0	0
SPATIAL STREAM2 0	0	0	0	0	0	0	0	0	0	0	0	0
SPATIAL STREAM2 1	0	0	0	0	0	0	0	0	0	0	0	0
SPATIAL STREAM2 2	0	0	0	0	0	0	0	0	0	0	0	0
SPATIAL STREAM2 3	0	0	0	0	0	0	0	0	0	0	0	0
SPATIAL STREAM2 4	0	0	0	0	0	0	0	0	0	0	0	0
SPATIAL STREAM2 5	0	0	0	0	0	0	0	0	0	0	0	0
SPATIAL STREAM2 6	0	0	0	0	0	0	0	0	0	0	0	0
SPATIAL STREAM2 7	0	0	0	0	0	0	0	0	0	0	0	0
SPATIAL STREAM2 8	0	0	0	0	0	0	0	0	0	0	0	0
SPATIAL STREAM2 9	0	0	0	0	0	0	0	0	0	0	0	0
SPATIAL STREAM3 0	0	0	0	0	0	0	0	0	0	0	0	0
SPATIAL STREAM3 1	0	0	0	0	0	0	0	0	0	0	0	0
SPATIAL STREAM3 2	0	0	0	0	0	0	0	0	0	0	0	0
SPATIAL STREAM3 3	0	0	0	0	0	0	0	0	0	0	0	0
SPATIAL STREAM3 4	0	0	0	0	0	0	0	0	0	0	0	0
SPATIAL STREAM3 5	0	0	0	0	0	0	0	0	0	0	0	0
SPATIAL STREAM3 6	0	0	0	0	0	0	0	0	0	0	0	0
SPATIAL STREAM3 7	0	0	0	0	0	0	0	0	0	0	0	0
SPATIAL STREAM3 8	0	0	0	0	0	0	0	0	0	0	0	0
SPATIAL STREAM3 9	0	0	0	0	0	0	0	0	0	0	0	0

11) Check the statistics of disassoc. count of the UE by status (by AP/Radio).
ex.) by AP/Radio
[Monitoring] > [Statistics] > [Network Quality] > [by AP] > [802.11a/n/ac] > **Handover Trace**
※ To change a radio, press 'Convert Radio' button by using the tab on the top of the right.

Handover count by destination AP

5 MIN		1 HOUR		1 DAY		TOTAL	
AP-7F22	0	AP-7F22	0	AP-7F22	0	AP-7F22	1
AP-7F32	0	AP-7F32	0	AP-7F32	2	AP-7F32	3
AP-7F02	0	AP-7F02	4	AP-7F02	6	AP-7F02	6
AP-7F28	0	AP-7F28	0	AP-7F28	9	AP-7F28	9
AP-7F30	0	AP-7F30	0	AP-7F30	1	AP-7F30	1
AP-7F29	0	AP-7F29	2	AP-7F29	5	AP-7F29	5
AP-7F26	0	AP-7F26	0	AP-7F26	1	AP-7F26	1
AP-7F31	0	AP-7F31	1	AP-7F31	2	AP-7F31	2

12) Check the statistics of scan count of the UE (by AP/Radio).

ex.) by AP/Radio

[Monitoring] > [Statistics] > [Network Quality] > [by AP] > [802.11a/n/ac] > [Association/Handover] > **RSSI/SKO**

※ To change a radio, press 'Convert Radio' button by using the tab on the top of the right.

Scan Count Of Stations

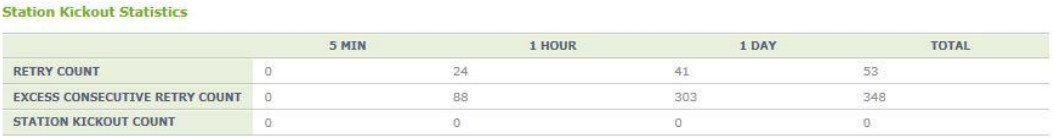
	5 MIN	1 HOUR	1 DAY	TOTAL
COUNT	0	30	131	145

13) Check the statistics of extracted UEs (by AP/Radio).

ex.) by AP/Radio

[Monitoring] > [Statistics] > [Network Quality] > [by AP] > [802.11a/n/ac] > [Association/Handover] > **RSSI/SKO**

※ To change a radio, press 'Convert Radio' button by using the tab on the top of the right.



Station Kickout Statistics

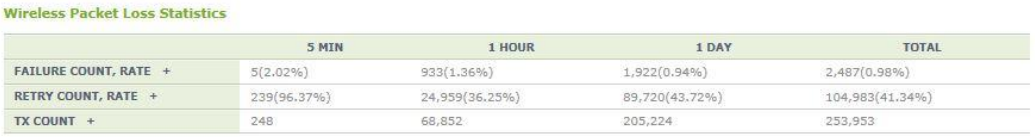
	5 MIN	1 HOUR	1 DAY	TOTAL
RETRY COUNT	0	24	41	53
EXCESS CONSECUTIVE RETRY COUNT	0	88	303	348
STATION KICKOUT COUNT	0	0	0	0

14) Check the statistics of wireless packet loss (by AP/Radio).

ex.) by AP/Radio

[Monitoring] > [Statistics] > [Network Quality] > [by AP] > [802.11a/n/ac] > **Data Traffic**

※ To change a radio, press 'Convert Radio' button by using the tab on the top of the right.



Wireless Packet Loss Statistics

	5 MIN	1 HOUR	1 DAY	TOTAL
FAILURE COUNT, RATE +	5(2.02%)	933(1.36%)	1,922(0.94%)	2,487(0.98%)
RETRY COUNT, RATE +	239(96.37%)	24,959(36.25%)	89,720(43.72%)	104,983(41.34%)
TX COUNT +	248	68,852	205,224	253,953

ANNEX A. CLI Command Structure

The structure of CLI command is as follows.

