

## 7.6 Spectrum Analysis

A non-802.11 device such as microwave oven, bluetooth, or Closed Circuit Television (CCTV), etc. deteriorates data transmitting/receiving performance because it causes interference in a wireless LAN environment. As a function that measures surrounding interference, the spectrum analysis analyzes wireless or Radio Frequency (RF) signals to resolve interference problem instantly.

### 7.6.1 Retrieving Spectrum Analysis Data

The spectrum analysis function of APC provides the following data.

- Sample report: Wireless capture data converted into Fast Fourier Transform (FFT)
- Duty cycle report: Channel utilization rate
- Interference report: Interference signal information

The FFT report provides the information of an AP and maximum 13 available channels and also maximum/minimum values of Received Signal Strength Indicator (RSSI) for each channel. The duty cycle report provides AP information and affected channel information. In addition, it provides duty cycle transmission data that indirectly provides channel utilization rate.

The interference report provides AP information, affected channel, or configuration information of an interferer and also interference information (RSSI or maximum/minimum frequency of an interference signal) in real-time.

#### Configuration using CLI

By using the following command, you can check each data.

- `show spectrum-analysis report [DATA] ap [AP_ID]`

| Parameter | Description  |
|-----------|--|
| DATA      | Spectrum analysis data type (sample/duty_cycle/interference) |
| AP_ID     | AP ID (range: 1-500)   |

An example of command execution and its execution result are as follows:

- FFT report

```

APC# show spectrum-analysis report sample ap 1

FFT (Fast Fourier Transform) Reporting Enabled
AP ID 1 Description:
  MAC Address..... 00:11:22:33:44:55
  Name..... AP_ 01122334455
  IP Address..... 100.100.100.220
  Mode..... General

```

```

Operational Status..... Up
Map Location.....
Channel Information:
  Channel Interval..... 2000 ms
  Channel..... 1 2 3 4 5 6 7 8
9 10 11 12 13

Channel ID..... 1
-----
Num  Maximum RSSI  Average RSSI
-----
  1  -120          -120
  2  -120          -120
  3  -120          -120
  4  -120          -120
  5  -120          -120
  6  -120          -120
  7  -120          -120
  8  -120          -120
  9  -120          -120
 10  -120          -120
 11  -120          -120
 12  -120          -120
 13  -120          -120
 14  -120          -120
 15  -120          -120
 16  -120          -120
 17  -120          -120
 18  -120          -120
 19  -120          -120
 20  -120          -120
 21  -120          -120
 22  -120          -120
 23  -120          -120
 24  -120          -120
 25  -120          -120
 26  -120          -120
 27  -120          -120
 28  -120          -120
 29  -120          -120
 30  -120          -120
Press any key to continue (q : quit | enter : next line) :

```

- Duty cycle report

```

APC# show spectrum-analysis report duty_cycle ap 1

Duty Cycle Reporting Enabled
AP ID 1 Description:
  MAC Address..... 00:11:22:33:44:55
  Name..... AP_ 01122334455

```

```

IP Address..... 100.100.100.220
Mode..... General
Operational Status..... Up
Map Location.....
Affected Channels:
  Channel Interval..... 2000 ms
  Channel..... 1 2 3 4 5 6 7 8 9
10 11 12 13
Real Time Duty Cycle Report:
Current Time : 2012-06-29 00:40:13
-----
Channel: 1..... D: 100 %
Channel: 2..... D: 100 %
Channel: 3..... D: 100 %
Channel: 4..... D: 100 %
Channel: 5..... D: 30 %
Channel: 6..... D: 100 %
Channel: 7..... D: 100 %
Channel: 8..... D: 100 %
Channel: 9..... D: 100 %
Channel: 10..... D: 50 %
Channel: 11..... D: 97 %
Channel: 12..... D: 70 %
Channel: 13..... D: 100 %
-----

```

- Interference report

```

APC# show spectrum-analysis report interference ap 1
Interference Reporting Enabled
AP ID 1 Description:
  MAC Address.....
00:11:22:33:44:55
  Name..... AP_
01122334455
  IP Address.....
100.100.100.220
  Mode..... General
  Operational Status..... Up
  Map Location.....

Affected Channels:
  Channel Interval..... 2000 ms
  Channel..... 1 2 3 4 5 6 7
8 9 10 11 12 13

Affected Interferers:
  BlueTooth..... Enabled
  Microwave Oven..... Enabled
  802.11bgn Continuous Transmitter..... Enabled
  802.11bgn DECT-like Phone..... Enabled

```

```

802.11bgn Video Camera..... Enabled
ZigBee..... Enabled
802.11an Continuous Transmitter..... Enabled
802.11an DECT-like Phone..... Enabled
802.11an Video Camera..... Enabled

Real Time Interference Report:
  Number of Interferers..... 1
Num Evoke   Time Interferer Type   RSSI Minimum Frequency Maximum
Frequency
-----
1    2012-06-29 08:52:47 802.11bgn Video Camera -80 2401 2401
    
```

### Configuration using Web UI

In the menu bar of <WEC Main window>, select <Monitor> and then select the <Interference Device> menu in the sub-menus. You can retrieve the interference report.

| AP PROFILE NAME | AP NAME | NO | EVOKE TIME          | INTERFERER TYPE | RSSI | MIN FREQUENCY | MAX FREQUENCY |
|-----------------|---------|----|---------------------|-----------------|------|---------------|---------------|
| ap_1            | NA      | 1  | 2013-01-07 14:37:42 | bluetooth       | -71  | 2452          | 2452          |

Figure 144. Spectrum Analysis Data

## 7.6.2 Spectrum Analysis Configuration

You can configure the spectrum analysis function and also a spectrum analysis channel that will be applied to each spectrum report. The channel information is as follows:

| Radio      | Channel   |
|------------|---|
| 2.4 GHz    | All, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13            |
| 5 GHz Low  | All, 36, 40, 44, 48, 52, 56, 60, 64                       |
| 5 GHz Mid  | All, 100, 104, 108, 112, 116, 120, 124, 128, 132, 136,140 |
| 5 GHz High | All, 149, 153, 157, 161, 165                              |

To configure the spectrum analysis related function, you must go to the configuration mode of an AP for which the spectrum analysis function will be configured by executing the command as follows:

```

APC# configure terminal
APC/configure# spectrum-analysis ap 1
APC/configure/spectrum-analysis/ap 1#
    
```

**[Enable/Disable Spectrum]**

The command that enables or disables the spectrum analysis function is shown below.

- service [MODE]

| Parameter | Description   |
|-----------|---|
| MODE      | Enables or disables spectrum analysis<br>- enable: Enable (default)<br>- disable: Disable |

**[Spectrum Analysis Report Configuration]**

The command used to enable or disable each spectrum analysis data item is shown below.

- configuration-request [DATA] [MODE]

| Parameter | Description  |
|-----------|--|
| DATA      | Type of a report to configure (sample/duty-cycle/interference)<br>- sample: FFT report (default: disabled)<br>- duty-cycle: Duty cycle report (default: disabled)<br>- interference: Interference report (default: enable) |
| MODE      | Enables or disables each report function.<br>- enable: Enable<br>- disable: Disable  |

**[Channel Report Interval Configuration]**

The command is shown below.

- channel-interval [INTERVAL]

| Parameter | Description   |
|-----------|---|
| INTERVAL  | Channel report interval (range: 1000-60000 ms, default: 1000) |

**[Changing Channel]**

By using the following command, you can change a channel for which the spectrum analysis will be executed.

(The default is 'All' channels.)

- dot11b: 2.4 GHz wireless bandwidth
- dot11aLow: 5 GHz low wireless bandwidth
- dot11aMid: 5 GHz mid wireless bandwidth
- dot11aHigh: 5 GHz high wireless bandwidth

### 7.6.3 Interference Type Configuration

The interference type of 2.4 GHz or 5 GHz that can be detected by the W-EP wireless LAN is shown below.

| Wireless bandwidth | Interference type   |
|--------------------|---|
| 2.4 GHz            | continuous_transmitter, cordless_phone, video_camera                                    |
| 5 GHz              | bluetooth, continuous_transmitter, cordless_phone, microwave_oven, video_camera, zigbee |

To configure an interference type, execute the command as follows:

- 1) Go to configure mode of CLI.

```
APC# configure terminal
APC/configure#
```

- 2) Configure an interference type. The default value of all the interference types is 'enabled'.
  - interferer 80211b zigbee: 2.4 GHz configuration
  - interferer 80211a cordless\_phone: 5 GHz configuration

## 7.7 Controlling Usage per User

A wireless terminal can control traffic usage per user by receiving a QoS profile that specifies traffic usage (bandwidth) from the RADIUS server at the authentication stage. You can configure upward and downward usage per wireless terminal.

### Configuration using CLI

The procedure of configuring a usage to a profile is as follows:

- 1) Go to configure mode of CLI.

```
APC# configure terminal
```

- 2) Create a QoS profile.

```
APC/configure# qos [PROFILE_NAME]
APC/configure/qos samsung#
```

| Parameter    | Description                     |
|--------------|---------------------------------|
| PROFILE_NAME | Name of a QoS profile to create |

- 3) Configure the downward usage in kbps.
  - bw-contract-downstream [VALUE]

| Parameter | Description    |
|-----------|----------------|
| VALUE     | Downward usage |

- 4) Configure the upward usage in kbps.
  - bw-contract-upstream [VALUE]

| Parameter | Description  |
|-----------|--------------|
| VALUE     | Upward usage |

- 5) To check the configured profile information, use the 'show qos profile' command.

### Configuration using Web UI

In the menu bar of <WEC Main window>, select <Configuration> and then select the <QoS> menu in the sub-menus. To create a QoS profile to apply to a terminal, click the <Add> button in the initial window.

The QoS addition window consists of the following QoS parameters. By entering each QoS parameter, you can configure the QoS profile of a specific terminal or configure the usage control function for each user.

|   |            |    |
|---|------------|----|
| ID  |            | 1  |
| PROFILE NAME                                  |            |    |
| DESCRIPTION                                   |            |    |
| MAX. DOT1P TAG                                |            | 6  |
| PER-USER UPSTREAM BANDWIDTH CONTRACT (Kbps)   |            | 0  |
| PER-USER DOWNSTREAM BANDWIDTH CONTRACT (Kbps) |            | 0  |
| VOICE   | 802.1P TAG | 6  |
|   | DSCP TAG   | 46 |
| VIDEO   | 802.1P TAG | 4  |
|   | DSCP TAG   | 26 |
| BEST EFFORT                                   | 802.1P TAG | 0  |
|   | DSCP TAG   | 0  |
| BACKGROUND                                    | 802.1P TAG | 1  |
|   | DSCP TAG   | 8  |

Figure 145. Controlling Usage per User

- ID: ID (range: 1-16)
- PROFILE NAME: Profile name
- DESCRIPTION: Profile description
- MAX. DOT1P TAG: Maximum allowed 802.1p tag (range: 0-7)
- PER-USER UPSTREAM BANDWIDTH CONTRACT: Maximum upward usage (range: 0-450000)
- PER-USER DOWNSTREAM BANDWIDTH CONTRACT: Maximum downward usage (range: 0-450000)
- VOICE/VIDEO/BEST EFFORT/BACKGROUND: Enter 802.1P TAG (range: 0-7) and DSCP TAG (range: 0-64) for each item.



## 7.8 Remote Packet Capture

APC can capture a packet exchanged between the wireless terminals on a remote PC in real-time by using the remote packet capture protocol.

To configure the remote packet capture function, you must go to the pcap mode by executing the command as follows:

```
APC# configure terminal
APC/configure# pcap
```

### Configuring the MAC address of a wireless terminal

Configure the MAC address of a wireless terminal whose packets will be captured.

```
APC/configure/pcap# config-filter
APC/configure/pcap/config-filter# station-mac [MAC_ADDRESS]
APC/configure/pcap/config-filter# enable-station-mac [INDEX]
```

| Parameter   | Description                               |
|-------------|---|
| MAC_ADDRESS | MAC address (11:22:33:44:55:66 format)    |
| INDEX       | Index number of MAC address (range: 1-10) |

### Configuring AP MAC address

Configure the MAC address of an AP whose packets will be captured.

```
APC/configure/pcap# config-filter
APC/configure/pcap/config-filter# ap-mac [MAC_ADDRESS]
APC/configure/pcap/config-filter# enable-ap-mac [INDEX]
```

| Parameter   | Description                               |
|-------------|---|
| MAC_ADDRESS | MAC address (11:22:33:44:55:66 format)    |
| INDEX       | Index number of MAC address (range: 1-10) |

### Configuring Filtering Mode

Capture target can be specified by configuring the filtering mode

```
APC/configure/pcap# filtering-mode [FILTERING MODE]
```

| Parameter      | Description  |
|----------------|--|
| FILTERING MODE | Filtering mode<br>- station-only: Use only the configured station MAC information.<br>- ap-only: Use only the configured AP MAC information. |

## Starting Service

You must start the remote packet capture service to connect to a device using a program that supports the remote packet capture protocol on a remote PC.

The related commands are given below.

```
APC/configure/pcap# start-service
```

## Retrieving Configuration Information

Use the 'show pcap current-config' command to retrieve the remote packet capture configuration information.

```
APC# show pcap current-config detail

- Current status : Idle
- Filtering mode : station-only

- Configured AP's MAC Information
  No.      MAC Addr.      Filtering      Matched Count
  Inbound Rate  Outbound Rate
  =====
  1  F4:D9:FB:23:66:00  -----> ON          0
  0.0      0.0
  ID      Prf.      AP Name      IPv4 Addr
  -----
  2      ap_2      AP_f4d9fb236600  10.10.10.20

- Configured Station's MAC Information
  No.      MAC Addr.      Filtering      Matched Count
  Inbound Rate  Outbound Rate
  =====
  1  78:47:1D:C5:4C:85  OFF <-----          0
  0.0      0.0
  AP      WN      SSID      IPv4 Addr
  -----
  2      2      Ajay_2_2_4G  20.20.20.30
  2  FC:A1:3E:47:59:E7  OFF <-----          0
  0.0      0.0
  AP      WN      SSID      IPv4 Addr
  -----
  2      2      Ajay_2_2_4G  20.20.20.25

WEC8500#
```

## 7.9 Clustering

The clustering function comprehensively manages several APC systems in a single wireless LAN when several APC systems are used to manage a wireless LAN that cannot be managed by a single APC. The inter-APC handover function is provided by using clustering. In other words, it can provide the handover function between wireless LANs managed by different APC systems.

However, if a model is different, it is not interoperated through clustering.

### Configuration using CLI

#### [Cluster Setting]

To use the clustering function, you must configure each APC according to the following procedure. Maximum 12 WEC8500 can be grouped in a cluster. Maximum 2 WEC8050 can be grouped in a cluster.

- 1) Go to configure mode of CLI.

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

- 2) Set the interval and the number of retries to transmit the Keep-alive messages between APCs in the cluster.
  - cluster keep-alive-interval [INTERVAL]
  - cluster keep-alive-retry-count [RETRY\_COUNT]

| Parameter   | Description  |
|-------------|--|
| INTERVAL    | Interval to transmit the Keep-alive message<br>(Unit: s, range: 1-30, default: 10)                                       |
| RETRY_COUNT | Maximum number of the transmission retries when there is no response to the Keep-alive message (range: 3-20, default: 3) |

- 3) Enable the cluster
  - cluster enable: Enable
  - no cluster enable: Disable
- 4) To check the configuration information, use the 'show cluster config' command.

```
WEC8500# show cluster config
=====
                CLUSTER CONFIGURATION INFORMATION
=====
KEEP-ALIVE-INTERVAL      : 10
KEEP-ALIVE-RETRY-COUNT  : 3
```

```

ENABLE                : YES
OWN-APC-INDEX        : 1
=====
    
```

**[Adding APC to APC List]**

To add an APC to the cluster, the APC must be added to the APC list first. APC information is automatically added to the APC list.

- 1) Go to apc-list configure mode of CLI.

```

WEC8500# configure terminal
WEC8500/configure# apc apc-list
WEC8500/configure/apc/apc-list#
    
```

- 2) Add the APC to the APC list.
  - add-apc [APC\_NAME] [MAC\_ADDRESS]

| Parameter   | Description  |
|-------------|--|
| APC_NAME    | APC name to be added to the APC list   |
| MAC_ADDRESS | MAC address of the APC to be added to the APC list<br>(system mac address output parameter value of the 'show system info' command in the APC) |

**[Adding APC to cluster]**

After adding APC to the APC list, the APC must be added to a cluster.

- 1) Go to configure mode of CLI.

```

WEC8500# configure terminal
WEC8500/configure#
    
```

- 2) Add the APC to a cluster.
  - cluster add-apc [INDEX] [APC\_NAME] [IPV4\_ADDRESS] [DB\_REFRESH\_INTERVAL]

| Parameter           | Description  |
|---------------------|--|
| INDEX               | Index in cluster (range: 1-12)                                   |
| APC_NAME            | APC name (maximum 18 characters)                                 |
| IPV4_ADDRESS        | IPv4 address   |
| DB_REFRESH_INTERVAL | Database update interval (Unit: s, range: 60-5000, default: 120) |

**[Deleting APC from cluster]**

Delete the APC added in cluster. To delete an APC from a cluster, you must delete the APC from the cluster configuration of all the APCs in the cluster.

- 1) Go to configure mode of CLI.

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

- 2) Delete an APC from the cluster. To delete all the APC systems in a cluster, enter the 'cluster del-apc-all' command.
  - cluster del-apc [INDEX]
  - cluster del-apc-all

| Parameter | Description                    |
|-----------|--------------------------------|
| INDEX     | Index in cluster (range: 1-12) |

**[Retrieving APC information added in cluster]**

You can check the added APC information using the 'show cluster list-apc' command.

```
WEC8500# show cluster list-apc
=====
INDEX  APC-NAME      IPv4-ADDRESS  DB-REF-INT  CONNECT-STATUS
=====
1      APC-1         192.168.87.146 120         CONNECTED [1]
2      APC-2         192.168.87.217 120         CONNECTED [1]
=====
```

## Configuration using Web UI

In the menu bar of <WEC Main window>, select <Configuration> and then select the <Mobility Management> → <Clustering> menu in the sub-menus.

The Clustering window is shown below.

| Information               |     |
|---------------------------|-----|
| CLUSTER NAME              | AHO |
| KEEP ALIVE INTERVAL (SEC) | 60  |
| KEEP ALIVE RETRY COUNT    | 3   |
| OWN APC ID                | 1   |

| Clustering Members |          |                |                   |                           |                |  |
|--------------------|----------|----------------|-------------------|---------------------------|----------------|--|
| APC ID             | APC NAME | APC IP ADDRESS | MULTICAST ADDRESS | DB REFRESH INTERVAL (SEC) | CONNECT STATUS |  |
| 1                  | APC-1    | 90.90.11.153   | 0.0.0.0           | 60                        | connected      |  |
| 2                  | APC-2    | 90.90.11.154   | 0.0.0.0           | 60                        | connected      |  |

Figure 146. Clustering window

Configure a clustering configuration value in the <Information> item and then click the <Apply> button to apply. The Clustering Members item shows all the clustering members. Click the <Add> or <Delete> button to add or delete a clustering member.

The clustering addition window is shown below.

|                           |                    |
|---------------------------|--------------------|
| APC ID                    | 1                  |
| APC NAME                  | apc-1              |
| APC IP ADDRESS            | 90 . 90 . 11 . 153 |
| MULTICAST ADDRESS         | 0 . 0 . 0 . 0      |
| DB REFRESH INTERVAL (SEC) | 120                |

Figure 147. Clustering addition window

## 7.10 Limiting the Number of Connected Users

The W-EP wireless LAN system limits the number of wireless terminals connected to each AP. The limitation is per radio (2.4/5 GHz bandwidth) or WLAN for each AP.

### 7.10.1 Limiting Connections per Radio

#### Configuration using CLI

- 1) Go to configure mode of CLI.

```
APC# configure terminal
APC/configure#
```

- 2) Configure connection limitation.
  - [RADIO] max-associated-stations [MAX\_STATION] global: Configures connection limitation per wireless bandwidth. When you enter the 'global' parameter at the end, connection limitation is applied to all the APs.
  - [RADIO] max-associated-stations [MAX\_STATION] [TARGET] [AP\_ID]: Configures connection limitation to a specific AP.

| Parameter   | Description   |
|-------------|---|
| RADIO       | Wireless area to configure<br>[80211bg/80211a]<br>- 80211bg: 2.4 GHz area<br>- 80211a: 5 GHz area |
| MAX-STATION | Maximum number of wireless terminals that can be connected<br>(default: 127)                      |
| TARGET      | Configuration range<br>- AP: Index of an AP to configure<br>- Global: All APs connected to an APC |
| AP_ID       | AP ID (range: 1-500)  |

- 3) To check the configuration information, use the 'show 80211bg radio-config global' command.

### Configuration using Web UI

In the menu bar of <WEC Main window>, select <Configuration> and then select the <Radio> → <802.11a/n> or <802.11b/g/n> → <General> menu in the sub-menus.

Figure 148. Configuring connection limitation per radio

After configuring MAX CLIENT COUNTS, click the <Apply> button.

## 7.10.2 Connection Limitation per WLAN

### Configuration using CLI

To configure connection limitation per WLAN, execute the command as follows:

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

```
APC# configure terminal
APC/configure# wlan 1
APC/configure/wlan 1#
```

- 2) Disable the WLAN.

```
APC/configure/wlan 1# no enable
```

- 3) Configure connection limitation.

```
max-associated-stations [MAX-STATION]
```

| Parameter   | Description   |
|-------------|---|
| MAX-STATION | Maximum number of wireless terminals that can be connected (default: 127) |



- 4) Enable the WLAN.

```
APC/configure/wlan 1# enable
```

- 5) To check the configured connection limitation, use the ‘show wlan detail’ command.

### Configuration using Web UI

In the menu bar of <WEC Main window>, select <Configuration> and then select the <Radio> → <802.11a/n> or <802.11b/g/n> → <General> menu in the sub-menus.

The screenshot shows two configuration panels. The 'General' panel includes fields for BEACON PERIOD (TUS) set to 100, RTS THRESHOLD (BYTES) set to 2346, SHORT RETRY set to 4, LONG RETRY set to 10, FRAGMENTATION THRESHOLD (BYTES) set to 2346, TX MSDU LIFE TIME (TUS) set to 512, RX MSDU LIFE TIME (TUS) set to 512, MAX. CLIENT COUNTS set to 127, and CONTROLLED VOICE OPTIMIZATION with radio buttons for Enable and Disable (Disable is selected). The 'Data Rates' panel lists rates from 6 MBPS to 54 MBPS with dropdown menus for each, showing 'Basic' for 6, 12, 24, and 54 MBPS, and 'Supported' for 9, 18, 36, 48, and 54 MBPS.

The screenshot shows the 'Call Admission Control' panel. It includes a radio button for 'ADMISSION CONTROL' (Disable is selected), and input fields for 'MAX CALLS' set to 24, 'HANDOVER CALLS' set to 2, 'MINOR ALARM THRESHOLD' set to 0, and 'MAJOR ALARM THRESHOLD' set to 0.

Figure 149. Configuring connection limitation per WLAN

After configuring MAXIMUM CONNECTIONS, click the <Apply> button.

## 7.11 Voice Statistics and Communication Failure Detection

Because APC provides voice statistics and the WLAN-based communication failure detection function, you can easily know communication failure reason.

### 7.11.1 Voice Statistics Function

It provides the number of successful voice communication and call time. When the CAC function is enabled, the CAC statistics is also provided.

#### Configuration using CLI

Use the following command to check voice statistics.

```
APC# show 80211bg voip-stats ap 2
VoIP Stats
  Cumulative Number of Calls ..... 4
  Cumulative Time of Calls ..... 0:0:23
  Number of Active Calls ..... 2
CAC Stats
  Calls In Progress ..... 2
  Handover Calls In Progress ..... 0
  Calls Since AP Joined ..... 4
  Handover Calls Since AP Joined ..... 0
  Calls Rejected Since AP Joined ..... 0
  Handover Calls Rejected Since AP Joined ... 0
  Calls On Invite ..... 0
  Preferred Calls Received ..... 0
  Preferred Calls Accepted ..... 0
```

## Configuration using Web UI

In the menu bar of <WEC Main window>, select <Monitor> and then select the <Access Points> → <Radio> → <802.11a/n> or <802.11b/g/n> → AP menu in the sub-menus.

|                                  |                   |
|----------------------------------|-------------------|
| AP PROFILE NAME                  | ap_1              |
| AP NAME                          | AP_f4d9fb2369e0   |
| <b>Radio Info</b> (* : Fixed)    |                   |
| CHANNEL                          | 1                 |
| TX POWER (DBM)                   | 3                 |
| BASE MAC ADDRESS                 | f4:d9:fb:23:69:e0 |
| <b>VoIP Statistics</b>           |                   |
| CUMULATIVE NUMBER OF CALLS       |                   |
| CUMULATIVE TIME OF CALLS         | 0 sec             |
| <b>SIP CAC CALL STATISTICS</b>   |                   |
| VOICE CALLS IN PROGRESS          | 0                 |
| HANDOVER VOICE CALLS IN PROGRESS | 0                 |
| TOTAL VOICE CALLS                | 0                 |
| TOTAL HANDOVER CALLS             | 0                 |
| REJECTED VOICE CALLS             | 0                 |
| REJECTED HANDOVER CALLS          | 0                 |
| VOICE CALLS ON INVITE            | 0                 |
| <b>PREFERRED CALL STATISTICS</b> |                   |
| TOTAL RECEIVED CALLS             | 0                 |
| TOTAL ACCEPTED CALLS             | 0                 |

Figure 150. Voice statistics

## 7.11.2 Detecting WLAN-based Communication Failure

You can configure whether to detect WLAN-based communication failure.

### Configuration using CLI

- 1) Go to configure mode of CLI.

```
APC# configure terminal
APC/configure#
```

- 2) Enable or disable communication failure detection.
  - [no] call-fail-detect [WLAN\_ID]

| Parameter | Description            |
|-----------|------------------------|
| WLAN_ID   | WLAN ID (range: 1-240) |

- 3) To check the configured connection limitation information, use the 'show voip config [WLAN\_ID]' command.

### Configuration using Web UI

In the menu bar of <WEC Main window>, select <Configuration> and then select the <WLANs> menu in the sub-menus. Select a WLAN ID to change in the WLANs screen and go to the <Advanced> tab.

The screenshot shows the configuration page for a WLAN profile named 'wlan1'. The 'VOIP FAILURE DETECT' section is highlighted, and the 'Disable' radio button is selected. Other sections include 'Static Address Disallowed', 'DHCP Override', 'WMM', 'DTIM', and 'Station Idle Timeout'.

Figure 151. Detecting WLAN-based communication failure

After configuring the VOIP FAILURE DETECT item, click the <Apply> button.

## 7.12 Voice Signal and Media Monitoring

For voice call fault analysis, the APC provides VoIP wireless terminal, call information, event and RTP media voice quality statistics.

### 7.12.1 Checking Voice Related Wireless Information

#### Configuration using CLI

Execute the following command to check voice related fault analysis statistics.

- 1) Check the connection status of a voice wireless terminal.

```
WEC8500# show voice station summary
MAC Address      IP Address      Tel-no      AP  BSS      WLAN
Proto  Server IP      Reg          Call
-----  -
50:01:BB:FD:96:E1 10.10.10.5    9922       3   F4:D9:FB:24:C8:C2 1
SIP(UDP) 90.90.1.100 Registered Established
78:47:1D:C2:18:11 10.10.10.10   9907       3   F4:D9:FB:24:C8:D1 1
SIP(UDP) 90.90.1.100 Registered Not calling
WEC8500#
```

- 2) Check the connection status of an active call.

```
WEC8500# show voice active-call summary
MAC Address      IP Address      Tel-No      AP  BSS      WLAN
Caller   Callee   Dir Status   Dur(sec) Start Time  MOS
-----  -
C8:19:F7:70:89:04 10.10.10.65    9961       3   F4:D9:FB:24:C8:C2 1
9907      9961     In  Established 48   05-12 21:16:13 3.95
50:01:BB:FD:96:E1 10.10.10.5     9922       3   F4:D9:FB:24:C8:C2 1
9922      9950     Out Established 336  05-12 21:11:25 3.95
78:47:1D:C2:18:11 10.10.10.10    9907       3   F4:D9:FB:24:C8:D1 1
9907      9961     Out Established 48   05-12 21:16:13 3.77
-----  -
-----  -#
```

3) Check the information of a completed call.

```

WEC8500# show voice complete-call summary
CONN      Start Time      Dur  AP      SSID      MAC Address
Tel-no IPv4 Address  Port  Rat  MOS LQ/CQ/PQ  Pkt Cnt
=====
0 2013/05/11-17:24:23  26   1      uready Caller D4:88:90:1B:3C:E2
10.10.10.194  23143 GOOD 4.01/3.95/3.84  225,664
                               Callee 3C:8B:FE:2E:6F:6A
10.10.10.193  10617 POOR 2.31/2.17/2.90  221,708
-----
1 2013/05/11-17:25:16  10   1      uready Caller 3C:8B:FE:2E:6F:6A
10.10.10.193  10617 FAIR 3.57/3.11/3.63   90,300
                               Callee D4:88:90:1B:3C:E2
10.10.10.194  23143 GOOD 4.06/3.91/3.94   85,140
-----
2 2013/05/11-19:02:10  28   1      uready Caller D4:88:90:1B:3C:E2
10.10.10.194  23143 POOR 3.21/2.92/3.44  244,756
                               Callee 3C:8B:FE:2E:6F:6A
10.10.10.193  10617 POOR 1.97/1.66/2.68  240,800
-----

```

4) Check the voice signal related log.

```

WEC8500/configure# show voice sipmsg-log
Time          MAC Address      Msg Type      Dir
SRC IP        DST IP          AP    BSS           WLAN  Contents
-----
-----
2013-05-12 21:26:45  c8:19:f7:70:89:04  INVITE        SEND
10.10.10.65  90.90.1.100    3      f4:d9:fb:24:c8:c2  1  F:9922, T:995
0, RTP:10.10.10.65:21120
2013-05-12 21:26:44  c8:19:f7:70:89:04  200(REGISTER)  RECV
90.90.1.100  10.10.10.65    3      f4:d9:fb:24:c8:c2  1  F:9961, T:996
1, Expire:600
2013-05-12 21:26:44  c8:19:f7:70:89:04  REGISTER       SEND
10.10.10.65  90.90.1.100    3      f4:d9:fb:24:c8:c2  1  F:9961, T:996
1, Expire:600
2013-05-12 21:26:44  c8:19:f7:70:89:04  401(REGISTER)  RECV
90.90.1.100  10.10.10.65    3      f4:d9:fb:24:c8:c2  1  F:9961, T:996
1, Expire:0
2013-05-12 21:26:44  c8:19:f7:70:89:04  REGISTER       SEND
10.10.10.65  90.90.1.100    3      f4:d9:fb:24:c8:c2  1  F:9961, T:996
1, Expire:

```

5) Check a WLAN event related to a voice.

```

WEC8500# show voice event
Event Type          MAC Address      AP   BSS              WLAN
Time                Contents
-----
-----
Deassoc During Call 78:47:1D:C2:18:11 3    F4:D9:FB:24:C8:D1 1
2013-05-12 21:22:04 wlan disconnected in AP(3) BSSID(f4:d9:fb:24:c8:d1)
during call caller(9907)      → callee(9950) duration(5)sec
CallStop            C8:19:F7:70:89:04 3    F4:D9:FB:24:C8:C2 1
2013-05-12 21:22:04 caller(9922) → callee(9950) duration(62)sec
CallConnect         78:47:1D:C2:18:11 3    F4:D9:FB:24:C8:D1 1
2013-05-12 21:22:01 caller(9907) → callee(9950)
CallSetup           78:47:1D:C2:18:11 3    F4:D9:FB:24:C8:D1 1
2013-05-12 21:21:59 caller(9907) → callee(9950)
CallStop            78:47:1D:C2:18:11 3    F4:D9:FB:24:C8:D1 1
2013-05-12 21:21:47 caller(9907) → callee(9950) duration(6)sec
CallConnect         78:47:1D:C2:18:11 3    F4:D9:FB:24:C8:D1 1
2013-05-12 21:21:47 caller(9907) → callee(9950)
    
```

6) Check the voice related statistics.

```

WEC8500# show voice statistics radio

RADIO (5G) Voice Statistis
-----
Type      Total  Success  Failed  Active  UpstreamTime  Downstream
          Calls Call    Call   Call   MOS Jitter Delay  MOS Jitter Delay
-----
Total          8      6      0      2 0.0      0      0 0.0      0      0
5 Min          0      0      0      0 0.0      0      0 0.0      0      0
15 Min         0      0      0      0 0.0      0      0 0.0      0      0
1 Hour         0      0      0      0 0.0      0      0 0.0      0      0
1 Day          8      6      0      2 0.0      0      0 0.0      0      0

RADIO (2.4G) Voice Statistis
-----
Type      Total  Success  Failed  Active  UpstreamTime  Downstream
          Calls Call    Call   Call   MOS Jitter Delay  MOS Jitter Delay
-----
Total          3      3      0      0 0.0      0      0 0.0      0      0
5 Min          0      0      0      0 0.0      0      0 0.0      0      0
15 Min         0      0      0      0 0.0      0      0 0.0      0      0
1 Hour         0      0      0      0 0.0      0      0 0.0      0      0
1 Day          3      3      0      0 0.0      0      0 0.0      0      0
WEC8500# show voice statistics wlan 1
    
```

```

WLAN (A_toanyone_1) Voice Statistis
-----
Type      Total  Success Failed Active  UpstreamTime      Downstream
          Calls Call   Call  Call  MOS Jitter Delay  MOS Jitter Delay
-----
Total      11    9     0    2 0.0  0    0 0.0    0    0
5 Min      0     0     0    0 0.0  0    0 0.0    0    0
15 Min     0     0     0    0 0.0  0    0 0.0    0    0
1 Hour     0     0     0    0 0.0  0    0 0.0    0    0
1 Day     11    9     0    2 0.0  0    0 0.0    0    0

WEC8500# show voice statistics device

DEVICE ( Model Name:SHV-E210L, OS Ver:4.1.1 Build Ver:E210LKLJLK1 )
Voice Statistis
-----
-----
Type      Total  Success Failed Active  UpstreamTime      Downstream
          Calls Call   Call  Call  MOS Jitter Delay  MOS Jitter Delay
-----
Total      8     6     0    2 0.0  0    0 0.0    0    0
5 Min      0     0     0    0 0.0  0    0 0.0    0    0
15 Min     0     0     0    0 0.0  0    0 0.0    0    0
1 Hour     0     0     0    0 0.0  0    0 0.0    0    0
1 Day     8     6     0    2 0.0  0    0 0.0    0    0
WEC8500#
    
```

### Configuration using Web UI

- 1) Check the connection status of a voice wireless terminal.  
 In the menu bar of <WEC Main window>, select <Monitor> and then select the <VoIP Call> → <VoIP Stations> <Active Calls> <Complete Calls> menu in the sub-menus.

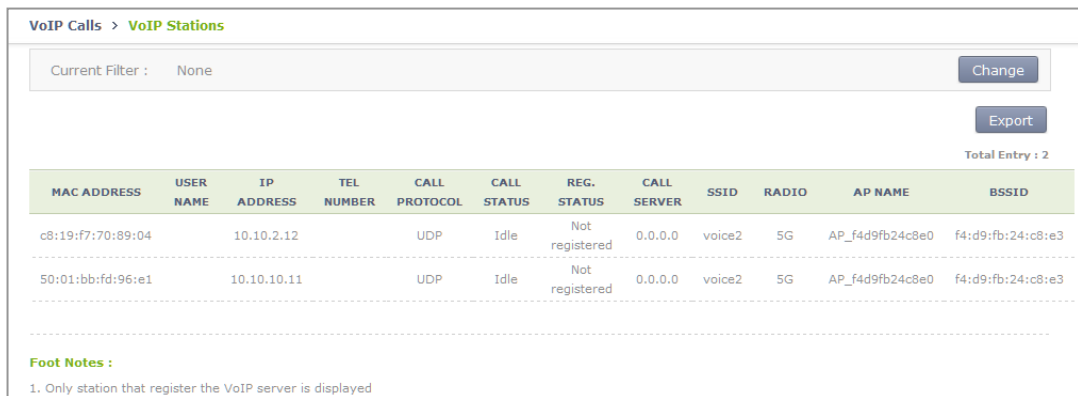


Figure 152. VoIP Stations Retrieval Screen



- 2) Check the connection status of an active call.  
 In the menu bar of <WEC Main window>, select <Monitor> and then select the <VoIP Call> → <Active Calls> menu in the sub-menus.

| MAC ADDRESS       | USER NAME | IP ADDRESS | CALLER | CALLEE | AP NAME         | START TIME | DIRECTION | MOS(UP) <sup>1</sup> | MOS(DOWN) <sup>1</sup> |
|-------------------|-----------|------------|--------|--------|-----------------|------------|-----------|----------------------|------------------------|
| c8:19:f7:70:89:04 |           | 10.10.2.12 | 9922   | 9961   | AP_f4d9fb24c8e0 | 13:43:36   | Inbound   | 2.17                 | 4.2                    |

Total Entry : 1

Figure 153. Active Call Retrieval Screen

- 3) Check the information of a completed call.  
 In the menu bar of <WEC Main window>, select <Monitor> and then select the <VoIP Call> → <Complete Calls> menu in the sub-menus.

| MAC ADDRESS       | USER NAME | IP ADDRESS  | CALLER | CALLEE | AP NAME         | START TIME     | END TIME       | MOS(UP) | MOS(DOWN) |
|-------------------|-----------|-------------|--------|--------|-----------------|----------------|----------------|---------|-----------|
| c8:19:f7:70:89:04 |           | 30.30.30.11 | 9961   | 9950   | AP_f4d9fb243341 | 09-06 23:47:01 | 09-06 23:47:16 | 2.87    | 0         |
| 28:cc:01:53:4c:b7 |           | 30.30.30.10 | 9955   | 9950   | AP_f4d9fb243341 | 09-06 23:47:58 | 09-06 23:48:15 | 1.84    | 0         |
| c8:19:f7:70:89:04 |           | 30.30.30.11 | 9961   | 9955   | AP_f4d9fb243341 | 09-06 23:51:48 | 09-06 23:51:52 | 4.18    | 4.18      |
| 28:cc:01:53:4c:b7 |           | 30.30.30.10 | 9961   | 9955   | AP_f4d9fb243341 | 09-06 23:51:48 | 09-06 23:51:52 | 4.18    | 4.18      |

Total Entry : 4

Figure 154. Complete Calls Retrieval Screen

## 7.12.2 Checking Voice Related Quality Information

### Configuration using CLI

Execute the following command to check the voice related quality analysis (Voice Quality Monitoring) information.