A.1 configure

```
|-- configure
|       |-- spectrum-analysis
|       |       |-- ap
|       |       |       |-- service
|       |       |       |-- channel-request
|       |       |       |       |-- channel-interval
|       |       |       |       |-- channel-control
|       |       |       |       |       |-- dot11b
|       |       |       |       |       |-- dot11aLow
|       |       |       |       |       |-- dot11aMid
|       |       |       |       |       |-- dot11aHigh
|       |       |       |       |-- configuration-request
|       |       |       |       |-- sample
|       |       |       |       |-- interference
|       |       |       |       |-- duty-cycle
|       |-- interferer
|       |       |-- 80211a
|       |       |       |-- continuous_transmitter
|       |       |       |-- cordless_phone
|       |       |       |-- video_camera
|       |       |-- 80211b
|       |       |       |-- bluetooth
|       |       |       |-- microwave_oven
|       |       |       |-- continuous_transmitter
|       |       |       |-- cordless_phone
|       |       |       |-- video_camera
|       |       |       |-- zigbee
|       |       |-- unknown
|       |-- hostname
|       |-- call-fail-detect
```

```
|       |-- mgmt-user-password
|       |-- mgmt-user
|       |-- telnet-timeout
|       |-- console-timeout
|       |-- system
|       |       |-- monitor
|       |       |       |-- cpu
|       |       |       |       |-- threshold
|       |       |       |-- memory
|       |       |       |       |-- threshold
|       |       |-- license
|       |       |       |-- install-key
|       |       |       |-- analyze-key
|       |-- qos
|       |       |-- description
|       |       |-- max-dot1p
|       |       |-- ac
|       |       |-- bw-contract-downstream
|       |       |-- bw-contract-upstream
|       |       |-- call-test
|       |-- country
|       |       |-- set-global
|       |       |-- set-ap
|       |       |-- add-channel
|       |       |-- del-channel
|       |       |-- max-tx-power
|       |-- handover
|       |       |-- time
|       |       |       |-- ho-decision
|       |       |       |-- command
|       |       |       |-- scan-suppress
|       |       |-- mode
|       |       |-- opmode
|       |       |-- scan-trigger-level
|       |       |-- scan-report-level
|       |       |-- scan-time-channel
|       |       |-- scan-time-service
|       |       |-- scan-time-interleave
|       |       |-- number-of-proreq
|       |       |-- number-of-channel
|       |       |-- buffered-forwarding
|       |       |-- handover-timer
|       |       |-- command
```

```
|       |       |-- scanmode-clear
|       |       |-- start-buffering
|       |       |-- fwd-buffering
|       |       |-- upload-data
|       |       |-- decision-delta
|       |       |-- station-decision-delta
|       |       |-- nchostats-req
|       |       |-- inter-apc
|       |-- station
|       |       |-- number-of-assoc-tracking
|       |       |-- stats-req
|       |       |-- device_type
|       |       |-- data
|       |       |       |-- collection
|       |       |       |-- assoc-latency-threshold
|       |       |       |-- ho-latency-threshold
|       |       |       |-- assoc-fail-threshold
|       |       |       |-- ho-fail-threshold
|       |-- security
|       |       |-- radius
|       |       |       |-- auth
|       |       |       |-- acct
|       |       |       |-- serverIp
|       |       |       |-- secret
|       |       |       |-- fo-retransmit-count
|       |       |       |-- retransmit-count
|       |       |       |-- retransmit-interval
|       |       |       |-- use-vip
|       |       |-- advanced
|       |       |       |-- eap-retransmit-interval
|       |       |       |-- eap-retransmit-count
|       |       |       |-- eap-key-retransmit-interval
|       |       |       |-- eap-key-retransmit-interval-1st
|       |       |       |-- eap-key-retransmit-count
|       |       |       |-- allow-last-eap-key-timeout
|       |       |       |-- rsn-ie-ptksa-replay-counter
|       |       |       |-- rsn-ie-gtksa-replay-counter
|       |       |       |-- sta-info-free-timer-after-disassoc
|       |       |       |-- log-mic-error
|       |       |       |-- sta-auth-session-limit
|       |       |       |-- eap-failure-quiet-period
|       |       |-- guestaccess
|       |       |       |-- enable
```

```
|       |       |       |-- secure-auth-enable
|       |       |       |-- idle-session-timeout
|       |       |       |-- add-user
|       |       |       |-- del-user
|       |       |       |-- db-access-flag
|       |       |       |-- ext-primary-radius-server
|       |       |       |-- ext-secondary-radius-server
|       |       |       |-- web-server
|       |       |-- captive-portal
|       |       |       |-- web-auth
|       |       |       |       |-- auth-type
|       |       |       |       |-- after-auth
|       |       |       |       |-- redirect-url
|       |       |       |       |-- external-url
|       |       |       |       |-- downloaded-url
|       |       |       |       |-- title
|       |       |       |       |-- content
|       |       |       |       |-- message
|       |       |       |-- enable
|       |       |       |-- guest-auth
|       |       |       |-- radius-primary
|       |       |       |-- radius-secondary
|       |       |       |-- web-server
|       |       |       |-- add-user
|       |       |       |-- del-user
|       |       |-- mac-filter
|       |       |       |-- policy
|       |       |       |-- mac
|       |       |       |-- wlan_id
|       |       |       |-- name
|       |       |-- ext-wips
|       |       |       |-- enable
|       |       |       |-- interval
|       |       |       |-- primary
|       |       |       |-- secondary
|       |       |       |-- port
|       |       |       |-- user
|       |       |       |-- password
|       |-- remote-ap-group
|       |       |-- add-ap
|       |       |-- local-auth
|       |       |-- primary-radius
|       |       |-- secondary-radius
```

```
|       |-- ap-group
|       |       |-- add-wlan
|       |       |-- add-ap
|       |       |-- profile
|       |       |       |-- echo-interval
|       |       |       |-- discovery-interval
|       |       |       |-- report-interval
|       |       |       |-- statistics-timer
|       |       |       |-- retransmit-interval
|       |       |       |-- max-retransmit
|       |       |       |-- echo-retransmit-interval
|       |       |       |-- max-echo-retransmit
|       |       |       |-- ip-mode
|       |       |       |-- primary-apc
|       |       |       |-- secondary-apc
|       |       |       |-- tertiary-apc
|       |       |       |-- vlan-support
|       |       |       |-- native-vlanId
|       |       |       |-- auto-mode
|       |       |       |-- description
|       |       |       |-- telnet-enable
|       |       |       |-- ssh-enable
|       |       |       |-- led-config
|       |       |       |-- fragment-size
|       |       |       |-- discovery
|       |       |       |-- time-config
|       |       |       |       |-- mode
|       |       |       |       |-- ac-stamp-interval
|       |       |       |       |-- timezone
|       |       |-- airmove
|       |       |       |-- enable
|       |       |       |-- target-ap
|       |       |       |-- scan-trigger-level
|       |       |       |-- scan-time-channel
|       |       |       |-- scan-time-service
|       |       |       |-- scan-time-interleave
|       |       |       |-- number-of-proreq
|       |       |       |-- number-of-channel
|       |       |       |-- decision-delta
|       |-- if-group
|       |       |-- add-if
|       |-- wlan
|       |       |-- band-steering
```

```
|       |       |-- load-balancing
|       |       |-- multicast-to-unicast
|       |       |       |-- enable
|       |       |       |-- discard
|       |       |       |-- max-entry
|       |       |-- enable
|       |       |-- guest-flag
|       |       |-- radio
|       |       |-- ssid
|       |       |-- security
|       |       |       |-- apply
|       |       |       |-- wpa
|       |       |       |-- psk
|       |       |       |-- wpa2
|       |       |       |-- ieee8021x
|       |       |       |-- keymgmt
|       |       |       |-- wep
|       |       |       |-- okc
|       |       |       |-- dynamicVlan
|       |       |       |-- setDefault
|       |       |       |-- grpRekeyTime
|       |       |       |-- pmkLifeTime
|       |       |       |-- radius-server
|       |       |       |       |-- auth-servers
|       |       |       |       |-- acct-servers
|       |       |       |-- eapReauthTime
|       |       |       |-- eapolVersion
|       |       |       |-- radiusPrimaryRetryInterval
|       |       |       |-- acct_interim_interval
|       |       |       |-- layer3
|       |       |       |       |-- web-policy
|       |       |       |       |-- pre-auth-acl
|       |       |       |       |-- redirect-URL-override
|       |       |       |-- mac-filter
|       |       |-- iuts
|       |       |       |-- mode
|       |       |       |-- latency
|       |       |       |-- queue-length
|       |       |       |-- filter-mode
|       |       |       |-- codec-list
|       |       |-- if-group
|       |       |-- acl
|       |       |-- aaa-override
```

```
|       |       |-- mac-type
|       |       |-- tunnel-mode
|       |       |-- qos-class
|       |       |-- ext-wips
|       |       |-- suppress-ssid
|       |       |-- dls-allowed
|       |       |-- local-vlan
|       |       |-- max-associated-stations
|       |       |-- vdm
|       |       |       |-- multicast-info
|       |       |       |-- station-policy
|       |       |       |-- mode
|       |       |       |-- threshold
|       |       |       |-- default-policy
|       |       |       |-- join-gap
|       |       |       |-- session-timeout
|       |       |       |-- multiframing_threshold
|       |       |       |-- limit
|       |       |       |-- retry-limit
|       |       |       |-- schedule-interval
|       |       |       |-- min-mux-packets
|       |       |       |-- mux-skip-limit
|       |       |       |-- station-queue-limit
|       |       |       |-- packet-lifetime
|       |       |       |-- pifs-access
|       |       |       |-- tx-rate
|       |       |       |-- retry-ratio-update-period
|       |       |       |-- stop-threshold
|       |       |       |-- stop-interval
|       |       |       |-- start-rssi
|       |       |       |-- seq-list-size
|       |       |       |-- nack-interval
|       |       |       |-- rx-timeout
|       |       |-- sds
|       |       |       |-- weight
|       |       |-- dhcp-override
|       |       |-- ampdu
|       |       |-- reject-probe-mode
|       |-- ap
|       |       |-- profile
|       |       |       |-- dtls-policy
|       |       |       |-- discovery
|       |       |       |-- mac
```

```
|       |       |       |-- location
|       |       |       |-- name
|       |       |       |-- echo-interval
|       |       |       |-- discovery-interval
|       |       |       |-- report-interval
|       |       |       |-- statistics-timer
|       |       |       |-- retransmit-interval
|       |       |       |-- max-retransmit
|       |       |       |-- echo-retransmit-interval
|       |       |       |-- max-echo-retransmit
|       |       |       |-- ap-mode
|       |       |       |-- ip-mode
|       |       |       |-- static-ip
|       |       |       |-- sync-group
|       |       |       |-- primary-apc
|       |       |       |-- secondary-apc
|       |       |       |-- tertiary-apc
|       |       |       |-- ap-stats-history-enable
|       |       |       |-- vlan-support
|       |       |       |-- native-vlanId
|       |       |       |-- telnet-enable
|       |       |       |-- ssh-enable
|       |       |       |-- led-config
|       |       |       |-- edge-ap
|       |       |       |-- fragment-size
|       |       |       |-- client-ip
|       |       |       |-- repeater-whitelist
|       |       |       |-- wlan-vlanId
|       |       |       |-- time-config
|       |       |       |       |-- mode
|       |       |       |       |-- ac-stamp-interval
|       |       |       |       |-- timezone
|       |       |-- reboot
|       |       |-- upgrade-request
|       |       |-- tech-support
|       |       |       |-- get-all
|       |       |       |-- get-crash-file
|       |       |       |-- get-coredump
|       |       |       |-- get-log-file
|       |       |       |-- get-system-report
|       |       |-- get-if-stats
|       |       |-- syslog-config
|       |       |-- shutdown
```

```
|       |       |-- audit
|       |       |       |-- wlan-reprovisioning
|       |       |       |-- bss-status
|       |       |-- airmove
|       |       |       |-- config-priority
|       |       |       |-- scan-trigger-level
|       |       |       |-- scan-time-channel
|       |       |       |-- scan-time-service
|       |       |       |-- scan-time-interleave
|       |       |       |-- number-of-proreq
|       |       |       |-- number-of-channel
|       |       |       |-- decision-delta
|       |-- ap-all
|       |       |-- upgrade
|       |       |       |-- transfer-protocol
|       |       |       |-- start
|       |       |       |-- stop
|       |       |       |-- max-retry
|       |       |       |-- max-download
|       |       |       |-- select-package
|       |       |       |-- target
|       |       |-- reboot
|       |-- apc
|       |       |-- security-auth-type
|       |       |-- R-MAC
|       |       |-- apc-list
|       |       |       |-- add-apc
|       |       |       |-- del-apc
|       |       |       |-- change-name
|       |       |       |-- change-mac
|       |       |-- ap-mgmt-if
|       |       |-- capwap
|       |       |       |-- ctr-src-port
|       |       |       |-- window-size
|       |       |       |-- change-state-pending-timer
|       |       |       |-- data-check-timer
|       |       |       |-- dtls-session-delete
|       |       |       |-- retransmit-interval
|       |       |       |-- wait-dtls-timer
|       |       |       |-- wait-join-timer
|       |       |       |-- discovery-del-timer
|       |       |       |-- max-retransmit
|       |       |       |-- mutal-auth-enable
```

```
|       |       |       |-- discovery-by-multicast
|       |       |       |-- add-multicast-if
|       |       |       |-- discovery-by-broadcast
|       |       |       |-- auto-discovery
|       |       |       |-- auto-discovery-ap-group
|       |       |       |-- add-admin-user
|       |       |       |-- add-user
|       |       |       |-- ecn-support
|       |       |-- tech-support
|       |       |       |-- mode
|       |       |       |-- max-retry
|       |       |-- ap-stats-history
|       |       |       |-- mode
|       |       |       |-- period
|       |       |       |-- max-retry
|       |       |       |-- enable
|       |       |-- ap-if-stats
|       |       |       |-- period
|       |       |-- ap-time-config
|       |       |       |-- add-ntp
|       |       |       |-- ntp-interval
|       |       |-- service
|       |       |       |-- wlan-reprovisioning
|       |       |       |-- wlan-reprovisioning-count
|       |       |       |-- wlan-reprovisioning-interval
|       |-- redundancy
|       |       |-- fallback-enable
|       |       |-- fallback-interval
|       |       |-- add-apc
|       |       |-- del-apc
|       |-- 80211a
|       |       |-- max-associated-stations
|       |       |-- edca-parameters
|       |       |-- qos
|       |       |       |-- protocol
|       |       |       |-- edca-profile
|       |       |       |       |-- cw-min
|       |       |       |       |-- cw-max
|       |       |       |       |-- aifsn
|       |       |       |       |-- txop-limit
|       |       |       |       |-- msdu-lifetime
|       |       |       |-- policy
|       |       |       |       |-- dot1p
```

```
|       |       |       |       |       |-- enable
|       |       |       |       |       |-- policy
|       |       |       |       |-- dscp
|       |       |       |       |       |-- enable
|       |       |       |       |       |-- policy
|       |       |       |-- dot1p-tag
|       |       |       |-- dscp-tag
|       |       |       |-- ap-tags
|       |       |       |-- qap-missing-ack-retry-limit
|       |       |       |-- edca-avg-period
|       |       |       |-- reset-edca-profiles
|       |       |-- cac
|       |       |       |-- acm
|       |       |       |-- reserved-ho-calls
|       |       |       |-- max-calls
|       |       |       |-- alarming-count
|       |       |-- rate
|       |       |       |-- basic
|       |       |       |-- supported
|       |       |-- txPower
|       |       |-- channel
|       |       |-- 11n-support
|       |       |       |-- enable
|       |       |       |-- mcs
|       |       |       |-- forty-mhz
|       |       |       |-- guard-interval
|       |       |       |-- rifs
|       |       |       |-- forty-mhz-intolerant
|       |       |       |-- phy-format
|       |       |       |-- tx-stbc
|       |       |       |-- rx-stbc
|       |       |       |-- beamforming
|       |       |       |-- tx-mcs-set
|       |       |       |-- protection
|       |       |       |-- spatial-stream
|       |       |-- retry-limit
|       |       |       |-- short
|       |       |       |-- long
|       |       |-- threshold
|       |       |       |-- rts
|       |       |       |-- fragmentation
|       |       |-- msdu-lifetime
|       |       |       |-- tx
```

```
|       |       |       |-- rx
|       |       |-- beacon
|       |       |       |-- period
|       |       |-- ofdm
|       |       |       |-- channel-width
|       |       |       |-- channel-starting-factor
|       |       |       |-- ti-threshold
|       |       |-- sds
|       |       |       |-- enable
|       |       |       |-- ampdu-control
|       |       |       |-- schedule-interval
|       |       |       |-- ac
|       |       |       |       |-- scheduler
|       |       |       |       |-- wfq-metric
|       |       |       |       |-- sq-max-length
|       |       |       |       |-- sq-drop-option
|       |       |       |       |-- token-unit
|       |       |       |       |-- fs-direction
|       |       |       |       |-- sq-retry-limit
|       |       |       |       |-- long-retry-limit
|       |       |       |       |-- short-retry-limit
|       |       |       |       |-- ampdu-tx-time-limit
|       |       |-- enable
|       |       |-- cvo
|       |       |       |-- enable
|       |       |       |-- local-call-enable
|       |       |       |-- edit-profile
|       |       |       |       |-- aifsn
|       |       |       |       |-- cw-min
|       |       |       |       |-- cw-max
|       |       |       |       |-- txop-limit
|       |       |       |       |-- ampdu-limit
|       |       |       |-- set-profile
|       |       |-- rate-control
|       |       |       |-- voice
|       |       |       |       |-- max-rate
|       |       |       |       |-- probe-interval
|       |       |       |       |-- weight
|       |       |       |       |-- threshold
|       |       |       |-- video
|       |       |       |       |-- max-rate
|       |       |       |       |-- probe-interval
|       |       |       |       |-- weight
```

```
|       |       |       |       |-- threshold
|       |       |-- antenna
|       |       |-- station-kickout
|       |-- 80211bg
|       |       |-- max-associated-stations
|       |       |-- edca-parameters
|       |       |-- qos
|       |       |       |-- protocol
|       |       |       |-- edca-profile
|       |       |       |       |-- cw-min
|       |       |       |       |-- cw-max
|       |       |       |       |-- aifsn
|       |       |       |       |-- txop-limit
|       |       |       |       |-- msdu-lifetime
|       |       |       |-- policy
|       |       |       |       |-- dot1p
|       |       |       |       |       |-- enable
|       |       |       |       |       |-- policy
|       |       |       |       |-- dscp
|       |       |       |       |       |-- enable
|       |       |       |       |       |-- policy
|       |       |       |-- dot1p-tag
|       |       |       |-- dscp-tag
|       |       |       |-- ap-tags
|       |       |       |-- qap-missing-ack-retry-limit
|       |       |       |-- edca-avg-period
|       |       |       |-- reset-edca-profiles
|       |       |-- cac
|       |       |       |-- acm
|       |       |       |-- reserved-ho-calls
|       |       |       |-- max-calls
|       |       |       |-- alarming-count
|       |       |-- rate
|       |       |       |-- basic
|       |       |       |-- supported
|       |       |-- txPower
|       |       |-- channel
|       |       |-- 11n-support
|       |       |       |-- enable
|       |       |       |-- mcs
|       |       |       |-- guard-interval
|       |       |       |-- rifs
|       |       |       |-- forty-mhz-intolerant
```

```
|       |       |       |-- phy-format
|       |       |       |-- tx-stbc
|       |       |       |-- rx-stbc
|       |       |       |-- beamforming
|       |       |       |-- tx-mcs-set
|       |       |       |-- protection
|       |       |       |-- spatial-stream
|       |       |-- 11g-support
|       |       |       |-- enable
|       |       |-- retry-limit
|       |       |       |-- short
|       |       |       |-- long
|       |       |-- threshold
|       |       |       |-- rts
|       |       |       |-- fragmentation
|       |       |-- msdu-lifetime
|       |       |       |-- tx
|       |       |       |-- rx
|       |       |-- beacon
|       |       |       |-- period
|       |       |-- cca
|       |       |       |-- mode
|       |       |       |-- threshold
|       |       |-- sds
|       |       |       |-- enable
|       |       |       |-- ampdu-control
|       |       |       |-- schedule-interval
|       |       |       |-- ac
|       |       |       |       |-- scheduler
|       |       |       |       |-- wfq-metric
|       |       |       |       |-- sq-max-length
|       |       |       |       |-- sq-drop-option
|       |       |       |       |-- token-unit
|       |       |       |       |-- fs-direction
|       |       |       |       |-- sq-retry-limit
|       |       |       |       |-- long-retry-limit
|       |       |       |       |-- short-retry-limit
|       |       |       |       |-- ampdu-tx-time-limit
|       |       |-- enable
|       |       |-- cvo
|       |       |       |-- enable
|       |       |       |-- local-call-enable
|       |       |       |-- edit-profile
```

```
|       |       |       |       |-- aifsn
|       |       |       |       |-- cw-min
|       |       |       |       |-- cw-max
|       |       |       |       |-- txop-limit
|       |       |       |       |-- ampdu-limit
|       |       |       |-- set-profile
|       |       |-- rate-control
|       |       |       |-- voice
|       |       |       |       |-- max-rate
|       |       |       |       |-- probe-interval
|       |       |       |       |-- weight
|       |       |       |       |-- threshold
|       |       |       |-- video
|       |       |       |       |-- max-rate
|       |       |       |       |-- probe-interval
|       |       |       |       |-- weight
|       |       |       |       |-- threshold
|       |       |-- antenna
|       |       |-- station-kickout
|       |-- 80211h
|       |       |-- no-possess-time
|       |       |-- channel-switch
|       |       |-- power-constraint
|       |-- alarm
|       |       |-- level
|       |       |-- group
|       |       |-- logsize
|       |       |-- logcount
|       |       |-- dump
|       |       |-- backupIP
|       |       |-- stdout
|       |       |-- current-terminal
|       |-- event-filter
|       |       |-- enable
|       |-- web-service-port
|       |-- ip
|       |       |-- dhcp
|       |       |       |-- pool
|       |       |       |       |-- network
|       |       |       |       |-- range
|       |       |       |       |-- lease
|       |       |       |       |-- domain-name
|       |       |       |       |-- dns-server
```

```
|       |       |       |       |-- default-router
|       |       |       |       |-- fix-address
|       |       |       |       |-- ntp-server
|       |       |       |       |-- user-option
|       |       |       |       |-- ping-check
|       |       |       |       |-- capwap-dhcp-option
|       |       |       |-- enable
|       |       |       |-- server-ip
|       |       |-- dhcp-proxy
|       |       |       |-- timeout
|       |       |       |-- default-dhcp-server
|       |       |       |-- enable
|       |       |-- dns
|       |       |       |-- client
|       |       |       |-- relay
|       |       |       |-- name-server
|       |       |-- igmp
|       |       |       |-- limit
|       |       |       |-- snooping
|       |       |       |-- ssm-map
|       |       |       |       |-- enable
|       |       |       |       |-- static
|       |       |-- route
|       |       |-- multicast-routing
|       |       |-- pim
|       |       |       |-- accept-register
|       |       |       |-- anycast-rp
|       |       |       |-- bsr-candidate
|       |       |       |-- cisco-register-checksum
|       |       |       |-- crp-cisco-prefix
|       |       |       |-- ignore-rp-set-priority
|       |       |       |-- jp-timer
|       |       |       |-- register-rate-limit
|       |       |       |-- register-rp-reachability
|       |       |       |-- register-source
|       |       |       |-- register-suppression
|       |       |       |-- rp-address
|       |       |       |-- rp-register-kat
|       |       |       |-- spt-threshold
|       |       |       |-- rp-candidate
|       |       |       |       |-- interval
|       |       |       |       |       |-- priority
|       |       |       |       |       |       |-- group-list
```

```
|       |       |-- nat
|       |-- access-list
|       |-- http
|       |-- https
|       |-- arp
|       |-- firewall
|       |-- wlan-arp-mode
|       |-- package
|       |       |-- upgrade
|       |-- stats-report
|       |       |-- enable
|       |       |-- upload
|       |       |-- target
|       |       |-- current-stats
|       |-- telnet-server
|       |       |-- enable
|       |       |-- port
|       |-- ssh-server
|       |       |-- enable
|       |       |-- port
|       |-- sftp-server
|       |       |-- enable
|       |       |-- chguser
|       |-- ftp-server
|       |       |-- enable
|       |       |-- port
|       |       |-- chguser
|       |-- clock
|       |       |-- set
|       |       |-- timezone
|       |-- ntp
|       |       |-- server
|       |       |       |-- enable
|       |       |-- client
|       |       |       |-- enable
|       |       |       |-- interval
|       |       |       |-- server-addr
|       |       |       |       |-- ip
|       |       |       |       |-- hostname
|       |-- syslog
|       |       |-- enable
|       |       |-- add
|       |       |-- del
```

```
|       |       |-- level
|       |-- bridge
|       |       |-- protocol
|       |       |       |-- ieee
|       |       |       |-- mstp
|       |       |       |-- rstp
|       |       |-- ageing-time
|       |       |-- address
|       |       |       |-- discard
|       |       |       |       |-- vlan
|       |       |       |-- forward
|       |       |       |       |-- vlan
|       |       |-- max-age
|       |       |-- forward-time
|       |       |-- hello-time
|       |       |-- instance
|       |       |-- max-hops
|       |       |-- spanning-tree
|       |       |       |-- enable
|       |       |       |-- errdisable-timeout
|       |       |       |       |-- enable
|       |       |       |       |-- interval
|       |       |       |-- portfast
|       |       |       |       |-- bpdu-filter
|       |       |       |       |-- bpdu-guard
|       |       |-- rapid-spanning-tree
|       |       |       |-- enable
|       |       |-- multiple-spanning-tree
|       |       |       |-- enable
|       |       |-- priority
|       |       |-- transmit-holdcount
|       |-- spanning-tree
|       |       |-- bridge
|       |       |       |-- instance
|       |       |       |       |-- vlan
|       |       |       |-- region
|       |       |       |-- revision
|       |-- vlan
|       |       |-- vlan
|       |-- interface
|       |       |-- switchport
|       |       |       |-- mode
|       |       |       |-- access
```

```
|       |       |       |-- trunk
|       |       |       |       |-- add
|       |       |       |       |-- except
|       |       |       |       |-- remove
|       |       |       |       |-- all
|       |       |       |       |-- none
|       |       |       |-- hybrid
|       |       |       |       |-- allowed
|       |       |       |       |       |-- add
|       |       |       |       |       |-- remove
|       |       |       |       |       |-- all
|       |       |       |       |       |-- none
|       |       |       |       |-- vlan
|       |       |-- static-channel-group
|       |       |-- channel-group
|       |       |-- flowcontrol
|       |       |-- storm-control
|       |       |       |-- level
|       |       |-- bridge-group
|       |       |       |-- instance
|       |       |       |       |-- path-cost
|       |       |       |       |-- priority
|       |       |       |-- priority
|       |       |       |-- path-cost
|       |       |-- mirror
|       |       |       |-- interface
|       |       |       |       |-- direction
|       |       |-- ip
|       |       |       |-- address
|       |       |       |-- igmp
|       |       |       |       |-- ra-option
|       |       |       |       |-- access-group
|       |       |       |       |-- immediate-leave
|       |       |       |       |-- last-member-query-count
|       |       |       |       |-- last-member-query-interval
|       |       |       |       |-- limit
|       |       |       |       |       |-- except
|       |       |       |       |-- mroute-proxy
|       |       |       |       |-- querier-timeout
|       |       |       |       |-- query-interval
|       |       |       |       |-- query-max-response-time
|       |       |       |       |-- robustness-variable
|       |       |       |       |-- snooping
```

```
|   |   |   |   |   |-- fast-leave
|   |   |   |   |   |-- mrouter
|   |   |   |   |   |-- querier
|   |   |   |   |   |-- report-suppression
|   |   |   |   |-- static-group
|   |   |   |   |   |-- interface
|   |   |   |   |   |-- source
|   |   |   |   |   |   |-- interface
|   |   |   |   |-- version
|   |   |   |-- pim
|   |   |   |   |-- sparse-mode
|   |   |   |   |-- bsr-border
|   |   |   |   |-- dr-priority
|   |   |   |   |-- exclude-genid
|   |   |   |   |-- hello-holdtime
|   |   |   |   |-- hello-interval
|   |   |   |   |-- neighbor-filter
|   |   |   |   |-- propagation-delay
|   |   |   |   |-- unicast-bsm
|   |   |   |-- access-group
|   |   |   |-- nat
|   |   |   |-- proxy-arp
|   |   |   |-- tcp-adjust-mss
|   |   |   |-- rip
|   |   |   |   |-- authentication
|   |   |   |   |   |-- key-chain
|   |   |   |   |   |-- mode
|   |   |   |   |   |-- string