- 1) Operator can check the voice quality analysis information of a wireless terminal that has an active call.

```
WEC8500# show voice vqm current-stats brief
=====
[CONN-740 Start Time=2013/7/19.14:47:27, Duration=47 sec(s)
  Call-ID[f03c77b50564418855587192e12b889d <-> ca371fce-6e10-401a-
9a4e-dd53678804c6@ug1.scm.com] Session id :0
  SRC [I/F=ge4 Phone-No=9960, IP=20.20.20.30:22458]
  DST [I/F=ge4 Phone-No=9910, IP=20.20.20.25:25407]
  RTP Flow Quality Metrics:
  [Flow-1] DIR=Forward Quality Ratings=Poor [MOS-LQ=3.06, MOS-
CQ=2.82, MOS-PQ=3.35]
  RTP Flow Quality Metrics:
  [Flow-2] DIR=Reverse Quality Ratings=Good [MOS-LQ=4.04, MOS-
CQ=3.95, MOS-PQ=3.89]
WEC8500#
```

- 2) Operator can check the voice quality analysis information of a wireless terminal that has a completed call.

```
WEC8500# show voice vqm history-stats brief
=====
[CONN-1 Start Time=2013/7/19.14:47:27, Duration=75 sec(s)
Station Mac [78:47:1d:c5:4c:85: <->fc:a1:3e:47:59:e7:] startBssid
[f4:d9:fb:23:66:10<->f4:d9:fb:23:66:10] endBssid
[f4:d9:fb:23:66:10<->f4:d9:fb:23:66:10]
ssid [Ajay_2_2_4G<->Ajay_2_2_4G] Direction [1<->2] wlanId [2<->2]
startApId [2<->2] endApId [2<->2]
Session id :0
SRC [I/F=ge4 Call-ID=f03c77b50564418855587192e12b889d Phone-No=9960,
IP=20.20.20.30:22458]
DST [I/F=ge4 Call-ID=ca371fce-6e10-401a-9a4e-dd53678804c6@ug1.scm.com
Phone-No=9910, IP=20.20.20.25:25407]
RTP Flow Quality Metrics:
[Flow-1] DIR==Forward Quality Ratings=Poor [MOS-LQ=2.21, MOS-CQ=1.33,
MOS-PQ=2.84]
RTP Flow Quality Metrics:
[Flow-2] DIR==Reverse Quality Ratings=Poor [MOS-LQ=2.46, MOS-CQ=1.50,
MOS-PQ=3.00]
=====
[CONN-2 Start Time=2013/7/19.14:52:36, Duration=30 sec(s)
Station Mac [fc:a1:3e:47:59:e7: <->78:47:1d:c5:4c:85:] startBssid
[f4:d9:fb:23:66:10<->f4:d9:fb:23:66:10] endBssid
[f4:d9:fb:23:66:10<->f4:d9:fb:23:66:10]
```

```

ssid [Ajay_2_2_4G↔Ajay_2_2_4G] Direction [1↔2] wlanId [2↔2]
startApId [2↔2] endApId [2↔2]
Session id :1
SRC [I/F=ge4 Call-ID=035be38a40032eb8edb0b94e944d58d4 Phone-No=9910,
IP=20.20.20.25:25407]
DST [I/F=ge4 Call-ID=917a913e-83ae-497f-ad84-bf0ee80edf36@ug1.scm.com
Phone-No=9960, IP=20.20.20.30:22458]
RTP Flow Quality Metrics:
[Flow-1] DIR==Forward Quality Ratings=Fair [MOS-LQ=3.73, MOS-CQ=3.65,
MOS-PQ=3.72]
RTP Flow Quality Metrics:
[Flow-2] DIR==Reverse Quality Ratings=Poor [MOS-LQ=3.30, MOS-CQ=3.06,
MOS-PQ=3.49]

=====
[CONN-3 Start Time=2013/7/19.14:53:12, Duration=24 sec(s)
Station Mac [78:47:1d:c5:4c:85:↔fc:a1:3e:47:59:e7:] startBssid
[f4:d9:fb:23:66:10↔f4:d9:fb:23:66:10] endBssid
[f4:d9:fb:23:66:10↔f4:d9:fb:23:66:10]
ssid [Ajay_2_2_4G↔Ajay_2_2_4G] Direction [1↔2] wlanId [2↔2]
startApId [2↔2] endApId [2↔2]
Session id :2
SRC [I/F=ge4 Call-ID=a47241e5f5d3d6b7f942d0aaeddbd8ef Phone-No=9960,
IP=20.20.20.30:22458]
DST [I/F=ge4 Call-ID=65031276-a4dd-4b1c-a718-4ed3188e44a5@ug1.scm.com
Phone-No=9910, IP=20.20.20.25:25407]
RTP Flow Quality Metrics:
[Flow-1] DIR==Forward Quality Ratings=Poor [MOS-LQ=3.25, MOS-CQ=2.96,
MOS-PQ=3.47]
RTP Flow Quality Metrics:
[Flow-2] DIR==Reverse Quality Ratings=Fair [MOS-LQ=3.65, MOS-CQ=3.57,
MOS-PQ=3.68]

WEC8500#

```

### 3) Operator can check the call statistics information.

```

WEC8500# show voice vqm summary-stats
=====
VQM Summary Stats for last YEAR:0 MONTH:0 DAY:0 0 HR:26 MN:44 SEC
Calls Active          = 0
Calls Terminated    = 3
Flows Quality Summary (Total/Good/Fair/Poor) = 6/0/2/4
Listening Call Quality (MOS) min/ave/max = 2.21/3.10/3.73
Conversational Call Quality (MOS) min/ave/max = 1.33/2.68/3.65
P.862 Raw Quality (MOS) min/ave/max = 2.84/3.36/3.72
Listening Call Quality (R-factor) min/ave/max = 45/63/77
Conversational Call Quality (R-factor) min/ave/max = 24/53/75
Packet Delay Variation (msec) ave/max = 13/25
Packet Received/Processed/Lost/Discarded = 12980/12909/93/1154
Packet Duplicate/OutOfseq = 0/135
Packet Error Stats: Ignored/Errors = 71/1
System Error Stats: Resource Unavail/Filter Mismatch/Limit Exceeded =
0/0/0
Voice Quality Alerts: Low R-factor/Excess Loss/Excess Delay/Upload =
1/6/5/0

```

```

Upload Count      = 1141
Upload Ok Count   = 0
Upload Fail Count = 0
Requested Count   = 1141

```

```
WEC8500#
```

4) Operator can check the alarm information that occurs during call.

```

WEC8500# show voice vqm alarms brief
=====
VQM ActiveRfactor/ActivePktLoss/ActivePktDly/ActiveMos = 1/1/1/1
VQM QualityThresh/LossThresh/DelayThresh/MOSThresh = 50/50/195/35
ALARMS REPORTED :
  Src Call Id = f03c77b50564418855587192e12b889d  Dst Call Id =
ca371fce-6e10-401a-9a4e-dd53678804c6@ugl.scm.com  Session = 0
  Direction :Forward Type : [Low-Quality]          [Excessive Burst]
[Excessive delay]
  Direction :Reverse Type : [Excessive Burst]      [Excessive delay]
ALARMS REPORTED :
  Src Call Id = 035be38a40032eb8edb0b94e944d58d4  Dst Call Id =
917a913e-83ae-497f-ad84-bf0ee80edf36@ugl.scm.com  Session = 1
  Direction :Forward Type : [Excessive Burst]
  Direction :Reverse Type : [Excessive Burst]      [Excessive delay]
ALARMS REPORTED :
  Src Call Id = a47241e5f5d3d6b7f942d0aaeddbd8ef  Dst Call Id =
65031276-a4dd-4b1c-a718-4ed3188e44a5@ugl.scm.com  Session = 2
  Direction :Forward Type : [Excessive Burst]
  Direction :Reverse Type : [Excessive Burst]

```

```
WEC8500#
```

## 7.13 Multicast Stream Admission Control

The multicast stream admission control is provided to protect the currently running multicast streams from new streams that flow into the wireless LAN. When the maximum allowed usage of streams or channels per radio is reached, the APC does not allow any additional streams.

### 7.13.1 Configuring Admission Control

The multicast stream admission control function configures the maximum number of streams or the maximum usage of channels to protect the currently running multicast streams. It denies multicast streaming requests once the maximum number of streams or the maximum usage of channels is reached. You can set the number of marginal streams or the usage of channels with consideration for handover.

#### Configuration using CLI

To set multicast stream admission control, execute the following commands:

- 1) Configuration mode of CLI → enter the multicast stream admission control mode of the desired wireless section.

```
APC# configure terminal
APC/configure# [80211a/80211bg] msac
APC/configure/80211a/msac#
```

- 2) Enable or disable the multicast stream admission control function.
  - acm [MODE]

| Parameter | Description   |
|-----------|---|
| Mode      | Whether or not to use the multicast stream admission control (enable/disable)<br>- enable: Enable<br>- disable: Disable |

- 3) Configure the maximum allowed number of streams.
  - max-streams [VALUE]

| Parameter | Description                       |
|-----------|-----------------------------------|
| VALUE     | Maximum allowed number of streams |

4) Set the maximum allowed usage of channels.

- max-chan-util [VALUE]

| Parameter | Description                       |
|-----------|-----------------------------------|
| VALUE     | Maximum allowed usage of channels |

5) Configure the number of marginal streams with consideration for handover.

- reserved-ho-streams [VALUE]

| Parameter | Description  |
|-----------|--|
| VALUE     | Number of marginal streams with consideration for handover |

6) Configure the usage of marginal channels with consideration for handover.

- reserved-ho-chan-util [VALUE]

| Parameter | Description  |
|-----------|--|
| VALUE     | Usage of marginal channels with consideration for handover |

7) You can view the information you configured by using the ‘show[80211a | 80211bg] msac configuration’ command.

### Configuration using Web UI

From the menu bar of <WEC Main Window>, select <Configuration> and then select <Radio> → <802.11a/n> or <802.11b/g/n> → <Admission Control> in the submenus.

**Multicast Stream Admission Control**

|   |   |
|---|---|
| <b>ADMISSION CONTROL</b>                | <input type="radio"/> Enable <input checked="" type="radio"/> Disable             |
| <b>METHOD</b>                           | <input checked="" type="radio"/> Static <input type="radio"/> Channel Utilization |
| <b>MAX STREAMS</b>                      | <input type="text" value="20"/>   |
| <b>HANDOVER STREAMS</b>                 | <input type="text" value="0"/>  |
| <b>MAX CHANNEL UTILIZATION (%)</b>      | <input type="text" value="75"/>   |
| <b>HANDOVER CHANNEL UTILIZATION (%)</b> | <input type="text" value="0"/>  |

Figure 155. 802.11a/n Admission Control Configuration Window

After configuring the items below in the Multicast Stream Admission Control, click the <Apply> button.

- **ADMISSION CONTROL:** Configure the CAC function
- **METHOD:** Select the method of admission control
- **MAX STREAMS:** Maximum allowed number of streams (range: 1-20)
- **HANDOVER STREAMS:** Number of marginal streams with consideration for handover (range: 0-6)  
The maximum allowed number of streams becomes MAX STREAMS-HANDOVER STREAMS.
- **MAX CHANNEL UTILIZATION (%):** Maximum allowed usage of channels (range: 5-85)
- **HANDOVER CHANNEL UTILIZATION (%):** Usage of marginal channels with consideration for handover (range: 0-30)

## 7.14 Wi-Fi Band Steering

This is a function of leading a UE which supports the Dual Band (2.4/5.0 GHz) to be connected to 2.4 GHz or 5.0 GHz to secure more stabilized performance if many resources are used in a specific radio.

### 7.14.1 Activating Band Steering Function

You can activate the Band Steering function by WLAN and the 5.0 GHz band steering is set as default upon Band Steering On.

#### Configuration using CLI

To activate or deactivate the Band Steering function, execute the command as follows:

- 1) Configure a specific WLAN which requires the steering band.

```
APC# configure terminal
APC/configure# wlan 1
APC/configure/wlan 1#
```

- 2) Activate or deactivate the Band Steering function.
  - band-steering [MODE]

| Parameter | Description   |
|-----------|---|
| Mode      | Whether to configure the Band Steering function<br>- enable: Setting<br>- disable: Release (by default) |

```
WEC8500/configure/wlan 1# band-steering enable
WLAN (1) band steering is On (5-GHz preferred)
WEC8500/configure/wlan 1# no band-steering enable
WLAN (1) band steering is Off
```

- 3) Select a steering band.
- band-steering [VALUE]

| Parameter | Description              |
|-----------|--------------------------|
| VALUE     | 1 (5.0 GHz), 2 (2.4 GHz) |

```
WEC8500/configure/wlan 1# band-steering 1
WLAN (1) band steering is On (5-GHz preferred)
WEC8500/configure/wlan 1# band-steering 2
WLAN (1) band steering is On (2.4-GHz preferred)
```

- 4) Add an entry to the dual band station database.
- band-steering add-station [MAC]

| Parameter | Description         |
|-----------|---------------------|
| MAC       | Station MAC Address |

```
WEC8500/configure/wlan 1# band-steering add-station 00:00:00:00:00:01
WLAN(1): add station(00:00:00:00:00:01), prefer a band(5-GHz) are set
```

- 5) Delete an entry from the dual band station database.
- band-steering delete-station [MAC]

| Parameter | Description         |
|-----------|---------------------|
| MAC       | Station MAC Address |

```
WEC8500/configure/wlan 1# band-steering delete-station
00:00:00:00:00:01
Deleted...
```

- 6) Delete all entries from the dual band station database.
- band-steering delete-all

```
WEC8500/configure/wlan 1# band-steering delete-all
WLAN(1): all stations are deleted...
```



## Configuration using Web UI

WLAN > Advanced > BAND STEERING [Disable][2.4 GHz preferred][5 GHz preferred]

The screenshot shows the Samsung Wireless Enterprise Web UI. The navigation path is WLAN > WLANs > Advanced. The configuration page is divided into several sections:

- General:** PROFILE NAME: wlan1
- Security:**
  - ACL RULE: [dropdown]
  - STATIC ADDRESS DISALLOWED:  Enable  Disable
  - DHCP OVERRIDE:  Enable  Disable
  - DHCP SERVER: [0] [0] [0] [0]
- Advanced:**
  - WMM:  Enable  Disable
  - DTIM: 1
  - STATION IDLE TIMEOUT (SEC): 300
  - VOIP FAILURE DETECT:  Enable  Disable
  - BAND STEERING: [5GHz preferred] (dropdown menu is open showing options: 5GHz preferred, Disabled, 2.4GHz preferred, 5GHz preferred)

Buttons for 'Back', 'Apply', and 'Apply' are visible throughout the configuration area.

Figure 156. Band Steering Function On/Off and Band Setting

## 7.15 Wi-Fi Load Balancing

The load balancing function in the AP Controller is a function of load balancing by transferring the message that the connections to wireless stations among APs have been permitted or cannot be permitted based on the set threshold value and then controlling the number of stations connected to APs.

### 7.15.1 Activating Load Balancing Function

The setting can be made based on the WLAN and it is possible to check the load balancing function among APs for stations attempting at association to APs with the threshold value and the maximum denial count value based on station count.

#### Configuration using CLI

For the load balancing function, execute the command as follows:

- 1) Configure a specific WLAN which requires load balancing.

```
APC# configure terminal
APC/configure# wlan 1
APC/configure/wlan 1#
```

- 2) Activate or deactivate the Load Balancing function.
  - load-balancing [MODE]

| Parameter | Description  |
|-----------|--|
| Mode      | Whether to configure the Load Balancing function<br>- enable: Setting<br>- disable: Release (by default) |

```
WEC8500/configure/wlan 1# load-balancing enable
WLAN (1), Wi-Fi Load Balancing: Enable
WEC8500/configure/wlan 1# no load-balancing enable
WLAN (1), Wi-Fi Load Balancing: Disable
```

- 3) Configure the load balancing station count threshold value.
  - load-balancing threshold\_station [VALUE]

| Parameter | Description            |
|-----------|------------------------|
| VALUE     | 1-127 (127 by default) |

```
WEC8500/configure/wlan 1# load-balancing threshold_station 100
Wi-Fi Load Balancing threshold: 100 stations
```

- 4) Configure the maximum denial count value.
- load-balancing denial\_count [VALUE]

| Parameter | Description         |
|-----------|---------------------|
| VALUE     | 1-10 (2 by default) |

```
WEC8500/configure/wlan 1# load-balancing denial_count 4
Wi-Fi Load Balancing MAX denial count: 4
```

### Configuration using Web UI

**Configure WLAN > Advanced > LOAD BALANCING[Enable] [Disable]**

**WLAN > Advanced > THRESHOLD[Value]**

**WLAN > Advanced > MAXIMUM DENIAL COUNT[Value].**

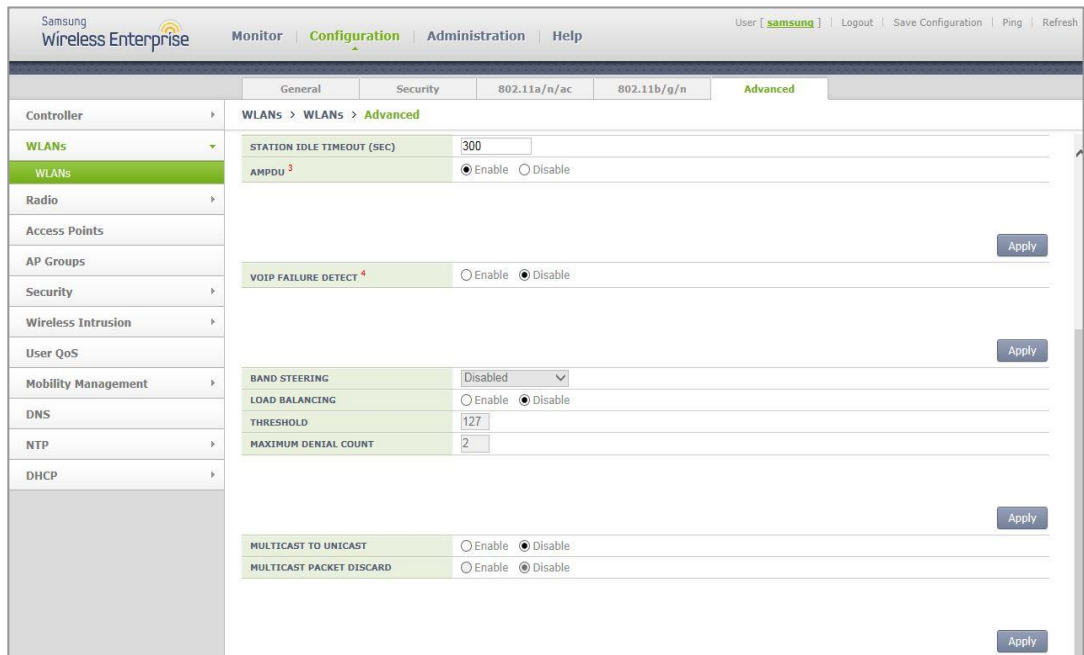


Figure 157. Configuring Load Balancing Function

## 7.16 Station-based Adaptive Load Balancing

Station-based Adaptive Load Balancing performs load balancing based on the number of stations and RSSI in an individual radio unit of the AP group. Configuring Basic Function and Setting Load Balancing Parameters of AP Group are available and the settings of the load balancing parameters in individual APs are available to apply a different value set only for a specific AP.