|   |   |   |   |-- receive
|   |   |   |   |   |-- version
|   |   |   |   |-- receive-packet
|   |   |   |   |-- send
|   |   |   |   |   |-- version
|   |   |   |   |-- send-packet
|   |   |   |   |-- split-horizon
|   |   |   |-- ospf
|   |   |   |   |-- address
|   |   |   |   |   |-- authentication
|   |   |   |   |   |-- authentication-key
|   |   |   |   |   |-- cost
|   |   |   |   |   |-- database-filter
|   |   |   |   |   |-- dead-interval
|   |   |   |   |   |-- hello-interval
```

```
|   |   |   |   |   |-- message-digest-key
|   |   |   |   |   |   |-- md5
|   |   |   |   |   |-- mtu-ignore
|   |   |   |   |   |-- priority
|   |   |   |   |   |-- retransmit-interval
|   |   |   |   |   |-- transmit-delay
|   |   |   |   |-- authentication
|   |   |   |   |-- authentication-key
|   |   |   |   |-- cost
|   |   |   |   |-- database-filter
|   |   |   |   |-- dead-interval
|   |   |   |   |-- hello-interval
|   |   |   |   |-- message-digest-key
|   |   |   |   |   |-- md5
|   |   |   |   |-- mtu-ignore
|   |   |   |   |-- priority
|   |   |   |   |-- retransmit-interval
|   |   |   |   |-- transmit-delay
|   |   |   |   |-- disable
|   |   |   |   |-- mtu
|   |   |   |   |-- network
|   |   |-- shutdown
|   |   |-- traffic-shape
|   |   |-- service-policy
|   |   |-- dhcp
|   |   |   |-- server
|   |   |   |-- option-82
|   |   |-- arp-ageing-timeout
|   |   |-- speed-duplex
|   |   |-- mtu
|   |   |-- spanning-tree
|   |   |   |-- autoedge
|   |   |   |-- edgeport
|   |   |   |-- force-version
|   |   |   |-- guard
|   |   |   |-- hello-time
|   |   |   |-- instance
|   |   |   |   |-- path-cost
|   |   |   |   |-- priority
|   |   |   |   |-- restricted-role
|   |   |   |   |-- restricted-tcn
|   |   |   |-- link-type
|   |   |   |-- path-cost
```

```
|       |       |       |-- portfast
|       |       |       |       |-- bpdu-filter
|       |       |       |       |-- bpdu-guard
|       |       |       |-- priority
|       |       |       |-- restricted-role
|       |       |       |-- restricted-tcn
|       |       |       |-- transmit-holdcount
|       |-- vrrp
|       |-- router
|       |       |-- rip
|       |       |       |-- cisco-metric-behavior
|       |       |       |-- default-information
|       |       |       |-- default-metric
|       |       |       |-- distance
|       |       |       |-- distribute-list
|       |       |       |-- maximum-prefix
|       |       |       |-- neighbor
|       |       |       |-- network
|       |       |       |-- offset-list
|       |       |       |-- passive-interface
|       |       |       |-- recv-buffer-size
|       |       |       |-- redistribute
|       |       |       |       |-- metric
|       |       |       |       |-- route-map
|       |       |       |-- route
|       |       |       |-- timers
|       |       |       |       |-- basic
|       |       |       |-- version
|       |       |-- ospf
|       |       |       |-- area
|       |       |       |       |-- authentication
|       |       |       |       |-- default-cost
|       |       |       |       |-- filter-list
|       |       |       |       |-- nssa
|       |       |       |       |       |-- default-information-originate
|       |       |       |       |       |       |-- metric
|       |       |       |       |       |       |-- metric-type
|       |       |       |       |       |       |-- no-redistribution
|       |       |       |       |       |       |-- no-summary
|       |       |       |       |       |       |-- translator-role
|       |       |       |       |       |-- no-redistribution
|       |       |       |       |       |-- no-summary
|       |       |       |       |       |-- translator-role
```

```
|   |   |   |   |-- range
|   |   |   |   |-- shortcut
|   |   |   |   |-- stub
|   |   |   |   |-- virtual-link
|   |   |   |   |   |-- authentication
|   |   |   |   |   |-- authentication-key
|   |   |   |   |   |-- dead-interval
|   |   |   |   |   |-- hello-interval
|   |   |   |   |   |-- message-digest-key
|   |   |   |   |   |   |-- md5
|   |   |   |   |   |-- retransmit-interval
|   |   |   |   |   |-- transmit-delay
|   |   |   |-- auto-cost
|   |   |   |-- capability
|   |   |   |   |-- opaque
|   |   |   |-- compatible
|   |   |   |-- default-information
|   |   |   |   |-- always
|   |   |   |   |-- metric
|   |   |   |   |-- metric-type
|   |   |   |   |-- route-map
|   |   |   |-- default-metric
|   |   |   |-- distance
|   |   |   |   |-- admin
|   |   |   |   |-- ospf
|   |   |   |-- distribute-list
|   |   |   |   |-- in
|   |   |   |   |-- out
|   |   |   |-- host
|   |   |   |   |-- area
|   |   |   |-- max-concurrent-dd
|   |   |   |-- maximum-area
|   |   |   |-- neighbor
|   |   |   |   |-- cost
|   |   |   |   |-- poll-interval
|   |   |   |   |-- priority
|   |   |   |-- network
|   |   |   |   |-- area
|   |   |   |-- ospf
|   |   |   |   |-- abr-type
|   |   |   |   |-- router-id
|   |   |   |-- overflow
|   |   |   |   |-- database
```

```
|       |       |       |-- passive-interface
|       |       |       |-- redistribute
|       |       |       |       |-- metric
|       |       |       |       |-- metric-type
|       |       |       |       |-- route-map
|       |       |       |       |-- tag
|       |       |       |-- router-id
|       |       |       |-- summary-address
|       |       |       |-- timers
|       |       |       |       |-- spf
|       |       |       |       |       |-- exp
|       |       |-- vrrp
|       |       |       |-- advertisement-interval
|       |       |       |-- circuit-failover
|       |       |       |-- disable
|       |       |       |-- enable
|       |       |       |-- preempt-mode
|       |       |       |-- preempt-delay
|       |       |       |-- priority
|       |       |       |-- virtual-ip
|       |-- os-aware
|       |       |-- os-aware
|       |       |-- delete
|       |       |-- update
|       |-- ipwatch
|       |-- ftp
|       |-- stationtracking
|       |       |-- station
|       |       |-- on
|       |       |-- off
|       |-- fqm-mode
|       |       |-- access-list
|       |       |-- class-map
|       |       |       |-- match
|       |       |       |       |-- access-group
|       |       |       |       |-- class
|       |       |       |       |-- cos
|       |       |       |       |-- dst
|       |       |       |       |-- ip
|       |       |       |       |       |-- dscp
|       |       |       |       |       |-- precedence
|       |       |       |       |       |-- tos
|       |       |       |       |-- protocol
```

```
|       |       |       |       |-- src
|       |       |       |-- match-type
|       |       |-- no
|       |       |-- policy-map
|       |       |       |-- class
|       |       |       |       |-- police
|       |       |       |       |       |-- cir
|       |       |       |       |-- mark
|       |       |       |       |       |-- cos
|       |       |       |       |       |-- ip
|       |       |       |       |       |       |-- dscp
|       |       |       |       |       |       |-- precdence
|       |       |       |       |       |-- priority
|       |       |       |       |-- bandwidth
|       |       |       |       |-- shape-peak
|       |       |       |       |-- queue-limit
|       |       |-- ip
|       |       |-- time-profile
|       |       |       |-- day-start
|       |       |-- update
|       |       |       |-- access-list
|       |-- if-arbiter
|       |-- sipalg
|       |       |-- enable
|       |       |-- sip-error-resp-enable
|       |       |-- monitor-port
|       |       |-- sip-detect-long-call-enable
|       |       |-- sip-long-call-timeout
|       |-- rrm
|       |       |-- enable
|       |       |-- 80211a
|       |       |       |-- dpc
|       |       |       |       |-- enable
|       |       |       |       |-- periodic-interval
|       |       |       |       |-- rssi-threshold
|       |       |       |       |-- txPower
|       |       |       |-- dcs
|       |       |       |       |-- enable
|       |       |       |       |-- periodic-interval
|       |       |       |       |-- anchor-time
|       |       |       |       |-- interference-level-threshold
|       |       |       |       |-- channel-utilization-threshold
|       |       |       |       |-- my-utilization-threshold
```

```
|       |       |       |       |-- channel
|       |       |       |       |-- aware-option
|       |       |       |       |-- delayed-channel-change
|       |       |       |-- chdc
|       |       |       |       |-- enable
|       |       |       |       |-- statsCollectEnable
|       |       |       |       |-- statsWarningEnable
|       |       |       |       |-- statsActionEnable
|       |       |       |       |-- statsCollectInterval
|       |       |       |       |-- rssi-threshold
|       |       |       |       |-- min-failed-client-count
|       |       |       |       |-- percent-failed-client-count
|       |       |-- 80211b
|       |       |       |-- dpc
|       |       |       |       |-- enable
|       |       |       |       |-- periodic-interval
|       |       |       |       |-- rssi-threshold
|       |       |       |       |-- txPower
|       |       |       |-- dcs
|       |       |       |       |-- enable
|       |       |       |       |-- periodic-interval
|       |       |       |       |-- anchor-time
|       |       |       |       |-- interference-level-threshold
|       |       |       |       |-- channel-utilization-threshold
|       |       |       |       |-- my-utilization-threshold
|       |       |       |       |-- channel
|       |       |       |       |-- aware-option
|       |       |       |       |-- delayed-channel-change
|       |       |       |-- chdc
|       |       |       |       |-- enable
|       |       |       |       |-- statsCollectEnable
|       |       |       |       |-- statsWarningEnable
|       |       |       |       |-- statsActionEnable
|       |       |       |       |-- statsCollectInterval
|       |       |       |       |-- rssi-threshold
|       |       |       |       |-- min-failed-client-count
|       |       |       |       |-- percent-failed-client-count
|       |       |-- rf-group-name
|       |       |-- sub-channel-group
|       |       |       |-- enable
|       |       |       |-- disable
|       |       |       |-- group-name
|       |       |       |-- add-ap
```

```
|       |       |       |-- del-ap
|       |       |       |-- add-channel
|       |       |       |-- del-channel
|       |-- cluster
|       |       |-- keep-alive-interval
|       |       |-- keep-alive-retry-count
|       |       |-- enable
|       |       |-- add-apc
|       |       |-- del-apc
|       |       |-- del-apc-all
|       |-- wids
|       |       |-- enable
|       |       |-- ap-blacklist
|       |       |-- client-blacklist
|       |       |-- ssid-whitelist
|       |       |-- oui-whitelist
|       |       |-- friendlylist
|       |       |-- rogue
|       |       |       |-- expiration-timeout
|       |       |       |-- remove
|       |       |       |-- move
|       |       |       |-- modify-state
|       |       |       |-- adhoc-connection-detection
|       |       |       |-- ap
|       |       |       |       |-- ap-blacklist-check
|       |       |       |       |-- managed_ssid_invalid_security
|       |       |       |       |-- illegal-channel-detection
|       |       |       |       |-- unknownap
|       |       |       |       |       |-- managed-ssid-withauth-client-det
|       |       |       |       |       |-- wired-netwrok-detection
|       |       |       |       |-- fakeap
|       |       |       |       |       |-- managed-ssid-detection
|       |       |       |       |       |-- beacon-without-ssid-detection
|       |       |       |       |       |-- beacon-on-invalid-channel-detection
|       |       |       |       |-- managedap
|       |       |       |       |       |-- invalid-ssid-detection
|       |       |       |-- client
|       |       |       |       |-- oui-list-check
|       |       |       |       |-- auth-request-det
|       |       |       |       |-- probe-request-det
|       |       |       |       |-- deauth-request-det
|       |       |       |       |-- assoc-fail-det
|       |       |       |       |-- auth-fail-det
```

```
|       |       |       |       |-- oneXauth-fail-det
|       |       |       |       |-- webauth-fail-det
|       |       |       |       |-- exclusion-list-check
|       |       |       |       |-- allowed-limit
|       |       |       |-- add-friendly-rule
|       |       |       |-- del-friendly-rule
|       |       |       |-- modify-friendly-rule
|       |       |       |-- add-malicious-rule
|       |       |       |-- del-malicious-rule
|       |       |       |-- modify-malicious-rule
|       |       |-- channel-validation
|       |       |       |-- enable
|       |       |       |-- add
|       |       |       |-- delete
|       |-- monitor-radio
|       |       |-- scan-interval
|       |       |-- periodic-interval
|       |-- snmp
|       |       |-- community
|       |       |-- user
|       |       |-- trap
|       |       |-- trap-source-ip
|       |-- pcap
|       |       |-- mode
|       |       |-- start-service
|       |       |-- filter
|       |       |       |-- station-mac
|       |       |       |-- enable-station-mac
|       |       |       |-- ap-mac
|       |       |       |-- enable-ap-mac
|       |-- wlan-radio-service
|       |       |-- sta-idle-timeout
|       |       |-- wmm-mode
|       |       |-- dtim
|       |-- preferred-calls
|       |       |-- add
|       |       |-- del
|       |-- locationtrack
|       |       |-- autotrace
|       |       |-- algorithm
|       |       |-- enable
|       |       |-- ap
|       |       |-- station
```

```
|       |       |-- rogueap
|       |       |-- roguestation
|       |       |-- expiryhistory
|       |-- vcc
|       |       |-- scme-if
|       |       |-- add-user
|       |       |-- handover
|       |       |-- enable
|       |-- voice
|       |       |-- monitor
|       |       |       |-- enable
|       |       |       |-- interval
|       |       |       |-- fieldType
|       |       |       |       |-- ip
|       |       |       |       |-- mac
|       |       |       |       |-- user-name
|       |       |       |       |-- phone-no
|       |       |-- vqm
|       |       |       |-- enable
|       |       |       |-- connection-limit
|       |       |       |-- reporting-mode
|       |       |       |-- periodic-timer
|       |       |       |-- session-idle-timer
|       |       |       |-- rtp-port-range
|       |       |       |-- alarm
|       |       |       |       |-- enable
|       |       |       |       |-- threshold
|       |       |       |-- upload
|       |       |       |       |-- enable
|       |       |       |       |-- server
|       |       |       |       |-- interval
|       |       |       |       |-- mode
|       |       |       |       |-- user-login
|       |       |       |       |-- target-directory
|       |       |       |       |-- file-size
|       |       |       |       |-- immediate-upload
|       |       |       |-- filter
|       |       |       |       |-- prefix
|       |-- router-id
|       |-- route-map
|       |       |-- match
|       |       |       |-- interface
|       |       |       |-- ip
```

```
|       |       |       |-- metric
|       |       |       |-- route-type
|       |       |       |-- tag
|       |       |-- set
|       |       |       |-- dampening
|       |       |       |-- ip
|       |       |       |-- metric
|       |       |       |-- metric-type
|       |       |       |-- tag
```

A.2 show

```
|-- show
|       |-- band-steering
|       |-- load-balancing
|       |-- air-quality
|       |       |-- count
|       |       |       |-- interferers
|       |       |       |-- worst-interferers
|       |-- spectrum-analysis
|       |       |-- config
|       |       |       |-- ap
|       |       |-- report
|       |       |       |-- duty_cycle
|       |       |       |       |-- ap
|       |       |       |-- sample
|       |       |       |       |-- ap
|       |       |       |-- interference
|       |       |       |       |-- ap
|       |-- mgmt-users
|       |-- command-log
|       |-- cli-idle-timeout
|       |-- cli-sessions
|       |-- country
|       |       |-- global-config
|       |       |-- ap-config
|       |       |-- information
|       |-- voip
|       |       |-- config
|       |       |-- call-info
|       |-- vcc
|       |       |-- connect-status
|       |       |-- msg-counts
|       |-- 80211a
|       |       |-- cac
|       |       |       |-- configuration
|       |       |-- summary
|       |       |-- qos
|       |       |       |-- policy
|       |       |       |-- ac-profile
|       |       |       |-- edca-parameters
|       |       |       |-- radio-configuration
|       |       |-- radio-config
|       |       |-- voip-stats
```

```
|       |       |-- cvo
|       |       |       |-- profile
|       |       |       |-- config
|       |       |       |-- neighbors
|       |       |       |-- channel-info
|       |       |       |-- call-count
|       |       |       |-- heads
|       |-- 80211bg
|       |       |-- cac
|       |       |       |-- configuration
|       |       |-- summary
|       |       |-- qos
|       |       |       |-- policy
|       |       |       |-- ac-profile
|       |       |       |-- edca-parameters
|       |       |       |-- radio-configuration
|       |       |-- radio-config
|       |       |-- voip-stats
|       |       |-- cvo
|       |       |       |-- profile
|       |       |       |-- config
|       |       |       |-- neighbors
|       |       |       |-- channel-info
|       |       |       |-- call-count
|       |       |       |-- heads
|       |-- 80211h
|       |       |-- configuration
|       |       |-- prohibit-channels
|       |-- qos
|       |       |-- profile
|       |-- wlan-radio-service
|       |       |-- config
|       |       |-- msg-counts
|       |-- handover
|       |-- airmove
|       |       |-- ap
|       |       |-- group
|       |-- station
|       |       |-- stats
|       |       |       |-- management_frame
|       |       |       |       |-- all
|       |       |       |-- NCHO
|       |       |       |       |-- all
```

```
|       |       |       |-- IAHO
|       |       |       |       |-- all
|       |       |       |-- debug
|       |       |       |       |-- all
|       |       |       |-- ap-80211-stats
|       |       |-- association
|       |       |       |-- history
|       |       |-- summary
|       |       |       |-- ap
|       |       |       |-- bssid
|       |       |       |-- wlan
|       |       |-- detail
|       |       |-- data
|       |       |       |-- configuration
|       |       |       |-- wlan
|       |       |       |-- radio
|       |       |       |-- ap
|       |       |       |-- ap-packet-loss
|       |       |       |-- ap-packet-loss-raw
|       |       |       |-- device
|       |       |       |-- worst_wlan
|       |       |       |-- worst_radio
|       |       |       |-- global_stats
|       |-- system
|       |       |-- info
|       |       |-- uptime
|       |       |-- load
|       |       |-- cpu
|       |       |-- memory
|       |       |-- disk
|       |       |-- fan
|       |       |-- temp
|       |       |-- threshold
|       |       |       |-- cpu
|       |       |       |-- memory
|       |       |       |-- disk
|       |       |       |-- fan
|       |       |       |-- temp
|       |       |-- fancontrol
|       |       |-- license-key
|       |-- remote-ap-group
|       |       |-- summary
|       |       |-- user-state
```

```
|       |       |-- detail
|       |-- ap-group
|       |       |-- summary
|       |       |-- detail
|       |       |-- time-config
|       |-- ap
|       |       |-- upgrade
|       |       |       |-- summary
|       |       |       |-- list
|       |       |-- summary
|       |       |-- detail
|       |       |-- wlan-vlan
|       |       |-- stats-history
|       |       |-- if-stats
|       |       |-- join-stats
|       |       |-- capwap-stats
|       |       |-- radio-stats
|       |       |-- tech-support
|       |       |-- time-config
|       |       |-- syslog-config
|       |-- apc
|       |       |-- summary
|       |       |-- list
|       |       |-- capwap
|       |       |       |-- summary
|       |       |-- ap-if-stats
|       |-- redundancy
|       |       |-- summary
|       |       |-- priority-list
|       |-- wlan
|       |       |-- summary
|       |       |-- detail
|       |       |-- security
|       |       |       |-- summary
|       |       |       |-- detail
|       |-- vap
|       |-- if-group
|       |-- alarm
|       |       |-- info
|       |       |-- conf
|       |       |-- list
|       |       |       |-- all
|       |       |       |-- level
```

```
|       |       |       |-- group
|       |       |-- history
|       |       |       |-- all
|       |       |       |-- level
|       |       |       |-- group
|       |       |-- backup
|       |-- event
|       |-- running-config
|       |       |-- system
|       |       |-- cli-idle-timeout
|       |       |-- alarm
|       |       |-- network
|       |       |-- snmp
|       |       |-- wifim
|       |       |-- vqm
|       |       |-- voice-vqm
|       |       |-- apc
|       |       |-- capwap
|       |       |-- if-group
|       |       |-- wlan
|       |       |-- wlan-security
|       |-- tech-support
|       |       |-- version
|       |       |-- uptime
|       |       |-- system
|       |       |-- cpu
|       |       |-- load
|       |       |-- memory
|       |       |-- disk
|       |       |-- process
|       |       |-- processlog
|       |       |-- processmemory
|       |       |-- coredump
|       |       |-- crash
|       |       |-- swm-log
|       |       |-- alarm
|       |       |-- debug
|       |       |-- cluster
|       |       |-- redundancy
|       |       |-- cli-idle-timeout
|       |       |-- network
|       |       |-- snmp
|       |       |-- wifim
```

```
|       |       |-- vqm
|       |       |-- apc
|       |       |-- capwap
|       |       |-- if-group
|       |       |-- wlan
|       |       |-- wlan-security
|       |       |-- rrm
|       |       |-- alarmhistory
|       |       |-- event
|       |       |-- wids
|       |-- ip
|       |       |-- dhcp
|       |       |       |-- pool
|       |       |       |-- lease
|       |       |       |-- proxy-lease
|       |       |       |-- statistics
|       |       |       |-- process
|       |       |-- dhcp-proxy
|       |       |-- dns
|       |       |       |-- name-server
|       |       |       |-- relay
|       |       |       |       |-- cache
|       |       |       |       |-- cache-info
|       |       |-- igmp
|       |       |       |-- groups
|       |       |       |-- interface
|       |       |       |-- snooping
|       |       |       |       |-- mroute
|       |       |       |       |-- statistics
|       |       |       |-- ssm-map
|       |       |-- route
|       |       |-- interface
|       |       |-- rip
|       |       |-- protocols
|       |       |-- nat
|       |       |-- access-list
|       |       |-- filter
|       |       |-- pim
|       |       |       |-- sparse-mode
|       |       |       |       |-- bsr-router
|       |       |       |       |-- interface
|       |       |       |       |-- local-members
|       |       |       |       |-- mroute
```

```
|       |       |       |       |-- neighbor
|       |       |       |       |-- nexthop
|       |       |       |       |-- rp
|       |       |       |       |-- rp-hash
|       |       |-- ospf
|       |       |       |-- border-routers
|       |       |       |-- database
|       |       |       |       |-- adv-router
|       |       |       |       |-- asbr-summary
|       |       |       |       |-- external
|       |       |       |       |-- max-age
|       |       |       |       |-- network
|       |       |       |       |-- nssa-external
|       |       |       |       |-- opaque-area
|       |       |       |       |-- opaque-as
|       |       |       |       |-- opaque-link
|       |       |       |       |-- router
|       |       |       |       |-- self-originate
|       |       |       |       |-- summary
|       |       |       |-- neighbor
|       |       |       |-- route
|       |       |       |-- virtual-links
|       |-- access-list
|       |-- arp
|       |-- wireless-acl-list
|       |-- multi2uni-list
|       |-- interface
|       |-- vlan
|       |-- mirror
|       |-- reboot
|       |-- processes
|       |       |-- status
|       |       |-- log
|       |       |-- memory
|       |-- version
|       |-- syslog
|       |-- debug
|       |       |-- coredump
|       |       |       |-- summary
|       |       |-- reboot
|       |       |       |-- info
|       |       |       |-- summary
|       |       |       |-- export
```

```
|       |       |-- log
|       |       |       |-- all
|       |       |       |-- level
|       |       |       |-- module
|       |       |       |-- conf
|       |       |       |-- backup
|       |       |       |-- keyword
|       |       |       |-- detail
|       |       |       |       |-- all
|       |       |       |       |-- level
|       |       |       |       |-- module
|       |       |       |       |-- backup
|       |       |       |       |-- conf
|       |       |       |       |-- keyword
|       |       |       |       |-- before
|       |       |       |       |-- after
|       |       |       |       |-- start-time
|       |       |       |-- before
|       |       |       |-- after
|       |       |       |-- start-time
|       |       |-- swm-log
|       |       |-- processes
|       |       |-- apm
|       |       |       |-- msg-count
|       |       |       |-- disk-size
|       |       |       |-- timer
|       |       |       |-- test-result
|       |       |       |-- end-message
|       |       |       |-- shared-memory
|       |       |-- event
|       |-- ssh-server
|       |-- telnet-server
|       |-- ftp-server
|       |-- filter
|       |-- filter-stats
|       |-- policy-map
|       |-- class-map
|       |-- firewall
|       |-- sftp-server
|       |-- ntp
|       |-- timezone
|       |-- clock
|       |-- event-filter
```

```
|       |-- security
|       |       |-- radius-server
|       |       |       |-- config
|       |       |       |-- summary
|       |       |       |-- detail
|       |       |       |-- stats
|       |       |-- advanced
|       |       |-- hapd-stats
|       |       |-- hapd-ap-stats
|       |       |-- guestaccess
|       |       |       |-- help
|       |       |       |-- current-config
|       |       |       |-- config-user-detail
|       |       |-- captive-portal
|       |       |       |-- stats
|       |       |       |-- running-info
|       |       |       |-- config
|       |       |       |-- guest
|       |       |       |-- web-auth
|       |       |       |-- rad-msg
|       |       |       |-- rad-retrans
|       |       |       |-- failed-sta
|       |       |-- mac-filter
|       |       |       |-- summary
|       |       |       |-- detail
|       |       |-- ext-wips
|       |       |       |-- config
|       |       |       |-- list
|       |-- vrrp
|       |-- static-channel-group
|       |-- bridge
|       |-- etherchannel
|       |-- spanning-tree
|       |       |-- mst
|       |       |       |-- config
|       |       |       |-- detail
|       |       |       |       |-- interface
|       |       |       |-- instance
|       |       |       |       |-- interface
|       |       |       |-- interface
|       |       |-- interface
|       |-- sipalg
|       |       |-- configuration
```

```
|       |       |-- stats
|       |       |-- call
|       |       |       |-- summary
|       |       |       |-- detail
|       |-- rrm
|       |       |-- config-summary
|       |       |-- help
|       |       |-- neighbor-list
|       |       |-- channel-status
|       |       |-- rrm-history
|       |       |-- sub-channel-group
|       |-- locationtrack
|       |       |-- help
|       |       |-- config
|       |       |-- ap
|       |       |-- floor
|       |       |-- station
|       |       |-- rogueap
|       |       |-- roguestation
|       |-- debugging
|       |       |-- lacp
|       |-- port
|       |-- lacp
|       |-- http
|       |-- https
|       |-- snmp
|       |       |-- community
|       |       |-- user
|       |       |-- trap
|       |-- pcap
|       |       |-- current-config
|       |-- cluster
|       |       |-- config
|       |       |-- current-stats-all
|       |       |-- current-stats-apc
|       |       |-- help
|       |       |-- list-apc
|       |       |-- list-station
|       |       |-- summary-stats-all
|       |       |-- summary-stats-apc
|       |-- wids
|       |       |-- help
|       |       |-- statistics
```

```
|       |       |-- current-config
|       |       |-- lists
|       |       |       |-- ap-whitelist
|       |       |       |-- ap-blacklist
|       |       |       |-- client-whitelist
|       |       |       |-- client-blacklist
|       |       |       |-- friendlylist
|       |       |       |-- oui-list
|       |       |       |-- ssid-whitelist
|       |       |-- rogue
|       |       |       |-- ap
|       |       |       |       |-- current-config
|       |       |       |       |-- list
|       |       |       |       |-- detail
|       |       |       |-- client
|       |       |       |       |-- current-config
|       |       |       |       |-- allow-limit
|       |       |       |       |-- list
|       |       |       |       |-- detail
|       |       |       |-- adhoc
|       |       |       |       |-- list
|       |       |       |       |-- detail
|       |       |       |-- rule
|       |       |       |       |-- friendly
|       |       |       |       |-- malicious
|       |-- wips
|       |       |-- help
|       |       |-- current-config
|       |-- stats-report
|       |       |-- conf
|       |       |-- current-stats
|       |-- stationtracking
|       |       |-- station
|       |       |-- conf
|       |-- preferred-calls
|       |-- vdm
|       |       |-- config
|       |       |-- policy-for-station
|       |-- sds
|       |       |-- radio
|       |       |-- wlan
|       |-- config-files
|       |-- rate-control
```

```
|       |-- tx-power-range
|       |-- os-aware
|       |-- os-aware-all
|       |-- monitor-radio
|       |-- voice
|       |       |-- station
|       |       |       |-- summary
|       |       |       |-- detail
|       |       |       |       |-- mac
|       |       |       |       |-- ip
|       |       |       |       |-- user-name
|       |       |       |       |-- tel-no
|       |       |-- active-call
|       |       |       |-- summary
|       |       |       |-- detail
|       |       |       |       |-- mac
|       |       |       |       |-- ip
|       |       |       |       |-- user-name
|       |       |       |       |-- tel-no
|       |       |-- complete-call
|       |       |       |-- summary
|       |       |       |-- detail
|       |       |       |       |-- mac
|       |       |       |       |-- ip
|       |       |       |       |-- user-name
|       |       |       |       |-- tel-no
|       |       |-- vqm
|       |       |       |-- help
|       |       |       |-- current-config
|       |       |       |-- summary-stats
|       |       |       |-- debug-stats
|       |       |       |-- current-stats
|       |       |       |-- history-stats
|       |       |       |-- alarms
|       |       |-- statistics
|       |       |       |-- ap
|       |       |       |-- radio
|       |       |       |-- wlan
|       |       |       |-- device
|       |       |       |-- station
|       |       |-- event
|       |       |-- sipmsg-log
|       |       |-- device
|       |       |-- debug-stats
|       |-- bss-if
```