### 7.16.1 Basic Setting of Station-based Adaptive Load Balancing

Station-based Adaptive Load Balancing operates only when it is enabled in the setting of the basic functions and configures options applied to the overall function operation.

#### Configuration using CLI

To configure the basic function, execute the commands as follows:

- 1) Go to the configure → load-balancing configuration mode of CLI.

```
APC# configure terminal
APC/configure# load-balancing
APC/configure/load-balancing#
```

- 2) Activate the Station-based Adaptive Load Balancing function.
  - enable
- 3) If a function of distributing stations uniformly among APs is necessary, activate the Active Load Balancing function (Default: no active).
  - active
- 4) To activate the Active Load Balancing function, set up the interval for attempting to distribute uniformly.
  - interval [NUMBER]

| Parameter | Description   |
|-----------|---|
| NUMBER    | Interval for performing active load balancing (sec) |

- 5) To allow load balancing among APs which use the same channel, set the following option (Default: no allow-channel):
  - allow-channel

- 6) To calibrate the RSSI value depending on types of stations, the calibration value must be set.
- calibration mobile [NUMBER]
  - calibration pc [NUMBER]
  - calibration others [NUMBER]

| Parameter | Description   |
|-----------|---|
| NUMBER    | RSSI calibration value (-dbm)<br>- Default value: 0 dbm |

- 7) To exclude stations where the traffic occurs from load balancing, the following option must be set (Default: no idle-station):
- idle-station

## 7.16.2 Setting AP Group Parameter

Station-based Adaptive Load Balancing must set operating parameters to the radio of the corresponding AP group because it operates in a radio unit of the AP group.

### Configuration using CLI

To set AP group parameters, execute the command as follows:

- 1) Go to the load-balancing configuration mode in configure → AP Group of CLI.

```
APC# configure terminal
APC/configure# ap-group lb
APC/configure/ap-group lb# load-balancing
APC/configure/ap-group lb/load-balancing#
```

- 2) Go to the radio to perform the Station-based Adaptive Load Balancing function.

```
APC/configure/ap-group lb/load-balancing# radio 1
APC/configure/ap-group lb/load-balancing/radio 1#
```

- 3) Activate load balancing in the corresponding radio.
- enable
- 4) Set the interval to attempt at the Load Balancing function.
- interval [NUMBER]

| Parameter | Description                                  |
|-----------|--|
| NUMBER    | Interval for performing load balancing (sec) |

- 5) Set the station threshold to perform the Load Balancing function.
- threshold [NUMBER]

| Parameter | Description   |
|-----------|---|
| NUMBER    | Station threshold as the standard for the performance of load balancing |

- 6) Set the time of blocking the reconnection after the load of the station is now balanced.
- kickout-timeout [NUMBER]

| Parameter | Description                          |
|-----------|--------------------------------------|
| NUMBER    | Reconnection limit time (0~100 sec.) |

- 7) To lead the station which performs load balancing to connect to a specific AP, set the probe response limit time to other APs.
- no-probe-timeout [NUMBER]

| Parameter | Description                            |
|-----------|--|
| NUMBER    | Probe response limit time (0~100 sec.) |

- 8) The rssi-high value is a criterion for excluding candidates for load balancing to be selected. The station with the RSSI value higher than the set value does not attempt at load balancing (In case of the active mode, N/A).
- rssi-high [NUMBER]

| Parameter | Description                       |
|-----------|-----------------------------------|
| NUMBER    | RSSI reference value (-100~0 dbm) |

- 9) The rssi-low value is a criterion for selecting a sticky station. The station with the RSSI value lower than the set value always attempts at load balancing.
- rssi-low [NUMBER]

| Parameter | Description                       |
|-----------|-----------------------------------|
| NUMBER    | RSSI reference value (-100~0 dbm) |

### 7.16.3 Setting AP Parameters

Station-based Adaptive Load Balancing operates as the default value of the setting of the AP group but it is possible to set other parameter value to an individual AP. Because it operates in a radio unit, the parameters to change must be set to the individual radio of the corresponding AP must be set.

#### Configuration using CLI

To set AP parameters, execute the command as follows:

- 1) Go to the load-balancing configuration mode in configure → AP of CLI.

```
APC# configure terminal
APC/configure# ap ap_1
APC/configure/ap ap_1# load-balancing
APC/configure/ap ap_1/load-balancing#
```

- 2) Go to the radio to perform the Station-based Adaptive Load Balancing function.

```
APC/configure/ap ap_1/load-balancing# radio 1
APC/configure/ap ap_1/load-balancing/radio 1#
```

- 3) Activate load balancing in the corresponding radio.
  - enable
- 4) Set the station threshold to perform the Load Balancing function.
  - interval [NUMBER]

| Parameter | Description                                  |
|-----------|--|
| NUMBER    | Interval for performing load balancing (sec) |

- 5) Set the station threshold to perform the Load Balancing function.
  - threshold [NUMBER]

| Parameter | Description   |
|-----------|---|
| NUMBER    | Station threshold as the standard for the performance of load balancing |

- 6) Set the time of blocking the reconnection after the load of the station is now balanced.
- kickout-timeout [NUMBER]

| Parameter | Description                          |
|-----------|--------------------------------------|
| NUMBER    | Reconnection limit time (0~100 sec.) |

- 7) To lead the station which performs load balancing to connect to a specific AP, set the probe response limit time to other APs.
- no-probe-timeout [NUMBER]

| Parameter | Description                            |
|-----------|--|
| NUMBER    | Probe response limit time (0~100 sec.) |

- 8) The rssi-high value is a criterion for excluding candidates for load balancing to be selected. The station with the RSSI value higher than the set value does not attempt at load balancing (In case of the active mode, N/A).
- rssi-high [NUMBER]

| Parameter | Description                            |
|-----------|--|
| NUMBER    | Probe response limit time (0~100 sec.) |

- 9) The rssi-high value is a criterion for excluding candidates for load balancing to be selected. The station with the RSSI value higher than the set value does not attempt at load balancing (In case of the active mode, N/A).
- rssi-low [NUMBER]

| Parameter | Description                       |
|-----------|-----------------------------------|
| NUMBER    | RSSI reference value (-100~0 dbm) |



# CHAPTER 8. Security

The W-EP wireless LAN system supports the security function, required in a wire/wireless network environment, such as RADIUS server interoperation function, system user management, guest connection service, unauthorized AP/terminal detection and simple blocking function, firewall, access control (ACL), etc.

In this chapter, how to configure various security functions supported in the system is described.

## 8.1 RADIUS Server Configuration

The W-EP wireless LAN system provides the security and authentication function by interoperating with an external RADIUS server. The WEC8050 also provides the internal RADIUS server function.

### 8.1.1 External RADIUS Server

The W-EP wireless LAN system provides the security and authentication function by interoperating with an external RADIUS server. Follow the below procedure to interoperate with a RADIUS server.

#### 8.1.1.1 Basic Settings

The basic steps for configuring a RADIUS server are as follows:

##### Configuration using CLI

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

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

- 2) Configure the IP address of a RADIUS server.

```
WEC8500/configure/security/radius 1# serverIp [IP_ADDRESS]
```

| Parameter  | Description                       |
|------------|-----------------------------------|
| IP_ADDRESS | The IP address of a RADIUS server |

- 3) Configure the key of a RADIUS server.

```
WEC8500/configure/security/radius 1# secret [KEY_TYPE] [KEY_STRING]
```

| Parameter  | Description   |
|------------|---|
| KEY_TYPE   | RADIUS server key input format<br>- ASCII: ASCII character string<br>- HEX: Hexadecimal value |
| KEY_STRING | RADIUS server key   |

- 4) Enable the accounting function of a RADIUS server and configure the port number.

```
WEC8500/configure/security/radius 1# acct [PORT_NUMBER]
```

| Parameter   | Description  |
|-------------|--|
| PORT_NUMBER | Accounting port number of a RADIUS server<br>(range: 1-65535, default: 1813) |

- 5) Configure the authentication port number of a RADIUS server.

```
WEC8500/configure/security/radius 1# auth [PORT_NUMBER]
```

| Parameter   | Description  |
|-------------|--|
| PORT_NUMBER | Accounting port number of a RADIUS server<br>(range: 1-65535, default: 1812) |

- 6) Configure the items related to retransmissions in RADIUS communications. You can use default values without changing configuration.

```
WEC8500/configure/security/radius 1# retransmit-interval  
[RETRY_INTERVAL]  
WEC8500/configure/security/radius 1# retransmit-count [RETRY_COUNT]  
WEC8500/configure/security/radius 1# fo-retransmit-count  
[FO_RETRY_COUNT]
```

| Parameter      | Description  |
|----------------|--|
| RETRY_INTERVAL | Retransmission interval for a RADIUS message<br>(unit: seconds, range: 1-60, default value: 2)   |
| RETRY_COUNT    | Maximum retransmission count of a RADIUS message<br>(range: 1-20, default value: 10)   |
| FO_RETRY_COUNT | Maximum retransmission count of a RADIUS message before<br>a RADIUS server failover is attempted<br>Must smaller than the RETRY_COUNT value (range: 1-10,<br>default value: 3) |

- 7) Exit RADIUS server configuration and security configuration mode.

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

- 8) To check the configuration information, use the ‘show security radius-server summary’ command.

### Configuration using Web UI

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

If you click the <Add> button in the RADIUS initial window, you can add a RADIUS server.

The server addition window is shown below.

|                               |  |
|-------------------------------|--|
| INDEX                         | 1  |
| TYPE                          | Auth/Acct  |
| IP ADDRESS                    | 90 . 90 . 7 . 207  |
| SHARED SECRET FORMAT          | <input checked="" type="radio"/> ASCII <input type="radio"/> HEX |
| SHARED SECRET                 | <input type="password" value="....."/>                           |
| CONFIRM SHARED SECRET         | <input type="password" value="....."/>                           |
| AUTH PORT NUMBER              | 1812   |
| ACCT PORT NUMBER              | 1813   |
| RETRANSMIT INTERVAL (SECONDS) | 2  |
| TOTAL RETRANSMIT COUNT        | 10   |
| RETRANSMIT COUNT FAILOVER     | 3  |

Figure 158. RADIUS server configuration

| Item                      | Description   |
|---------------------------|---|
| INDEX                     | ID that distinguishes RADIUS server configurations  |
| TYPE                      | Selects the type of the RADIUS server<br>- Auth: Performs authentication<br>- Acct: Performs accounting<br>- Auth/Acct: Performs authentication and accounting                    |
| IP ADDRESS                | IP address of the RADIUS server   |
| SHARED SECRET FORMAT      | Key input format for communications with the RADIUS server<br>- ASCII: ASCII strings<br>- HEX: Hexadecimal values   |
| SHARED SECRET             | Key for RADIUS server communications  |
| CONFIRM SHARED SECRET     | Re-enters the key for RADIUS server communications for confirmation   |
| AUTH PORT NUMBER          | Number of the communication port for RADIUS server authentication<br>(range: 1-65,535, default value: 1,812)  |
| ACCT PORT NUMBER          | Number of the communication port for RADIUS server accounting<br>(range: 1-65,535, default value: 1,813)  |
| RETRANSMIT INTERVAL       | Retransmission interval for a RADIUS message<br>(range: 1-60, default value: 2, unit: seconds)  |
| TOTAL RETRANSMIT COUNT    | Maximum retransmission count of a RADIUS message<br>(range: 1-20, default value: 10)  |
| RETRANSMIT COUNT FAILOVER | Maximum retransmission count of a RADIUS message before a RADIUS server failover is attempted<br>(range: 1-10, default value: 3, must be smaller than the TOTAL RETRANSMIT value) |

### 8.1.1.2 Configuring MAC Authentication

The MAC authentication of a RADIUS server is configured as follows:

#### Configuration using CLI

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

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

- 2) Set the password type that will be used for the MAC authentication of the device.

```
WEC8500/configure/security/radius 1# mac-auth-pw-type [PW_TYPE]
```

| Parameter | Description  |
|-----------|--|
| PW_TYPE   | Password type (default value: mac)<br>- mac: MAC address of the device. Note: it must be a string whose type must be the same as that of the MAC string which is used as a user ID when the MAC authentication of the device is performed<br>- shared-secret: Key shared between the APC and RADIUS server |

- 3) Set the type of separator of the device's MAC string which is used as a user ID when the MAC authentication of the device is performed.

```
WEC8500/configure/security/radius 1# mac-auth-delimiter [DELIMITER_TYPE]
```

| Parameter      | Description  |
|----------------|--|
| DELIMITER_TYPE | Type of the MAC string separator (default: none)<br>- none: no separator (xxxxxxxxxxxx)<br>- colon: Uses ':' as a separator (xx:xx:xx:xx:xx:xx)<br>- hyphen: Uses '-' as a separator (xx-xx-xx-xx-xx-xx)<br>- single-hyphen: Uses only one '-' in the middle (xxxxxx-xxxxxx) |

- 4) Configure whether to use lowercase characters or uppercase characters for the device's MAC string that will be used as an ID upon the MAC authentication of the device.

```
WEC8500/configure/security/radius 1# mac-auth-case [CASE_TYPE]
```

| Parameter | Description   |
|-----------|---|
| CASE_TYPE | Case type of the device's MAC string (default value: lower)<br>- lower: Uses lowercase<br>- upper: Uses uppercase |

- 5) Exit RADIUS server configuration and then security configuration mode.

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

- 6) You can view configuration information by using the 'show security radius-server detail <server-id>' command.

### Configuration using Web UI

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

After selecting a RADIUS server to configure, configure the MAC authentication item.

| MAC Authentication |                               |
|--------------------|-------------------------------|
| PASSWORD TYPE      | MAC Address ▼                 |
| MAC DELIMITER      | No Delimiter (xxxxxxxxxxxx) ▼ |
| MAC CASE           | Lower ▼                       |

Figure 159. RADIUS Server MAC Authentication Configuration Window

| Item          | Description  |
|---------------|--|
| PASSWORD TYPE | Password type <ul style="list-style-type: none"> <li>- MAC Address: MAC address of the UE. The string in a type same to the MAC string used as a user ID upon the authentication of the MAC of the UE</li> <li>- APC Shared Secret: The shared key between the APC and the RADIUS server</li> </ul>                        |
| MAC DELIMITER | MAC string delimiter type <ul style="list-style-type: none"> <li>- No Delimiter: No delimiter (xxxxxxxxxxxx)</li> <li>- Colon: ':' used as delimiter (xx:xx:xx:xx:xx:xx)</li> <li>- Hyphen: '-' used as delimiter (xx-xx-xx-xx-xx-xx)</li> <li>- Single Hyphen: Only one '-' used in the middle (xxxxxx-xxxxxx)</li> </ul> |
| MAC CASE      | English upper case and lower case types of the MAC string <ul style="list-style-type: none"> <li>- Lower: Lower case used</li> <li>- Upper: Upper case used</li> </ul>   |

## 8.1.2 Internal RADIUS Server

The W-EP wireless LAN system provides the security and authentication function by interoperating with an internal RADIUS server.

To use the internal RADIUS server, operator can add, delete, or edit a user (WEC8500: maximum 2048 users, WEC8050: maximum 512 users).

### Configuration using CLI

To configure a local network user related function, enter into the 'radiuscm' of configure mode by executing the following command.

```
WEC8050# configure terminal
WEC8050/configure# radiuscm
```

Operator can execute various commands for Local Net Users.

#### [Adding User]

To add a user to the Local Net Users, execute the following command.

- Add-local-userdb {username} {password} [name] [email] [department] [home\_phone] [work\_phone] [mobile\_phone]

| Parameter | Description  |
|-----------|--|
| Username  | Login ID of a user<br>- Character varying (1-63)<br>- MANDATORY<br>- Korean is not allowed.<br>- Special characters {, }, (, ), ,, ;, +=, -=, :=, =, !=, >=, >, <=, <, = - , !<br>-, =*, !*, ==, #, "", " ", ` , * , ? , \, space, & Cannot be used. |
| Password  | User's password<br>- Character varying (1-63)<br>- MANDATORY<br>- Korean is not allowed.<br>- Special characters {, }, (, ), ,, ;, +=, -=, :=, =, !=, >=, >, <=, <, = - , !<br>-, =*, !*, ==, #, "", " ", ` , * , ? , \, space, & Cannot be used.    |
| Name      | Name<br>- Character varying (1-63)<br>- OPTIONAL<br>- Korean is not allowed.<br>- Special characters ' , * , ? , \ , ; cannot be used.   |
| email     | email address<br>- Character varying (1-63)<br>- OPTIONAL  |

| Parameter    | Description   |
|--------------|---|
|              | <ul style="list-style-type: none"> <li>- Korean is not allowed.</li> <li>- Special characters ' , * , ? , \ , ; cannot be used.</li> </ul>  |
| department   | Division information <ul style="list-style-type: none"> <li>- Character varying (1-63)</li> <li>- OPTIONAL</li> <li>- Korean is not allowed.</li> <li>- Special characters ' , * , ? , \ , ; cannot be used.</li> </ul> |
| Home_phone   | Home phone number <ul style="list-style-type: none"> <li>- Character varying (1-63)</li> <li>- OPTIONAL</li> <li>- Korean is not allowed.</li> <li>- Special characters ' , * , ? , \ , ; cannot be used.</li> </ul>    |
| Work_phone   | Office phone number <ul style="list-style-type: none"> <li>- Character varying (1-63)</li> <li>- OPTIONAL</li> <li>- Korean is not allowed.</li> <li>- Special characters ' , * , ? , \ , ; cannot be used.</li> </ul>  |
| Mobile_phone | Mobile phone number. <ul style="list-style-type: none"> <li>- Character varying (1-63)</li> <li>- OPTIONAL</li> <li>- Korean is not allowed.</li> <li>- Special characters ' , * , ? , \ , ; cannot be used.</li> </ul> |

**[Modifying User]**

To modify a user from the Local Net Users, execute the following command.

- `modify-local-userdb {username} {password} [name] [email] [department] [home_phone] [work_phone] [mobile_phone]`

**[Deleting User]**

To delete one user from the Local Net Users, execute the following command.

- `delete-local-userdb {username}`

| Parameter | Description   |
|-----------|---|
| Username  | User's ID <ul style="list-style-type: none"> <li>- Character varying (1-63)</li> <li>- MANDATORY</li> <li>- Korean is not allowed.</li> <li>- Special characters { , } , ( , ) , , , ; , + = , - = , : = , = , ! = , &gt; = , &gt; , &lt; = , &lt; , = - , ! - , = * , ! * , = = , # , " , " , ` , * , ? , \ , space , &amp; Cannot be used.</li> </ul> |

To delete all the users from the Local Net Users, execute the following command.

- `Remove-all-local-userdb`



**[Importing User]**

To import the Local Net Users list file, execute the following command.

- Import-local-userdb {filename}

| Parameter | Description   |
|-----------|---|
| Filename  | File to import<br>- CSV file format<br>- Filename (1-512) |

**[Exporting User]**

To export the Local Net Users list file, execute the following command.

- Export-local-userdb {filename}

| Parameter | Description   |
|-----------|---|
| Filename  | File to export<br>- CSV file format<br>- Filename (1-512) |

**[Checking User]**

To check one local net user, execute the following command.

- Show radiuscm username {username}

To check all the local net users, execute the following command.