A.3 clear

```
|-- clear
|       |-- air-quality
|       |       |-- count
|       |       |       |-- interferers
|       |-- stats
|       |       |-- station
|       |       |       |-- globally
|       |       |       |-- individually
|       |-- interference
|       |       |-- report
|       |-- vap
|       |-- ip
|       |       |-- igmp
|       |       |       |-- group
|       |       |       |-- interface
|       |       |-- rip
|       |       |-- pim
|       |       |       |-- sparse-mode
|       |       |-- nat
|       |       |-- ospf
|       |-- spanning-tree
|       |       |-- bridge
|       |       |-- interface
|       |-- 80211a
|       |       |-- voip-stats
|       |-- 80211bg
|       |       |-- voip-stats
|       |-- preferred-calls
|       |-- wlan-radio-service
|       |-- vcc-msg-counts
|       |-- cli-session
|       |-- interface
|       |-- arp-cache
|       |-- voice
|       |       |-- vqm
|       |       |       |-- all
|       |       |       |-- history-stats
|       |       |       |-- summary-stats
|       |       |       |-- current-stats
|       |       |       |-- history-file
|       |       |       |-- debug-stats
|       |       |-- active-call
```

```
|       |       |-- statistics
|       |       |-- event
|       |       |-- sipmsg-log
|       |       |-- debug-stats
|       |-- sipalg
|       |       |-- stats
|       |-- pcap-stat
|       |-- security
|       |       |-- radius-server
|       |       |       |-- stats
|       |       |-- hapd-stats
|       |       |-- hapd-ap-stats
|       |       |-- captive-portal
|       |       |       |-- stats
|       |-- cluster
|       |       |-- clear-all
|       |       |-- clear-apc
|       |-- log
|       |       |-- debug
|       |       |       |-- current
|       |       |       |-- all
|       |       |       |-- detail
|       |       |       |       |-- current
|       |       |       |       |-- all
|       |       |-- alarm
|       |       |-- actalarm
|       |       |-- alarminfo
|       |-- vrrp
```

A.4 debug

```
|-- debug
|       |-- processes
|       |       |-- config
|       |-- crash
|       |       |-- erase
|       |-- igmp
|       |-- lacp
|       |-- pim
|       |       |-- sparse-mode
|       |-- fqm
|       |       |-- acl
|       |       |-- function
|       |       |-- message
|       |       |-- qos
|       |-- nsm
|       |       |-- all
|       |       |-- events
|       |       |-- kernel
|       |       |-- mcast
|       |       |-- packet
|       |-- rip
|       |       |-- all
|       |       |-- events
|       |       |-- nsm
|       |       |-- packet
|       |-- mstp
|       |       |-- all
|       |       |-- cli
|       |       |-- packet
|       |       |-- protocol
|       |       |-- timer
|       |-- vrrp
|       |-- ospf
|       |       |-- all
|       |       |-- events
|       |       |-- ifsm
|       |       |-- lsa
|       |       |-- nfsm
|       |       |-- nsm
|       |       |-- packet
|       |       |-- route
|       |-- traceroute
```

```
|       |-- tcpdump
|       |-- irfm
|       |       |-- module
|       |-- rfsgw
|       |-- wids
|       |-- locationtracking
|       |-- cluster
|       |       |-- all
|       |-- guestaccess
|       |       |-- all
|       |-- log
|       |       |-- level
|       |       |-- logsize
|       |       |-- logcount
|       |       |-- on
|       |       |-- off
|       |       |-- detail
|       |       |       |-- level
|       |       |       |-- logsize
|       |       |       |-- logcount
|       |       |       |-- on
|       |       |       |-- off
|       |       |-- mstdout
|       |       |       |-- module
|       |       |       |-- level
|       |       |       |-- on
|       |       |       |-- off
|       |-- dhcp-info
|       |-- capwap
|       |       |-- trace
|       |       |-- log
|       |       |-- status
|       |       |-- ip
|       |       |-- statistics
|       |-- sipalg
|       |       |-- enable
|       |-- apm
|       |       |-- clear
|       |       |-- block-endmsg
|       |       |-- fail-endmsg
|       |       |-- capwap-result-code
|       |       |-- event
|       |       |       |-- AP_UPGRADE_STATUS
```

```
|       |       |-- shared-memory
|       |       |       |-- clear
|       |       |       |-- add-ap
|       |       |       |-- del-ap
|       |       |       |-- findApIdListWithWlanProfileId
|       |       |       |-- findWlanIdWithApgIdAndWlanProfileId
|       |       |       |-- findWlanIdWithApIdAndWlanProfileId
|       |       |       |-- findWlanProfileIdWithApIdAndWlanId
|       |       |       |-- findWlanIdSetListWithApgId
|       |       |       |-- findWlanIdSetListWithAp
|       |       |-- wlan
|       |       |       |-- reject-probe
|       |       |       |       |-- rssi
|       |       |       |       |-- time
```