- Show radiuscm all-user

**Configuration using Web UI**

In the menu bar of <WEC Main window>, select <Configuration> and then select the <Security> → <AAA> → <Local User> menu in the sub-menus.

| NO. | USER ID | E-MAIL |
|-----|---------|--------|
| 1   | test111 | PPP    |
| 2   | test22  |        |

Total Entry : 2

1

To add a user, click the <Add> button.

|                                     |                      |
|-------------------------------------|----------------------|
|                                     | Back Apply           |
| USER ID                             | <input type="text"/> |
| PASSWORD <input type="checkbox"/> 1 | <input type="text"/> |
| CONFIRM PASSWORD                    | <input type="text"/> |
| FULL NAME                           | <input type="text"/> |
| DEPARTMENT                          | <input type="text"/> |
| OFFICE PHONE                        | <input type="text"/> |
| CELL PHONE                          | <input type="text"/> |
| HOME PHONE                          | <input type="text"/> |
| E-MAIL                              | <input type="text"/> |

- 1) Enter an item according to each parameter description, and click the <Apply> button.
  - ID: ID of a user to add
  - PASSWORD: User's initial password
  - CONFIRM PASSWORD: Repeat Password
  - FULL NAME: User's name (option)
  - DEPARTMENT: User's department information (option)
  - OFFICE PHONE: Office phone number (option)
  - CELL PHONE: Mobile phone number (option)
  - HOME PHONE: Home phone number (option)
  - E-MAIL: email (option)
  
- 2) Importing a local net user list
 

Operator can import or export the list of local users. The user list is in the CSV format. An existing data is deleted if there is new importing.
  
- 3) Exporting a local net user list
 

Operator can export the list of local users in the CSV format file.

## 8.2 Unauthorized AP/Terminal Detection and Blocking

As the security function, the W-EP wireless LAN device provides the detection service for an unauthorized AP using the Wireless Intrusion Detection System (WIDS)/WIPS function. This function detects any AP that is illegally installed without an administrator's approval and also any wireless terminals connected to the AP. If an authorized wireless terminal is connected to an unauthorized AP, some information may be exposed or the wireless LAN may be attacked in some ways. Therefore, it is important to manage the risk.

### 8.2.1 Enabling Detection Function

The procedure of enabling the unauthorized AP and terminal detection function is shown below.

#### Configuration using CLI

- 1) Go to configure mode of CLI.

```
WEC8500# configure terminal
```

- 2) Enable the detection function.

```
WEC8500/configure# wi enable
```

- 3) To check the configured information, use 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> → <General> menu in the sub-menus.

Click Apply after selecting Enable or Disable, then operator can configure the Wireless Intrusion service status.

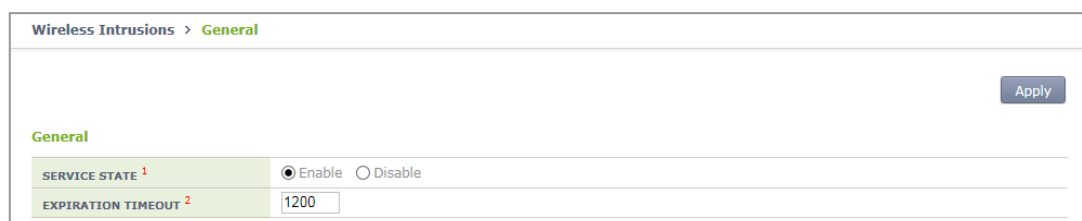


Figure 160. Wireless Intrusion General Configuration Window

## 8.2.2 Detection

The W-EP wireless LAN system detects all the packets in a wireless LAN network, classifies unauthorized APs and wireless terminals, and creates related alarms and logs. The detected unauthorized APs are classified as follows according to the configured classification policy.

| Classification type | Description  |
|---------------------|--|
| Managed AP          | <p>AP that is allowed to be used by an administrator among the detected unauthorized APs</p> <ul style="list-style-type: none"> <li>- Configures the managed AP classification policy.</li> <li>- An administrator can classify a specific AP as a managed AP among the manually detected unauthorized APs.</li> </ul>   |
| Unmanage AP         | <p>AP that is not allowed to be used by an administrator among the detected unauthorized APs and AP that can be used maliciously</p> <ul style="list-style-type: none"> <li>- Configures the unmanaged AP classification policy.</li> <li>- An administrator can classify a specific AP as a unmanaged AP among the manually detected unauthorized APs.</li> </ul> |

### 8.2.2.1 Configuring the managed AP classification policy

To configure the managed type authorized AP classification policy, execute the command as follows:

#### 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) Configure the managed type authorized AP policy.
  - add-classification-rule- managed [RULE\_NAME] enable [PRIORITY] [SSID\_TYPE] [SSID]

| Parameter | Description  |
|-----------|--|
| RULE_NAME | Classification policy name   |
| PRIORITY  | Priority number  |
| SSID_TYPE | <p>SSID type</p> <ul style="list-style-type: none"> <li>- managed-ssid: SSID that is used in an authorized AP that is connected to the APC.</li> <li>- user-configured-ssid [SSID]: Entered SSID (An AP that has SSID as SSID_NAME is classified as a friendly type unauthorized AP.)</li> </ul> |

| Parameter | Description   |
|-----------|---|
| SSID_NAME | SSID that is used when the SSID_TYPE is entered as user-configured-ssid |

- 3) To check the configured information, use the ‘show wids device rule managed’ command.

### Configuration using Web UI

In the menu bar of <WEC Main window>, select <Configuration> and then select the <Wireless Intrusion> → <Policy> → <User Defined Rule> menu in the sub-menus. And then, select <Managed> at the upper tab.

- 1) By using Add, Delete, or Change, operator can add, delete, or change user defined rules.

|                          | RULE NAME             | STATE  | PRIORITY | SSID TYPE       | CLASS TYPE |
|--------------------------|-----------------------|--------|----------|-----------------|------------|
| <input type="checkbox"/> | 123445234563456345645 | Enable | 1        | Managed         | Managed    |
| <input type="checkbox"/> | hb                    | Enable | 2        | User Configured | Managed    |

Total Entry : 2

Figure 161. Managed Rule Configuration Window

- 2) In the rule addition screen, operator can add a rule by entering the information and click Apply.

|               |  |
|---------------|--|
| CLASS TYPE    | <input checked="" type="radio"/> Managed <input type="radio"/> Unmanaged                 |
| RULE NAME     | <input type="text"/>   |
| PRIORITY      | <input type="text" value="1"/>   |
| SERVICE STATE | <input checked="" type="radio"/> Enable <input type="radio"/> Disable                    |
| SSID TYPE     | <input checked="" type="radio"/> Managed SSID <input type="radio"/> User Configured SSID |

Figure 162. Managed Addition Window

### 8.2.2.2 Configuring the unmanaged AP classification policy

To configure the unmanaged type unauthorized AP classification policy, execute the command as follows:

#### 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) Configure the unmanaged type unauthorized AP policy.

- add-classification-rule-unmanaged [RULE\_NAME] enable [PRIORITY] [MATCH\_TYPE] [MIN\_RSSI] [MIN\_DURATION] [NO\_OF\_MIN\_ASSOC CLIENTS] [ENCRYPTION] [SSID\_TYPE] [SSID]

| Parameter               | Description  |
|-------------------------|--|
| RULE_NAME               | Classification policy name   |
| PRIORITY                | Rule priority number   |
| MATCH_TYPE              | Enter either match-all or match-any.<br>- match-all: Classifies as a unmanaged unauthorized AP when the detection criteria entered thereafter are all satisfied.<br>- match-any: Classifies as a unmanaged unauthorized AP when any one of the detection criteria entered thereafter is satisfied. |
| MIN_RSSI                | Minimum RSSI. When the RSSI value is higher than this value, it is classified as a unmanaged unauthorized AP.  |
| MIN_DURATION            | Minimum lasting time (unit: s). When the signal lasting time is higher than this value, it is classified as a unmanaged unauthorized AP.   |
| NO_OF_MIN_ASSOC CLIENTS | Minimum number of connected terminals When the number of connected terminals is higher than this value, it is classified as a unmanaged unauthorized AP.   |
| ENCRYPTION              | Whether to use encryption<br>- 0: Does not use encryption. If encryption is not used, it is classified as a unmanaged unauthorized AP.<br>- 1: Uses encryption. If encryption is used, it is classified as a malicious unauthorized AP.  |
| SSID TYPE               | SSID type<br>- managed-ssid: SSID that is used in an authorized AP that is connected to the APC.<br>- user-configured-ssid [SSID]: Entered SSID (An AP that has SSID as SSID_NAME is classified as a friendly type unauthorized AP.)   |
| SSID_NAME               | SSID that is used when the SSID_TYPE is entered as user-configured-ssid  |

- 3) To check the configured information, use the ‘show wids device rule unmanaged’ command.

### Configuration using Web UI

In the menu bar of <WEC Main window>, select <Configuration> and then select the <Wireless Intrusion> → <Policy> → <User Defined Rule> menu in the sub-menus. And then, select <Unmanaged> at the upper tab.

- 1) By using Add, Delete, or Change, operator can add, delete, or change user defined rules.

|                          | RULE NAME             | STATE  | PRIORITY | SSID TYPE       | CLASS TYPE |
|--------------------------|-----------------------|--------|----------|-----------------|------------|
| <input type="checkbox"/> | 123445234563456345645 | Enable | 1        | Managed         | Managed    |
| <input type="checkbox"/> | hh                    | Enable | 2        | User Configured | Managed    |

Figure 163. Unmanaged Rule Configuration Window

- 2) In the rule addition screen, operator can add a rule by entering the information and click Apply.

Figure 164. Unmanaged Rule Addition Window

### 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.

Wireless Intrusions > AP

Current Filter : None Change

Containment Remove Export

Total Entry : 1432

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

Wireless Intrusions > AP > Detail

Back Apply

|                      |   |
|----------------------|---|
| 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 <input type="button" value="v"/>                      |
| REMOVE MANUALLY      | <input type="radio"/> On <input checked="" type="radio"/> 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.

|                          | MAC ADDRESS       | SSID                   | CHANNEL NUMBER | NUMBER OF CLIENTS | CLASS TYPE | STATUS  | DETECTING AP      |
|--------------------------|-------------------|------------------------|----------------|-------------------|------------|---------|-------------------|
| <input type="checkbox"/> | f4:d9:fb:42:7d:00 | 403_wlan_onoff_test_15 | 36             | 2                 |            | Alert   | f4:d9:fb:24:d1:c0 |
| <input type="checkbox"/> | f4:d9:fb:35:cc:00 | ureadymobile           | 40             | 2                 |            | Alert   | f4:d9:fb:24:d1:c0 |
| <input type="checkbox"/> | f4:d9:fb:35:cc:01 | setup                  | 40             | 0                 |            | Alert   | f4:d9:fb:24:d1:c0 |
| <input type="checkbox"/> | f4:d9:fb:23:c4:02 | SCME_AP                | 157            | 0                 |            | Alert   | f4:d9:fb:24:d1:c0 |
| <input type="checkbox"/> | f4:d9:fb:35:92:02 | ureadymobile           | 44             | 0                 |            | Removed | f4:d9:fb:34:1f:e0 |
| <input type="checkbox"/> | f4:d9:fb:35:8a:02 | WEC8500IG13            | 153            | 0                 |            | Alert   | f4:d9:fb:34:20:20 |
| <input type="checkbox"/> | f4:d9:fb:36:d9:02 | wec8500khh             | 153            | 0                 |            | Removed | f4:d9:fb:24:d1:c0 |
| <input type="checkbox"/> | f4:d9:fb:69:9a:02 | ALEX_5G                | 161            | 0                 |            | Removed | f4:d9:fb:24:d1:c0 |
| <input type="checkbox"/> | f4:d9:fb:23:be:02 | ZCLUSTERED_RRM_5G      | 161            | 0                 | Managed    | Managed | f4:d9:fb:34:20:60 |
| <input type="checkbox"/> | f4:d9:fb:23:be:02 | ZCLUSTER_TEST_16       | 9              | 0                 | Managed    | Managed | f4:d9:fb:34:1f:e0 |

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'.

Wireless Intrusions > AP > Detail

Back Apply

|                      |   |
|----------------------|---|
| 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      | <input type="radio"/> On <input checked="" type="radio"/> 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 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/configuration# wi
WEC8500/configuration/wi# device
WEC8500/configuration/wi/device# ap
WEC8500/configuration/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<br>- notify: Notify the state with alarm<br>- 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.

| AP BLACKLIST  | <input checked="" type="radio"/> Detect & Notify | <input type="radio"/> Detect | <input type="radio"/> None |
|---|--|------------------------------|----------------------------|
| UNMANAGED AP WORKS WITH MANAGED SSID AND ASSOCIATED WITH AUTHORIZED STATION | <input checked="" type="radio"/> Detect & Notify | <input type="radio"/> Detect | <input type="radio"/> None |
| FAKE AP WORKS WITH MANAGED SSID   | <input checked="" type="radio"/> Detect & Notify | <input type="radio"/> Detect | <input type="radio"/> None |
| FAKE AP WITH HIDDEN SSID  | <input checked="" type="radio"/> Detect & Notify | <input type="radio"/> Detect | <input type="radio"/> None |
| FAKE AP WORKS IN INVALID CHANNEL  | <input checked="" type="radio"/> Detect & Notify | <input type="radio"/> Detect | <input type="radio"/> None |
| AP WORKS WITH MANAGED SSID BUT INVALID SECURITY                             | <input checked="" type="radio"/> Detect & Notify | <input type="radio"/> Detect | <input type="radio"/> None |
| MANAGED AP WITH INVALID SSID  | <input checked="" type="radio"/> Detect & Notify | <input type="radio"/> Detect | <input type="radio"/> None |
| AP WORKS IN ILLEGAL CHANNEL   | <input checked="" type="radio"/> Detect & Notify | <input type="radio"/> Detect | <input type="radio"/> None |
| ADHOC   | <input checked="" type="radio"/> Detect & Notify | <input type="radio"/> Detect | <input type="radio"/> None |
| MANAGED WITHOUT SYSTEM AP WORKS IN SERVING CHANNEL                          | <input checked="" type="radio"/> Detect & Notify | <input type="radio"/> Detect | <input type="radio"/> None |

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<br>- notify: Notify the state with alarm<br>- 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.

| AP BLACKLIST  | <input checked="" type="radio"/> Detect & Notify | <input type="radio"/> Detect | <input type="radio"/> None |
|---|--|------------------------------|----------------------------|
| UNMANAGED AP WORKS WITH MANAGED SSID AND ASSOCIATED WITH AUTHORIZED STATION | <input checked="" type="radio"/> Detect & Notify | <input type="radio"/> Detect | <input type="radio"/> None |
| FAKE AP WORKS WITH MANAGED SSID   | <input checked="" type="radio"/> Detect & Notify | <input type="radio"/> Detect | <input type="radio"/> None |
| FAKE AP WITH HIDDEN SSID  | <input checked="" type="radio"/> Detect & Notify | <input type="radio"/> Detect | <input type="radio"/> None |
| FAKE AP WORKS IN INVALID CHANNEL  | <input checked="" type="radio"/> Detect & Notify | <input type="radio"/> Detect | <input type="radio"/> None |
| AP WORKS WITH MANAGED SSID BUT INVALID SECURITY                             | <input checked="" type="radio"/> Detect & Notify | <input type="radio"/> Detect | <input type="radio"/> None |
| MANAGED AP WITH INVALID SSID  | <input checked="" type="radio"/> Detect & Notify | <input type="radio"/> Detect | <input type="radio"/> None |
| AP WORKS IN ILLEGAL CHANNEL   | <input checked="" type="radio"/> Detect & Notify | <input type="radio"/> Detect | <input type="radio"/> None |
| ADHOC   | <input checked="" type="radio"/> Detect & Notify | <input type="radio"/> Detect | <input type="radio"/> None |
| MANAGED WITHOUT SYSTEM AP WORKS IN SERVING CHANNEL                          | <input checked="" type="radio"/> Detect & Notify | <input type="radio"/> Detect | <input type="radio"/> None |

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<br>- 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> → <Classification> 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.

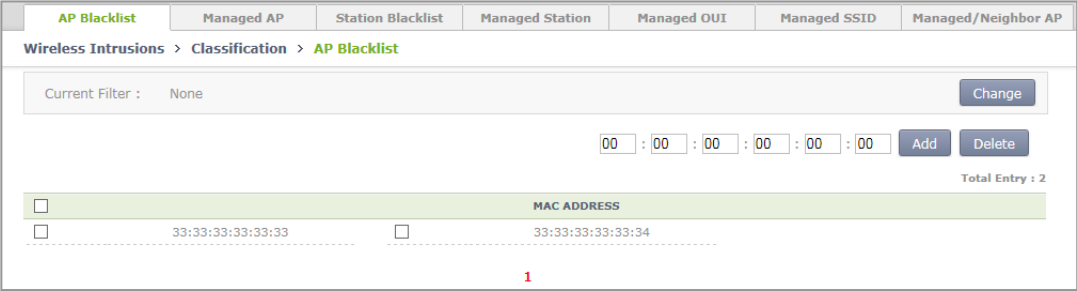


Figure 172. AP blacklist Configuration Window

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

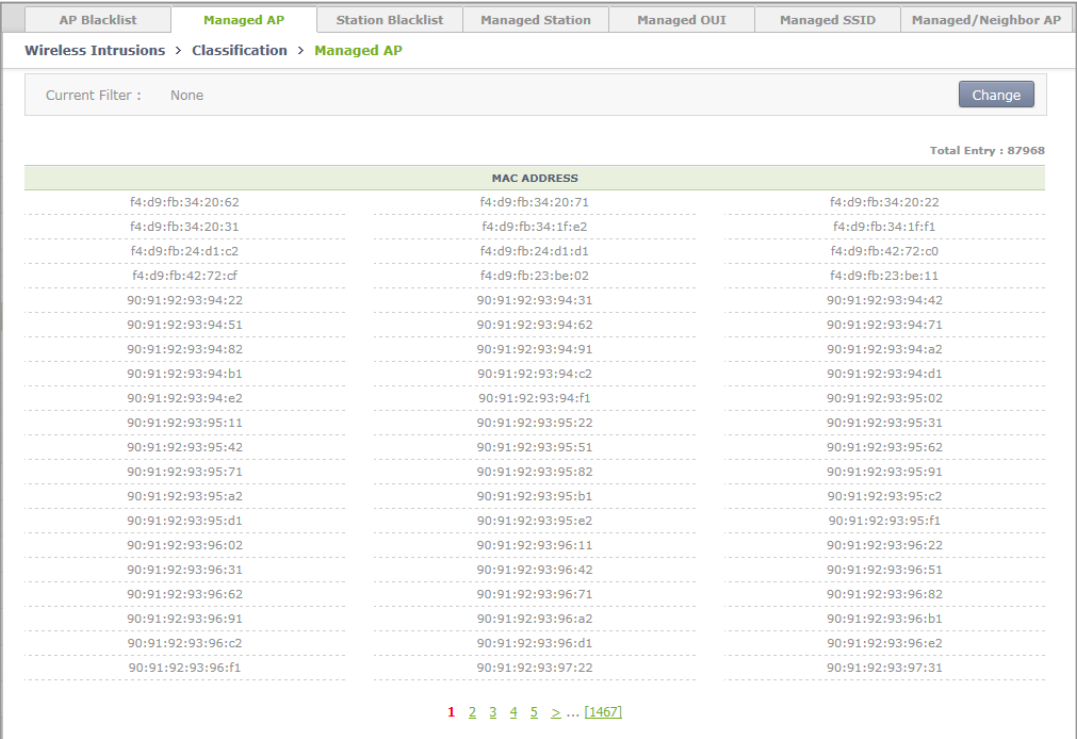


Figure 173. Managed AP Window

- 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.

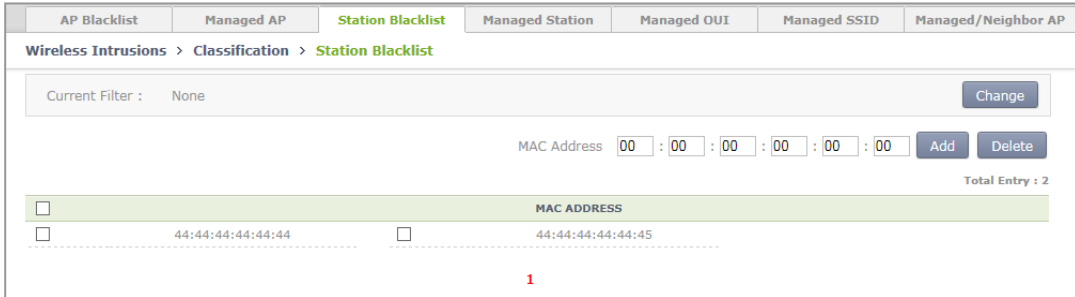


Figure 174. Station blacklist Search/Configuration Window

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

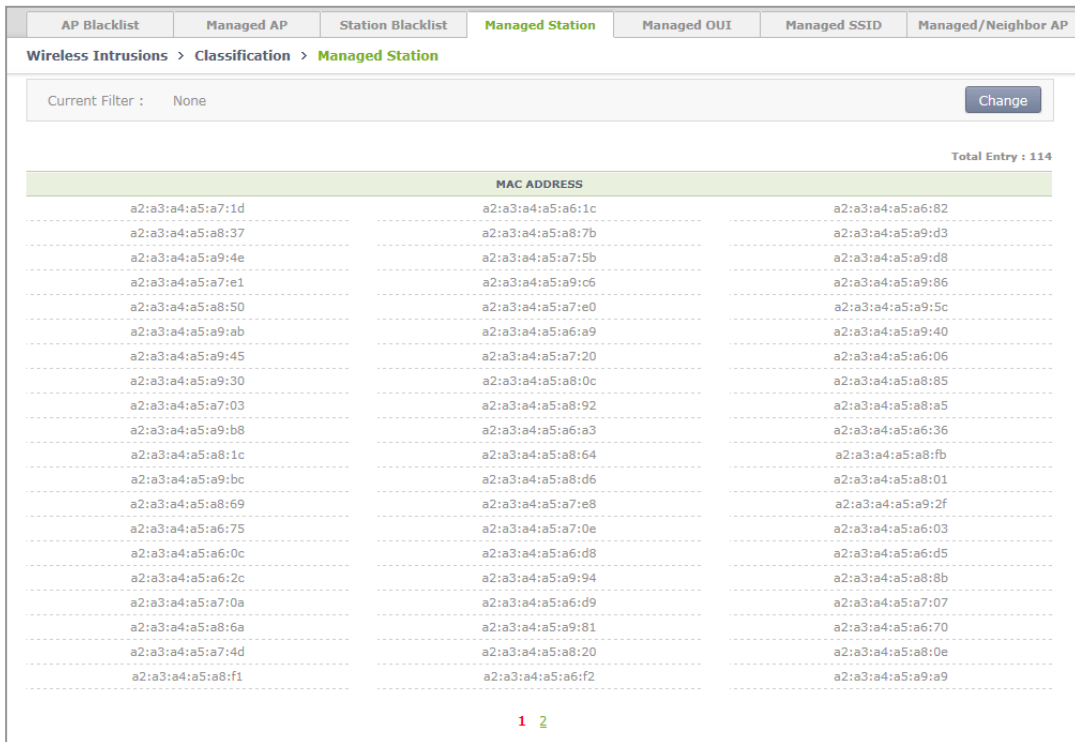
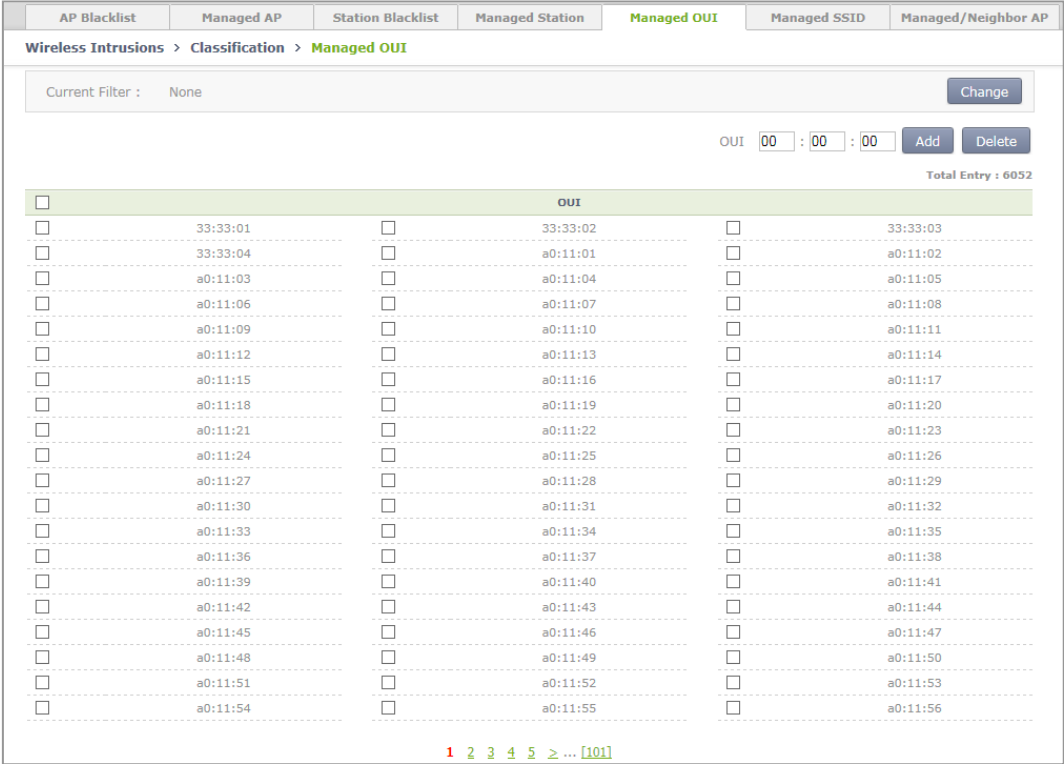


Figure 175. Managed Station Search Window

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.

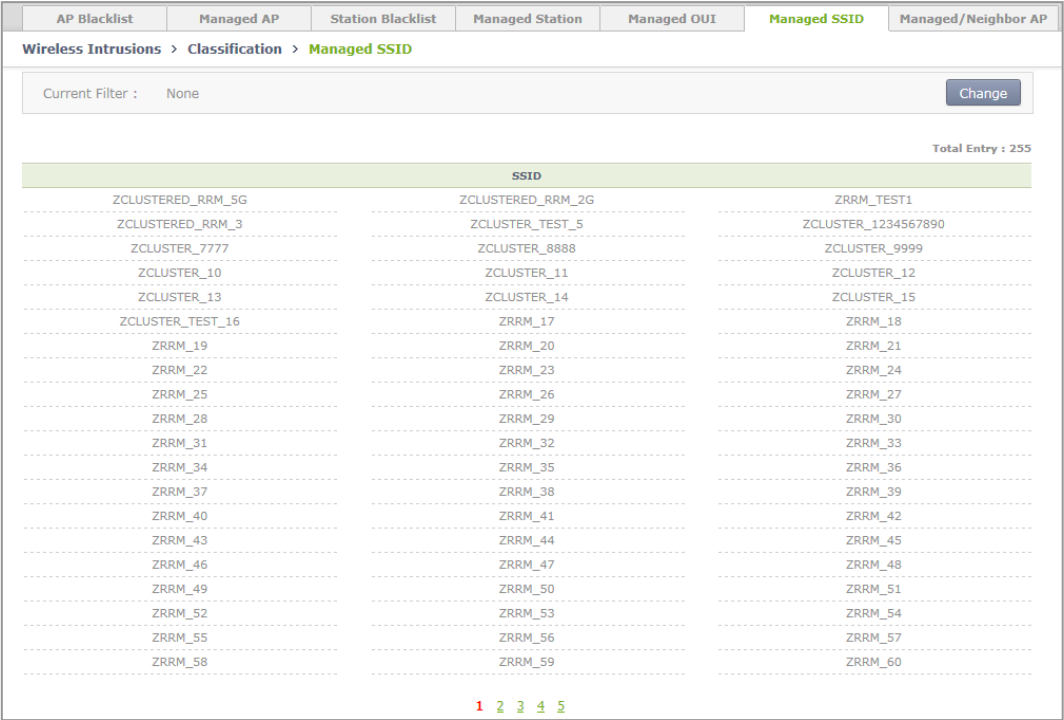


Figure 176. Managed SSID Window

- 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

|                          | MAC ADDRESS       | STATE    |
|--------------------------|-------------------|----------|
| <input type="checkbox"/> | f4:d9:fb:24:d2:02 | Managed  |
| <input type="checkbox"/> | f4:d9:fb:37:a9:02 | Neighbor |
| <input type="checkbox"/> | f4:d9:fb:37:a1:02 | Managed  |
| <input type="checkbox"/> | f4:d9:fb:35:e6:03 | Neighbor |
| <input type="checkbox"/> | f4:d9:fb:36:e5:04 | Neighbor |
| <input type="checkbox"/> | f4:d9:fb:23:be:04 | Managed  |
| <input type="checkbox"/> | 22:22:22:22:22:22 | Managed  |
| <input type="checkbox"/> | 22:22:22:22:22:23 | Managed  |