A.5 file

|-- file
| |-- download
| |-- upload
| |-- copy
| |-- remove
| |-- move
| |-- ls
| |-- pwd
| |-- cd
| |-- dump
| |-- df
| |-- verify
| |-- version

A.6 Etc

|-- reboot
|-- save
| |-- local
|-- factory-reset
|-- export
|-- import
|-- ping
|-- traceroute
|-- tcpdump
|-- telnet
|-- ssh

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ABBREVIATION

A

ACL	Access Control List
AES	Advanced Encryption Standard
ALG	Application Layer Gateway
AP	Access Point
APC	Access Point Controller

B

BPDU	Bridge Protocol Data Unit

C

CAC	Call Admission Control
CAPWAP	Control And Provisioning Wireless Access Point
CCM	Counter mode encryption with CBC-MAC
CCMP	Counter mode encryption with CBC-MAC Protocol
CCTV	Closed Circuit Television
CDR	Crash Detect and Report
CHDC	Coverage Hole Detection and Control
CLI	Command Line Interface
CSMA/CD	Carrier Sense Multiple Access/Collision Detect
CVO	Controlled Voice Optimization

D

DCS	Dynamic Channel Selection
DECT	Digital Enhanced Cordless Telecommunications
DFS	Dynamic Frequency Selection
DHCP	Dynamic Host Configuration Protocol
DNAT	Destination NAT
DNS	Domain Naming Service
DPC	Dynamic Power control
DSCP	Differentiated Services Code Point
DTIM	Delivery Traffic Indication Message
DTLS	Datagram Transmission Layer Security

E

EAP	Extensible Authentication Protocol
EAPOL	EAP over LANs
EDCA	Enhanced Distributed Channel Access

F

FFT	Fast Fourier Transform
FIFO	First-In-First-Out
FMC	Fixed Mobile Convergence
FTP	File Transfer Protocol

G

GARP	Gratuitous Address Resolution Protocol
GbE	Giga Bit Ethernet
GI	Guard Interval

H

HO	Handover

I

IGMP	Internet Group Management Protocol
IP	Internet Protocol
IPWATCHD	IP WATCH Deamon
IV	Initial Vector

L

LACP	Link Aggregation Control Protocol
LAN	Local Area Network
LED	Light Emitting Diode
LSA	Link State Advertisement

M

MAC	Medium Access Control
MCS	Modulation and Coding Scheme
MIB	Management Information Base
MIMO	Multiple Input Multiple Output
MSTP	Multiple Spanning-Tree Protocol
MTU	Maximum Transmission Unit

N

NAT	Network Address Translation
NMS	Network Management System
NSSA	Not So Stubby Areas
NTP	Network Time Protocol

O

OKC	Opportunistic Key Caching
OSPF	Open Shortest Path First
OUI	Organizationally Unique Identifier

P

PHY	Physical layer
PIM-SM	Protocol Independent Multicast-Sparse Mode
PoE	Power over Ethernet
PMK	Pairwise Master Key
PSK	Pre-Shared Key

Q

QoS	Quality of Service

R

RADIUS	Remote Authentication Dial-In User Service
RF	Radio Frequency
RPM	Revolution Per Minute
RRM	Radio Resource Management
RSSI	Received Signal Strength Indication
RSTP	Rapid Spanning-Tree Protocol
RTP	Real-time Transport Protocol

S

SDS	Samsung Downlink Scheduler
SIP	Session Initiation Protocol
SNAT	Source NAT
SNMP	Simple Network Management Protocol
SNR	Signal to Noise Ratio
SSH	Secure Shell
SSID	Service Set Identifier
STP	Signaling Transfer Point

T

TBTT	Target Beacon Transmission Times
TKIP	Temporal Key Integrity Protocol

U

USB	Universal Serial Bus
UTC	Coordinated Universal Time
UTP	Unshielded Twisted Pair

V

VAP	Virtual Access Point
VATS	Voice-Aware Traffic Scheduling
VLAN	Virtual Local Area Network
VoIP	Voice over IP
VPN	Virtual Private Network
VQM	Voice Quality Monitoring
VRRP	Virtual Router Redundancy Protocol

W

WAN	Wide Area Network
WDS	Wireless Distribution Service
WEM	Wireless Enterprise WLAN Manager
WEP	Wired Equivalent Privacy
Wi-Fi	Wireless Fidelity
WIDS	Wireless Intrusion Detection System
WIPS	Wireless Intrusion Prevention System
WLAN	Wireless Local Area Network
WMM	WiFi Multimedia
WPA	Wi-Fi Protected Access
WPA2	Wi-Fi Protected Access Version 2

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Operation Manual