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/configuration# wi
WEC8500/configuration/wi# device
WEC8500/configuration/wi/device# client
WEC8500/configuration/wi/device/client#
```

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

| Parameter | Description   |
|-----------|---|
| OPTION    | <ul style="list-style-type: none"> <li>- 80211-auth-req: Authentication requests threshold per second</li> <li>- 80211-probe-req: Probe requests threshold per second</li> <li>- 80211-deauth-req: De-authentication requests threshold per second</li> <li>- 80211-assoc-fail: Association failures threshold per second</li> <li>- 80211-auth-fail: Authentication failures threshold per second</li> <li>- 8021x-auth-fail: 802.1x authentication failures threshold per WIDS interval</li> <li>- web-auth-fail: Web authentication failures threshold that occurs continuously</li> </ul> |
| 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.

| Wireless Intrusions > Station Allow Limit       |   |
|---|---|
| EXCESSIVE 802.11 AUTH REQUESTS THRESHOLD        | 3 |
| EXCESSIVE 802.11 DEAUTH REQUESTS THRESHOLD      | 5 |
| EXCESSIVE 802.11 PROBE REQUESTS THRESHOLD       | 5 |
| EXCESSIVE 802.11 ASSOCIATION FAILURES THRESHOLD | 5 |
| EXCESSIVE 802.11 AUTH FAILURES THRESHOLD        | 5 |
| EXCESSIVE 802.1X AUTH FAILURES THRESHOLD        | 3 |
| EXCESSIVE WEB AUTH FAILURES THRESHOLD           | 5 |

**Foot Notes :**

1. Set the threshold of management packet per sec. It's for the detect flood attack

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/configuration# wids
WEC8500/configuration/wids# containment
WEC8500/configuration/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.

|                          | MAC ADDRESS       | SSID         | CHANNEL NUMBER | NUMBER OF CLIENTS | CLASS TYPE | STATUS  | DETECTING AP      |
|--------------------------|-------------------|--------------|----------------|-------------------|------------|---------|-------------------|
| <input type="checkbox"/> | 3c:a1:0d:11:00:29 |              | 6              | 2                 | Unmanaged  | Removed | 00:00:00:07:08:29 |
| <input type="checkbox"/> | 00:00:00:d2:00:40 | PMF_TEST_1X  | 40             | 0                 | Unmanaged  | Alert   | f4:d9:fb:42:77:ae |
| <input type="checkbox"/> | 00:00:00:d2:00:41 | PMF_TEST_PSK | 40             | 1                 | Unmanaged  | Alert   | f4:d9:fb:42:77:ae |
| <input type="checkbox"/> | 00:00:aa:01:01:23 | hoon         | 157            | 0                 | Unmanaged  | Alert   | 00:00:00:07:08:29 |
| <input type="checkbox"/> | 00:00:00:07:04:80 | stability    | 157            | 0                 | Unmanaged  | Alert   | 00:00:00:07:08:29 |
| <input type="checkbox"/> | 00:00:00:07:04:81 | stability3   | 157            | 0                 | Unmanaged  | Alert   | 00:00:00:07:08:29 |
| <input type="checkbox"/> | 00:00:00:07:04:82 | stability4   | 157            | 0                 | Unmanaged  | Removed | 00:00:00:07:08:29 |
| <input type="checkbox"/> | 00:00:00:07:04:83 | SMBtest01    | 157            | 0                 | Unmanaged  | Alert   | 00:00:00:07:08:29 |
| <input type="checkbox"/> | 00:00:00:07:04:84 | External     | 157            | 0                 | Unmanaged  | Alert   | 00:00:00:07:08:29 |
| <input type="checkbox"/> | f4:d9:fb:24:04:e2 | testgroup16  | 1              | 0                 | Unmanaged  | Alert   | f4:d9:fb:35:9f:ad |
| <input type="checkbox"/> | f4:d9:fb:24:04:e2 | testgroup1   | 149            | 0                 | Unmanaged  | Alert   | f4:d9:fb:42:77:ae |
| <input type="checkbox"/> | f4:d9:fb:24:04:e3 | testgroup15  | 1              | 0                 | Unmanaged  | Alert   | 00:00:00:07:08:29 |
| <input type="checkbox"/> | f4:d9:fb:24:04:e3 | testgroup2   | 149            | 0                 | Unmanaged  | Alert   | f4:d9:fb:42:77:ae |
| <input type="checkbox"/> | f4:d9:fb:24:04:e4 | testgroup14  | 1              | 0                 | Unmanaged  | Alert   | f4:d9:fb:42:77:ae |

Figure 181. List Window for Blocking AP

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

|                          | MAC ADDRESS       | BSSID             | SSID         | CHANNEL NUMBER | STATUS  | DETECTING AP      |
|--------------------------|-------------------|-------------------|--------------|----------------|---------|-------------------|
| <input type="checkbox"/> | 94:d7:71:fc:00:15 | F4:d9:fb:35:76:8f | ureadymobile | 9              | Removed | F4:d9:fb:35:9f:ad |
| <input type="checkbox"/> | 00:00:f0:07:01:a3 | 00:00:00:00:00:00 |              | 0              | Removed | F4:d9:fb:42:77:ae |
| <input type="checkbox"/> | 00:00:f0:07:02:c0 | 00:00:00:00:00:00 |              | 0              | Removed | 00:00:f0:07:08:29 |
| <input type="checkbox"/> | 64:e5:99:f4:03:17 | F4:d9:fb:68:14:63 | SMBtest01    | 157            | Removed | F4:d9:fb:42:6e:ae |
| <input type="checkbox"/> | 88:53:2e:d4:03:82 | 00:00:00:00:00:00 |              | 0              | Removed | F4:d9:fb:42:6e:ae |
| <input type="checkbox"/> | 00:1b:b1:a7:04:2c | F4:d9:fb:35:e3:0f | uready       | 13             | Removed | 00:00:f0:07:08:29 |
| <input type="checkbox"/> | 88:9b:39:f2:05:05 | 00:00:00:00:00:00 |              | 0              | Removed | F4:d9:fb:35:9f:ad |
| <input type="checkbox"/> | 8c:0e:e3:7b:05:82 | 00:00:00:00:00:00 |              | 0              | Removed | F4:d9:fb:42:77:ae |
| <input type="checkbox"/> | 18:83:31:9e:05:f5 | 00:00:f0:06:f3:c1 | arate_1      | 36             | Removed | F4:d9:fb:42:6e:ae |
| <input type="checkbox"/> | 18:83:31:9e:06:5b | F4:d9:fb:69:e6:20 | hoon         | 36             | Removed | F4:d9:fb:42:77:ae |
| <input type="checkbox"/> | bc:44:86:b3:06:69 | F4:d9:fb:35:9f:45 | smart2       | 161            | Alert   | 00:00:f0:07:08:29 |
| <input type="checkbox"/> | 00:00:f0:07:07:40 | 00:00:f0:06:f3:8f | hyc_call     | 149            | Alert   | F4:d9:fb:42:77:ae |
| <input type="checkbox"/> | c4:88:e5:08:07:c8 | 00:00:00:00:00:00 |              | 0              | Removed | 00:00:f0:07:08:29 |
| <input type="checkbox"/> | f8:16:54:b1:08:37 | 00:00:f0:d2:00:41 | PMF_TEST_PSK | 40             | Alert   | 00:00:f0:07:08:29 |
| <input type="checkbox"/> | 78:e4:00:50:08:d2 | 00:00:00:00:00:00 |              | 0              | Removed | 00:00:f0:07:08:29 |
| <input type="checkbox"/> | e0:cb:ee:e6:08:6f | 00:00:00:00:00:00 |              | 0              | Removed | F4:d9:fb:42:77:ae |

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/configuration# wids
WEC8500/configuration/wids# containment
WEC8500/configuration/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. |



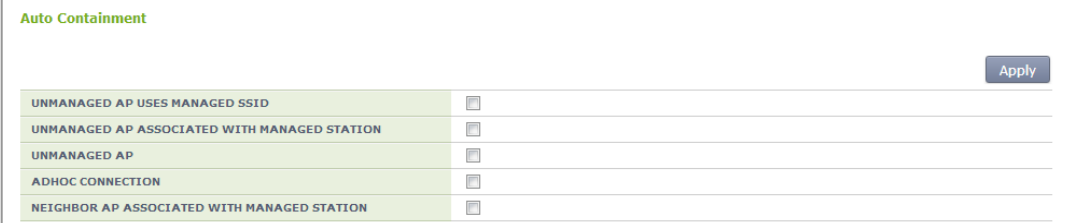
| Parameter                  | Description   |
|----------------------------|---|
| rogue-ap-with-managed-ssid | If the honeypot is detected, it is automatically blocked.     |
| unmanaged-ap               | If the unmanaged AP is detected, it is automatically blocked. |

- 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.



| Auto Containment                             |                          |
|--|--------------------------|
| UNMANAGED AP USES MANAGED SSID               | <input type="checkbox"/> |
| UNMANAGED AP ASSOCIATED WITH MANAGED STATION | <input type="checkbox"/> |
| UNMANAGED AP                                 | <input type="checkbox"/> |
| ADHOC CONNECTION                             | <input type="checkbox"/> |
| NEIGHBOR AP ASSOCIATED WITH MANAGED STATION  | <input type="checkbox"/> |

Apply

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<br>- local-only: Uses internal authentication.<br>- radius-only: Uses the authentication of the RADIUS server.<br>- 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.

**Guest Users**

|  |  |  |
|--|--|--|
| <b>USER ID</b>                             | <input type="text"/>   | <input type="button" value="Generator"/> |
| <b>PASSWORD</b> <input type="checkbox"/> 1 | <input type="text"/>   | <input type="button" value="Generator"/> |
| <b>CONFIRM PASSWORD</b>                    | <input type="text"/>   |  |
| <b>START TIME</b>                          | 2014-03-12 <input type="text" value="00"/> : <input type="text" value="00"/> : <input type="text" value="00"/><br><input type="checkbox"/> Immediate |  |
| <b>END TIME</b>                            | 2014-03-12 <input type="text" value="23"/> : <input type="text" value="59"/> : <input type="text" value="59"/><br><input type="checkbox"/> Unlimited |  |
| <b>FULL NAME</b>                           | <input type="text"/>   |  |
| <b>COMPANY</b>                             | <input type="text"/>   |  |
| <b>EMAIL</b>                               | <input type="text"/>   |  |
| <b>PHONE</b>                               | <input type="text"/>   |  |
| <b>MAX SESSION</b>                         | <input type="text" value="1"/>   |  |
| <b>STATUS</b>                              | <input checked="" type="radio"/> Enable <input type="radio"/> Disable  |  |
| <b>COMMENTS</b>                            | <input type="text"/>   |  |

**Sponsor**

|                   |                      |
|-------------------|----------------------|
| <b>SPONSOR</b>    | <input type="text"/> |
| <b>DEPARTMENT</b> | <input type="text"/> |
| <b>EMAIL</b>      | <input type="text"/> |
| <b>PHONE</b>      | <input type="text"/> |
| <b>COMMENTS</b>   | <input type="text"/> |

Figure 184. Guest User Configuration Window

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

|                          |         |                     | Add                 | Delete |
|--------------------------|---------|---------------------|---------------------|--------|
|                          |         |                     | Total Entry : 1     |        |
| <input type="checkbox"/> | USER ID | START TIME          | END TIME            |        |
| <input type="checkbox"/> | u2      | 2013-08-13 07:00:00 | 9999-99-99 99:99:99 |        |

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.

|                         |                            |
|-------------------------|----------------------------|
| GUEST AUTH TYPE         | RADIUS                     |
| PRIMARY RADIUS SERVER   | 90.90.40.140 : 1812 / 1813 |
| SECONDARY RADIUS SERVER | 90.90.40.140 : 1812 / 1813 |

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

| <input type="checkbox"/> | SEQ | ACTION | PROTOCOL | SOURCE IP/MASK                | SOURCE PORT | DESTINATION IP/MASK           | DESTINATION PORT | MATCH COUNT |
|--------------------------|-----|--------|----------|-------------------------------|-------------|-------------------------------|------------------|-------------|
| <input type="checkbox"/> | 1   | Permit | UDP      | Any                           | Any         | Any                           | =53              | 4829        |
| <input type="checkbox"/> | 2   | Permit | TCP      | 192.168.20.10/255.255.255.255 | =80         | Any                           | Any              | 0           |
| <input type="checkbox"/> | 3   | Permit | TCP      | Any                           | Any         | 192.168.20.10/255.255.255.255 | =80              | 0           |
| <input type="checkbox"/> | 4   | Permit | TCP      | 90.90.100.120/255.255.255.255 | =80         | Any                           | Any              | 0           |
| <input type="checkbox"/> | 5   | Permit | TCP      | Any                           | Any         | 90.90.100.120/255.255.255.255 | =80              | 0           |
| <input type="checkbox"/> | 6   | Permit | UDP      | Any                           | Any         | Any                           | Any              | 30311       |
| <input type="checkbox"/> | 7   | Permit | TCP      | 192.168.10.10/255.255.255.255 | =80         | Any                           | Any              | 0           |
| <input type="checkbox"/> | 8   | Permit | TCP      | Any                           | Any         | 192.168.10.10/255.255.255.255 | =80              | 60747       |

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<br>- internal: Uses the internal authentication page.<br>- external: Uses the authentication page of an external web server.<br>- downloaded: Uses the authentication page downloaded from the system.<br>- 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<br>- redirect: Redirect to a specified URL<br>- 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.

|                       |   |
|-----------------------|---|
| MAX. ALLOWED STATIONS | 127   |
| GUEST SERVICE         | <input checked="" type="radio"/> Enable <input type="radio"/> Disable |
| ADMIN STATUS          | <input checked="" type="radio"/> Enable <input type="radio"/> Disable |

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>.

|                         |   |
|-------------------------|---|
| ID                      | 1   |
| PROFILE NAME            | wlan1   |
| WEB POLICY              | <input checked="" type="radio"/> Enable <input type="radio"/> Disable               |
|                         | <input checked="" type="radio"/> Web Authentication                                 |
|                         | <input type="radio"/> Web Authentication on MAC Authentication failure <sup>1</sup> |
|                         | <input type="radio"/> Web Pass Through  |
|                         | <input type="radio"/> Conditional Web Redirection                                   |
|                         | <input type="radio"/> One Time Redirection  |
| PRE-AUTHENTICATION ACL  | preauth ▼   |
| OVERRIDING REDIRECT URL | <input type="radio"/> Enable <input checked="" type="radio"/> Disable               |
| 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.

|                         |  |
|-------------------------|--|
| Web Login Page          |  |
| WEB AUTHENTICATION TYPE | Internal ▼   |
| AFTER AUTHENTICATION    | <input type="radio"/> Redirect user's original opening web page. |
|                         | <input checked="" type="radio"/> Redirect URL                    |
|                         | http://90.90.40.124  |

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<br>- internal: Uses the internal authentication page.<br>- external: Uses the authentication page of an external web server.<br>- downloaded: Uses the authentication page downloaded from the system.<br>- 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<br>- redirect: Redirect to a specified URL<br>- 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.

|                       |   |
|-----------------------|---|
| MAX. ALLOWED STATIONS | 127   |
| GUEST SERVICE         | <input checked="" type="radio"/> Enable <input type="radio"/> Disable |
| ADMIN STATUS          | <input checked="" type="radio"/> Enable <input type="radio"/> Disable |

Figure 192. WLAN Guest Configuration Window

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

|                               |   |
|-------------------------------|---|
| ID                            | 1   |
| PROFILE NAME                  | wlan1   |
| L2 SECURITY TYPE <sup>1</sup> | None  |
| MAC AUTHENTICATION            | <input checked="" type="radio"/> Enable <input type="radio"/> Disable |
| MAC FILTER                    | -----   |

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>.

|                                |  |
|--------------------------------|--|
| <b>ID</b>                      | 1  |
| <b>PROFILE NAME</b>            | wlan1  |
| <b>WEB POLICY</b>              | <input checked="" type="radio"/> Enable <input type="radio"/> Disable<br><input type="radio"/> Web Authentication<br><input checked="" type="radio"/> Web Authentication on MAC Authentication failure <sup>1</sup><br><input type="radio"/> Web Pass Through<br><input type="radio"/> Conditional Web Redirection<br><input type="radio"/> One Time Redirection |
| <b>PRE-AUTHENTICATION ACL</b>  | preauth ▼  |
| <b>OVERRIDING REDIRECT URL</b> | <input type="radio"/> Enable <input checked="" type="radio"/> Disable  |
| <b>URL</b>                     | <input type="text"/>   |

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.

|                                |   |
|--------------------------------|---|
| <b>Web Login Page</b>          |   |
| <b>WEB AUTHENTICATION TYPE</b> | Internal ▼  |
| <b>AFTER AUTHENTICATION</b>    | <input type="radio"/> Redirect user's original opening web page.<br><input checked="" type="radio"/> Redirect URL<br><input type="text" value="http://90.90.40.124"/> |

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.

|                       |   |
|-----------------------|---|
| MAX. ALLOWED STATIONS | 127   |
| GUEST SERVICE         | <input checked="" type="radio"/> Enable <input type="radio"/> Disable |
| ADMIN STATUS          | <input checked="" type="radio"/> Enable <input type="radio"/> Disable |

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>.

|                         |   |
|-------------------------|---|
| ID                      | 1   |
| PROFILE NAME            | wlan1   |
| WEB POLICY              | <input checked="" type="radio"/> Enable <input type="radio"/> Disable               |
|                         | <input type="radio"/> Web Authentication  |
|                         | <input type="radio"/> Web Authentication on MAC Authentication failure <sup>1</sup> |
|                         | <input checked="" type="radio"/> Web Pass Through                                   |
|                         | <input type="radio"/> Conditional Web Redirection                                   |
|                         | <input type="radio"/> One Time Redirection  |
| PRE-AUTHENTICATION ACL  | preauth <input type="button" value="v"/>  |
| OVERRIDING REDIRECT URL | <input type="radio"/> Enable <input checked="" type="radio"/> Disable               |
| URL                     | <input type="text"/>  |

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.

|                       |   |
|-----------------------|---|
| MAX. ALLOWED STATIONS | 127   |
| GUEST SERVICE         | <input checked="" type="radio"/> Enable <input type="radio"/> Disable |
| ADMIN STATUS          | <input checked="" type="radio"/> Enable <input type="radio"/> Disable |

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>.

|                         |   |
|-------------------------|---|
| ID                      | 1   |
| PROFILE NAME            | wlan1   |
| WEB POLICY              | <input checked="" type="radio"/> Enable <input type="radio"/> Disable               |
|                         | <input type="radio"/> Web Authentication  |
|                         | <input type="radio"/> Web Authentication on MAC Authentication failure <sup>1</sup> |
|                         | <input type="radio"/> Web Pass Through  |
|                         | <input type="radio"/> Conditional Web Redirection                                   |
|                         | <input checked="" type="radio"/> One Time Redirection                               |
| PRE-AUTHENTICATION ACL  | preauth ▼   |
| OVERRIDING REDIRECT URL | <input type="radio"/> Enable <input checked="" type="radio"/> Disable               |
| 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.

|                  |                                     |            |
|------------------|-------------------------------------|------------|
|                  |                                     | Back Apply |
| NAME             | <input type="text"/>                |            |
| PROTOCOL         | Any ▾                               |            |
| SOURCE IP        | Any ▾ 0 . 0 . 0 . 0 / 0 . 0 . 0 . 0 |            |
| SOURCE PORT      | Any ▾                               |            |
| DESTINATION IP   | Any ▾ 0 . 0 . 0 . 0 / 0 . 0 . 0 . 0 |            |
| DESTINATION PORT | Any ▾                               |            |
| ICMP TYPE        | NotUsed ▾                           |            |
| ACTION           | Permit ▾                            |            |

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.

|               |       |     |     |     |
|---------------|-------|-----|-----|-----|
| NAME          | pool1 |     |     |     |
| START IP ADDR | 192   | 168 | 20  | 10  |
| END IP ADDR   | 192   | 168 | 20  | 200 |
| SUBNET MASK   | 255   | 255 | 255 | 0   |

Back Apply

Figure 203. NAT configuration (1)

- 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.

|                           |                          |  |
|---------------------------|--------------------------|--|
|                           |                          | <input type="button" value="Back"/> <input type="button" value="Apply"/> |
| NAT TYPE                  | SNAT ▾                   |  |
| NAT DIRECTION             | Inside ▾                 |  |
| STATIC                    | <input type="checkbox"/> |  |
| PROTOCOL                  | Any ▾                    |  |
| ORIGINAL IP ADDR : PORT   | 0 . 0 . 0 . 0 : 0        |  |
| TRANSLATED IP ADDR : PORT | 0 . 0 . 0 . 0 : 0        |  |
| FIREWALL POLICY           | jf_test1 ▾               |  |
| NAT POOL                  | pool1 ▾                  |  |

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.

| <input type="checkbox"/> | INDEX | NAME         | POLICY  | RADIUS AUTH | INTERVAL | COUNT |
|--------------------------|-------|--------------|---------|-------------|----------|-------|
| <input type="checkbox"/> | 1     | MAC_Filter_1 | Allow   | disable     | 0        | 0     |
| <input type="checkbox"/> | 2     | MAC_Filter_2 | Deny    | enable      | 0        | 1     |
| <input type="checkbox"/> | 3     | MAC_Filter_3 | Not Use | disable     | 0        | 0     |
| <input type="checkbox"/> | 4     | MAC_Filter_4 | Allow   | disable     | 0        | 2     |

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.

| MAC         | 00 : 16 : 32 : 82 : ed : ca |
|-------------|-----------------------------|
| DESCRIPTION | station 1                   |

Figure 206. MAC entry configuration window(1)

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

| Security > MAC Filter > Edit |              |
|------------------------------|--------------|
| INDEX                        | 1            |
| NAME                         | MAC_Filter_1 |
| POLICY <sup>1</sup>          | Deny         |
| RADIUS AUTH <sup>2</sup>     | disable      |
| INTERVAL <sup>3</sup>        | 1            |
| COUNT                        | 0            |

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.

| WLANs > WLANs > Security > L2 |              |
|-------------------------------|--------------|
| L2   L3   Radius              |              |
| PROFILE NAME                  | wlan2        |
| L2 SECURITY TYPE <sup>1</sup> | None         |
| MAC FILTER                    | MAC_Filter_1 |

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<br>(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<br>(unit: seconds, range: 1-5, default value: 3)                       |
| FO_RETRY_COUNT | Maximum message retransmission count before a TACACS+<br>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<br>Note: it must be one of the IP addresses configured in the W-<br>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<br>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<br>- 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/configuration#
```

- 2) Configure the type of operator account authentication.

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

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

| PROFILE NAME | ACL RULE | USER QOS | VLAN ID |
|--------------|----------|----------|---------|
| role_01      | acl1     | 1 (qos1) | 10      |

Figure 211. Role Profile Configuration

|              |                  |
|--------------|------------------|
| PROFILE NAME | role_01          |
| ACL RULE     | acl1             |
| USER QOS     | 1 (qos1)         |
| VLAN ID      | 10               |
| URL          | http://www.role1 |

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:

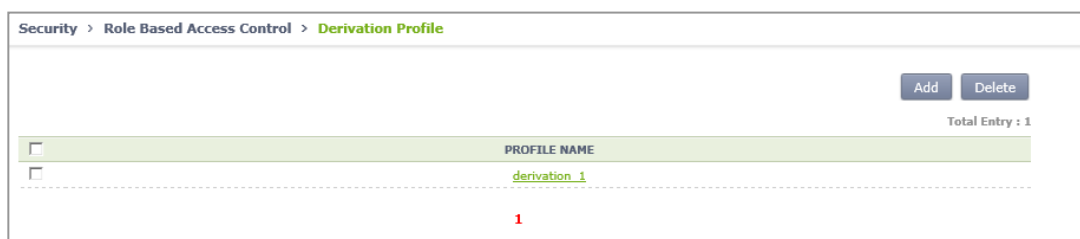


Figure 213. Derivation Profile Configuration

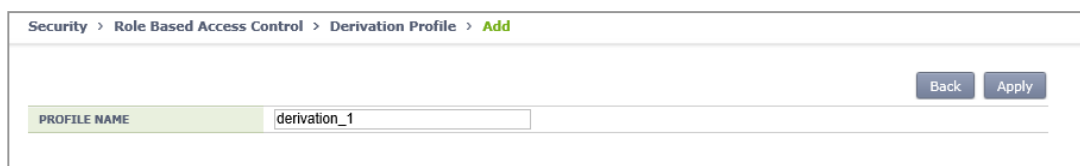


Figure 214. Derivation Profile Add Configuration

Security > Role Based Access Control > Derivation Profile > Controls > Add

Back Apply

|              |              |        |                |
|--------------|--------------|--------|----------------|
| PROFILE NAME | derivation_1 |        |                |
| PRIORITY     | 1            |        |                |
| CONDITION    | User         | Equals | derivationUser |
| ROLE PROFILE | role_01      |        |                |

Figure 215. Derivation Profile Configuration

Security > Role Based Access Control > Derivation Profile > Edit

Back

PROFILE NAME  
derivation\_1

---

Add Delete

| <input type="checkbox"/> | PRIORITY | CONDITION                    | ROLE PROFILE |
|--------------------------|----------|------------------------------|--------------|
| <input type="checkbox"/> | 1        | User Equals "derivationUser" | role_01      |

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       CaptivePotat       0
```

### Configuration using Web UI

Configuration > WLANs > Security > Radius

#### Example:

WLANs > WLANs > Security > Radius

L2 | L3 **Radius**

Back Apply

|                                  |   |
|----------------------------------|---|
| PROFILE NAME                     | wlan1   |
| AUTHENTICATION SERVER            | <input type="radio"/> Enable <input checked="" type="radio"/> Disable |
| RADIUS SERVER 1                  | -----   |
| RADIUS SERVER 2                  | -----   |
| RADIUS SERVER 3                  | -----   |
| ACCOUNTING SERVER                | <input type="radio"/> Enable <input checked="" type="radio"/> Disable |
| RADIUS SERVER 1                  | -----   |
| RADIUS SERVER 2                  | -----   |
| RADIUS SERVER 3                  | -----   |
| FALLBACK TEST INTERVAL (SECONDS) | 0   |
| ACCOUNTING INTERVAL (SECONDS)    | 600   |
| DERIVATION PROFILE NAME          | derivation_1  |

**Foot Notes :**

- If L2 Security Type in 'Security > AAA > L2' is one of the following conditions,
  - 802.1x
  - Static WEP + 802.1x
  - WPA+WPA2 and 802.1x is enabled

At least one Radius server should be configured in 'Security > AAA > Radius'. Also, Radius must be enabled in 'WLANs > Security > Radius'

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.

Security > Role Based Access Control > ACL Profile

Add Delete Send To APs

Total Entry : 1

| <input type="checkbox"/> | PROFILE NAME | ACL COUNT | TOTAL RULE COUNT |
|--------------------------|--------------|-----------|------------------|
| <input type="checkbox"/> | aclPro_1     | 2         | 2                |

**Foot Notes :**

- Can't be deleted if the access list is used in an Access Group.

### 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:

Security > Role Based Access Control > Derivation Profile > Add

Back Apply

PROFILE NAME derivation\_1

Figure 218. Acl Profile Configuration

Security > Role Based Access Control > ACL Profile > Add

Back Apply

PROFILE NAME

Figure 219. Acl Profile Add Configuration

Security > Role Based Access Control > ACL Profile > Edit

Back Apply

PROFILE NAME

ACL COUNT

Selected

ad1  ad2

All

>>

<<

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:

The screenshot displays the configuration page for an ACL Profile within a Remote AP Group. The breadcrumb path is 'AP Groups > Remote AP Group > ACL Profile'. The page is titled 'User Authentication' and 'ACL Profile'. Key configuration elements include:

- AP GROUP NAME:** testgroup01
- SCOPE:** All (selected), ACL Profile Only
- ACL PROFILE NAME:** test
- OVERWRITE AP CONFIG:** Tunnel Forwarding (checked), Local Bridging Forwarding (unchecked)

There are two main sections for forwarding rules:

- Tunnel Forwarding:** Includes a table with columns NO., WLAN, SPLIT TUNNEL ACL, and EDIT. One entry is shown: NO. 1, WLAN wan220, SPLIT TUNNEL ACL ac101.
- Local Bridging Forwarding:** Includes a table with columns NO., WLAN, VLAN ID, ACL, PRE-AUTH. ACL, and EDIT. The table is currently empty, showing 'No data'.

Buttons for 'Back', 'Send To APs', 'Apply', 'Add', and 'Delete' are visible throughout the interface.

Figure 221. Remote Ap Group-ACL 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’

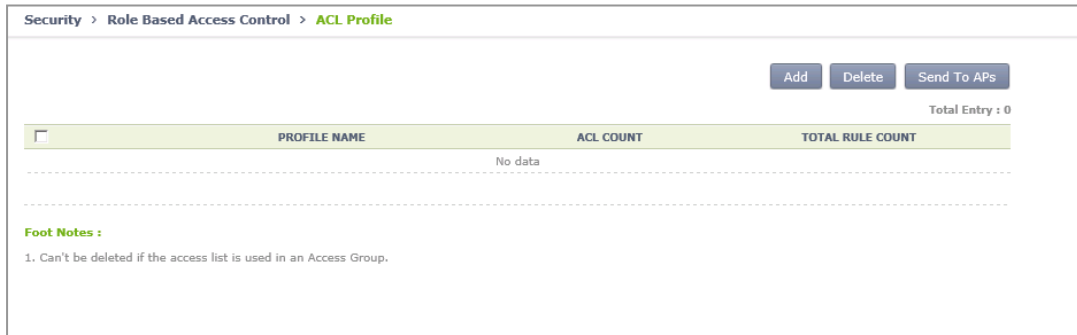


Figure 222. ACL Configuration Synchronization - All

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

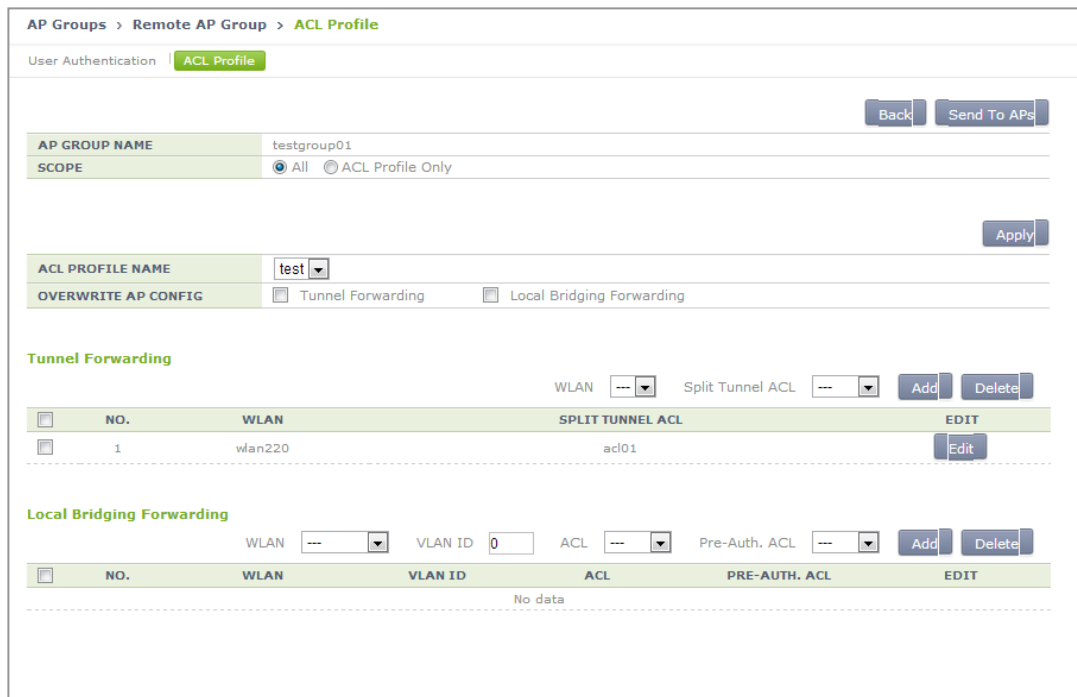


Figure 223. ACL Configuration Synchronization - Remote Group



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

Access Points > Remote AP

Back Send To APs

|                 |   |
|-----------------|---|
| AP PROFILE NAME | ap_1  |
| AP NAME         | AP_f4d9fb118973   |
| AP GROUP NAME   | testgroup01   |
| ACL PROFILE     | test  |
| SCOPE           | <input checked="" type="radio"/> All <input type="radio"/> ACL Profile Only |

**Tunnel Forwarding**

WLAN  Split Tunnel ACL  Add Delete

| NO. | WLAN    | SPLIT TUNNEL ACL | EDIT |
|-----|---------|------------------|------|
| 1   | wlan220 | acl01            | Edit |

---

**Local Bridging Forwarding**

WLAN  VLAN ID  ACL  Pre-Auth. ACL  Add Delete

| NO. | WLAN    | VLAN ID | ACL   | PRE-AUTH. ACL | EDIT |
|-----|---------|---------|-------|---------------|------|
| 1   | wlan221 | 0       | acl01 | acl01         | Edit |

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.

| Security > AAA > External BYOD Server |   |
|---------------------------------------|---|
| SERVICE                               | <input checked="" type="radio"/> Enable <input type="radio"/> Disable |
| SERVER IP ADDRESS 1                   | 90 . 90 . 100 . 120   |
| SERVER IP ADDRESS 2                   | 0 . 0 . 0 . 0   |
| REQUEST URL                           | regist,do?cmd=dhcpTableXMLReceiver                                    |
| SYNC. STATUS                          | Idle  |
| SYNC. FAIL REASON                     | None  |

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.

| <input type="checkbox"/> | SEQ | ACTION | PROTOCOL | SOURCE IP/MASK                | SOURCE PORT | DESTINATION IP/MASK           | DESTINATION PORT | MATCH COUNT |
|--------------------------|-----|--------|----------|-------------------------------|-------------|-------------------------------|------------------|-------------|
| <input type="checkbox"/> | 1   | Permit | UDP      | Any                           | Any         | Any                           | =53              | 0           |
| <input type="checkbox"/> | 2   | Permit | TCP      | 192.168.20.10/255.255.255.255 | =80         | Any                           | Any              | 0           |
| <input type="checkbox"/> | 3   | Permit | TCP      | Any                           | Any         | 192.168.20.10/255.255.255.255 | =80              | 0           |
| <input type="checkbox"/> | 4   | Permit | TCP      | 90.90.100.120/255.255.255.255 | =80         | Any                           | Any              | 0           |
| <input type="checkbox"/> | 5   | Permit | TCP      | Any                           | Any         | 90.90.100.120/255.255.255.255 | =80              | 0           |
| <input type="checkbox"/> | 6   | Permit | UDP      | Any                           | Any         | Any                           | Any              | 2313        |

### 2) Configuring WLAN

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

General
Security
Advanced

WLANs > WLANs > General

|                                 |   |
|---------------------------------|---|
| ID                              | 1   |
| PROFILE NAME                    | wlan1   |
| SSID                            | smart5  |
| AP GROUP LISTS                  | default   |
| INTERFACE GROUP                 | v10   |
| RADIO AREA <sup>1</sup>         | All   |
| CAPWAP TUNNEL MODE <sup>2</sup> | 802.3 Tunnel  |
| SUPPRESS SSID                   | <input type="radio"/> Enable <input checked="" type="radio"/> Disable |
| AAA OVERRIDE                    | <input type="radio"/> Enable <input checked="" type="radio"/> Disable |
| MAX. ALLOWED STATIONS           | 127   |
| GUEST SERVICE                   | <input checked="" type="radio"/> Enable <input type="radio"/> Disable |
| ADMIN STATUS                    | <input checked="" type="radio"/> Enable <input type="radio"/> Disable |

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.

|                                |   |
|--------------------------------|---|
| <b>ID</b>                      | 1   |
| <b>PROFILE NAME</b>            | wlan1   |
| <b>WEB POLICY</b>              | <input checked="" type="radio"/> Enable <input type="radio"/> Disable               |
|                                | <input checked="" type="radio"/> Web Authentication                                 |
|                                | <input type="radio"/> Web Authentication on MAC Authentication failure <sup>1</sup> |
|                                | <input type="radio"/> Web Pass Through  |
|                                | <input type="radio"/> Conditional Web Redirection                                   |
|                                | <input type="radio"/> One Time Redirection  |
| <b>PRE-AUTHENTICATION ACL</b>  | preauth ▾   |
| <b>OVERRIDING REDIRECT URL</b> | <input type="radio"/> Enable <input checked="" type="radio"/> Disable               |
| <b>URL</b>                     | <input type="text"/>  |

### 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.

|  |   |   |
|--|---|---|
|  |   | <input type="button" value="Preview"/> <input type="button" value="Apply"/> |
| <b>Web Login Page</b>                    |   |   |
| <b>WEB AUTHENTICATION TYPE</b>           | External ▾  |   |
| <b>EXTERNAL WEB AUTH. URL</b>            | <input type="text" value="http://90.90.100.120/zero_page.jsp"/>                                       |   |
| <b>AFTER AUTHENTICATION</b> <sup>1</sup> | <input checked="" type="radio"/> Redirect to the requested URL.<br><input type="radio"/> Redirect URL |   |
|  | <input type="text"/>  |   |

# 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.

| DNS Server     |   |
|----------------|---|
| QUERY          | <input checked="" type="radio"/> Enable <input type="radio"/> Disable |
| 1ST DNS SERVER | 3 . 1 . 1 . 1   |
| 2ND DNS SERVER | 2 . 2 . 2 . 2   |
| 3RD DNS SERVER | 8 . 8 . 8 . 8   |
| DNS Relay      |   |
| SERVICE        | <input checked="" type="radio"/> Enable <input type="radio"/> Disable |
| CACHING SIZE   | 10000   |

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.

| DNS Server     |   |
|----------------|---|
| QUERY          | <input checked="" type="radio"/> Enable <input type="radio"/> Disable |
| 1ST DNS SERVER | 3 . 1 . 1 . 1   |
| 2ND DNS SERVER | 2 . 2 . 2 . 2   |
| 3RD DNS SERVER | 8 . 8 . 8 . 8   |
| DNS Relay      |   |
| SERVICE        | <input checked="" type="radio"/> Enable <input type="radio"/> Disable |
| CACHING SIZE   | 10000   |

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.

| FTP                                |   | SFTP              |   |
|------------------------------------|---|-------------------|---|
| FTP                                | <input checked="" type="radio"/> Enable <input type="radio"/> Disable | SFTP              | <input checked="" type="radio"/> Enable <input type="radio"/> Disable |
| PORT                               | 21  | PORT <sup>2</sup> | 22  |
| USER                               | samsung   | USER              | samsung   |
| PASSWORD                           | <input type="checkbox"/> <sup>3</sup> ●●●●●●                          | PASSWORD          | <input type="checkbox"/> <sup>3</sup> ●●●●●●                          |
| CONFIRM PASSWORD                   | ●●●●●●  | CONFIRM PASSWORD  | ●●●●●●  |
| IDLE TIMEOUT (MINUTE) <sup>4</sup> | 17  |                   |   |

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)<br>If the port number is not entered, its default is shown below.<br>- telnet: 23<br>- 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.

| Telnet-SSH                 |   |
|----------------------------|---|
| SESSION TIMEOUT(MIN)       | 0   |
| MAXIMUM NUMBER OF SESSIONS | 20  |
| TELNET SERVICE             | <input checked="" type="radio"/> Enable <input type="radio"/> Disable |
| TELNET PORT                | 23  |
| SSH SERVICE                | <input type="radio"/> Enable <input checked="" type="radio"/> Disable |
| SSH PORT                   | 22  |

**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)<br>- rw: read-write privilege<br>- 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.



The image shows a web-based configuration form for SNMP trap settings. It includes fields for IPv4 address, port number, trap version, and community name, along with 'Back' and 'Apply' buttons.

|                |   |
|----------------|---|
| IPV4 ADDRESS   | <input type="text" value="0"/> <input type="text" value="0"/> <input type="text" value="0"/> <input type="text" value="0"/> |
| PORT NUMBER    | <input type="text" value="162"/>  |
| TRAP VERSION   | <input type="text" value="v1"/>   |
| COMMUNITY NAME | <input type="text"/>  |

Back Apply

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.

This chassis refreshes every 5 seconds.



This page refreshes every 30 seconds.

#### Inventory

|                  |                                |
|------------------|--------------------------------|
| SYSTEM NAME      | APC_152                        |
| LOCATION         | 0                              |
| MODEL NAME       | WEC8500                        |
| MAC ADDRESS      | 00:7e:37:00:20:00              |
| HARDWARE VERSION | 0.3                            |
| FIRMWARE VERSION | 0.5                            |
| SOFTWARE VERSION | 1.2.5                          |
| SERIAL NUMBER    |                                |
| SYSTEM UP TIME   | 16 day, 4 hour, 54 min, 54 sec |
| SYSTEM TIME      | Wed Jan 2 14:50:09 2013        |

#### Package Information

|            |                          |
|------------|--------------------------|
| VERSION    | 1.2.5.R                  |
| BUILD TIME | Sat Dec 15 13:57:36 2012 |
| STATUS     | Active                   |

#### Resource & Environment [Detail](#)

|                              |      |     |
|------------------------------|------|-----|
| CPU USAGE (%)(CONTROL, DATA) | 4%   | 0%  |
| CPU ALARM STATUS             | ● 32 | ● 0 |
| MEMORY USAGE (%)             | 44%  |     |
| MEMORY ALARM STATUS          | ●    |     |
| DISK USAGE (%)               | 13%  |     |
| DISK ALARM STATUS            | ●    |     |
| FAN RPH STATUS               | ● 4  | ● 0 |
| TEMPERATURE                  | ● 3  | ● 0 |

#### Top WLANs [View All](#)

| PROFILE NAME | CURRENT STATIONS |
|--------------|------------------|
|              |                  |

#### Access Points

|                    | TOTAL | UP  | DOWN |                        |
|--------------------|-------|-----|------|------------------------|
| ALL APs            | 1     | ● 1 | ● 0  | <a href="#">Detail</a> |
| 802.11A/N RADIOS   | 1     | ● 1 | ● 0  | <a href="#">Detail</a> |
| 802.11B/G/N RADIOS | 1     | ● 1 | ● 0  | <a href="#">Detail</a> |

#### Current Stations

|       |   |                        |
|-------|---|------------------------|
| COUNT | 0 | <a href="#">Detail</a> |
|-------|---|------------------------|

#### Rogue

|    |     |                        |
|----|-----|------------------------|
| AP | 148 | <a href="#">Detail</a> |
|----|-----|------------------------|

[View All](#)

#### Latest Trap Lists


| NO. | SEVERITY | GROUP    | LOCATION    | PROBABLE CAUSE   | TIME                | STATUS  |
|-----|----------|----------|-------------|--|---------------------|---------|
| 1   | MIN      | security | 002666d94cc | Rogue AP Detected (mac=00:26:66:d9:4c:cc, ClassType=1, Ch=8, Radio=2, SSID=)             | 2013-01-02 14:49:22 | Declare |
| 2   | MIN      | security | 061f1bda0d4 | Rogue AP Detected (mac=06:1f:1b:da:0d:04, ClassType=1, Ch=9, Radio=2, SSID=KT_WLAN_9CB1) | 2013-01-02 14:49:22 | Declare |
| 3   | MIN      | security | 001f1bda0d4 | Rogue AP Detected (mac=00:1f:1b:da:0d:04, ClassType=1, Ch=9, Radio=2, SSID=)             | 2013-01-02 14:49:22 | Declare |
| 4   | MIN      | security | M49fb23c3cc | Rogue AP Detected (mac=M4:d9:fb:23:c3:cc, ClassType=1, Ch=161, Radio=2, SSID=)           | 2013-01-02 14:49:22 | Declare |
| 5   | MIN      | security | M49fb24d06f | Rogue AP Detected (mac=M4:d9:fb:24:d0:6f, ClassType=1, Ch=1, Radio=2, SSID=soyoung_wlan) | 2013-01-02 14:49:22 | Declare |

Figure 233. System information

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

**Summary**

This chassis refreshes every 5 seconds.



This page refreshes every 30 seconds.

**Inventory**

|                  |                          |
|------------------|--------------------------|
| SYSTEM NAME      | SMB_96                   |
| LOCATION         | where                    |
| MODEL NAME       | WEC8050                  |
| MAC ADDRESS      | 00:7e:37:00:21:04        |
| HARDWARE VERSION | 0.0                      |
| FIRMWARE VERSION | 0.1                      |
| SOFTWARE VERSION | 0.4.4                    |
| SERIAL NUMBER    |                          |
| SYSTEM UP TIME   | 16 min, 1 sec            |
| SYSTEM TIME      | Fri Sep 06 10:27:41 2013 |

**Package Information**

|            |                         |
|------------|-------------------------|
| VERSION    | 0.4.4.R                 |
| BUILD TIME | Thu Sep 5 15:28:34 2013 |
| STATUS     | Active                  |

**Top WLANs** [View All](#)

| PROFILE NAME | CURRENT STATIONS |
|--------------|------------------|
|              |                  |

**Resource & Environment** [Detail](#)

|                              |     |     |
|------------------------------|-----|-----|
| CPU USAGE (%)(CONTROL, DATA) | 59% | 0%  |
| CPU ALARM STATUS             | ● 6 | ● 0 |
| MEMORY USAGE (%)             | 50% |     |
| MEMORY ALARM STATUS          | ●   |     |
| DISK USAGE (%)               | 50% |     |
| DISK ALARM STATUS            | ●   |     |
| FAN RPM STATUS               | ● 2 | ● 0 |
| TEMPERATURE                  | ● 2 | ● 0 |

**Access Points**

|                    | TOTAL | UP  | DOWN  |                        |
|--------------------|-------|-----|-------|------------------------|
| ALL APs            | 150   | ● 0 | ● 150 | <a href="#">Detail</a> |
| 802.11A/N RADIOS   | 150   | ● 0 | ● 150 | <a href="#">Detail</a> |
| 802.11B/G/N RADIOS | 150   | ● 0 | ● 150 | <a href="#">Detail</a> |

**Current Stations**

|       |   |                        |
|-------|---|------------------------|
| COUNT | 0 | <a href="#">Detail</a> |
|-------|---|------------------------|

**Rogue**

|         |   |                        |
|---------|---|------------------------|
| AP      | 0 | <a href="#">Detail</a> |
| STATION | 0 | <a href="#">Detail</a> |
| ADHOC   | 0 | <a href="#">Detail</a> |

[View All](#)

**Latest Trap Lists**

| NO. | SEVERITY | GROUP  | LOCATION | PROBABLE CAUSE  | TIME                | STATUS |
|-----|----------|--------|----------|---|---------------------|--------|
| 1   | NOT      | pm     | APC      | Reporting Statistics Failed (Reason=ftp connection failure) | 2013-09-06 10:27:20 | Notice |
| 2   | NOT      | wifi   | APC      | RRM DPC RUN (Dynamic power control done [2.4GHz])           | 2013-09-06 10:22:53 | Notice |
| 3   | NOT      | wifi   | APC      | RRM DPC RUN (Dynamic power control done [5GHz])             | 2013-09-06 10:22:50 | Notice |
| 4   | NOT      | pm     | APC      | Reporting Statistics Failed (Reason=ftp connection failure) | 2013-09-06 10:22:20 | Notice |
| 5   | NOT      | system | APC      | Management User Login (ID=samsung, IP=10.254.175.139 (WEC)) | 2013-09-06 10:22:09 | Notice |

## 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]

|                          |                 |                 | <i>Reboot All with Upgrade</i> | <i>Reboot</i> |
|--------------------------|-----------------|-----------------|--------------------------------|---------------|
| <input type="checkbox"/> | AP PROFILE NAME | AP NAME         | REBOOT CAUSE                   |               |
| <input type="checkbox"/> | ap_1            | AP_f4d9fb24d2c0 | reboot after package upgrade   |               |
| <input type="checkbox"/> | ap_2            | AP_f4d9fb24cfc0 | -                              |               |

1

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 (°C).

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 (°C).

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.

The screenshot shows a web interface for configuring SNMP alarm thresholds. It is organized into five sections, each with a 'MONITOR' checkbox (checked) and a 'THRESHOLD' input field:

- CPU Load:** MONITOR  Enable  Disable, THRESHOLD(%) 90
- Memory Usage:** MONITOR  Enable  Disable, THRESHOLD(%) 90
- Disk Usage:** MONITOR  Enable  Disable, THRESHOLD(%) 90
- Fan Alarm:** MONITOR  Enable  Disable, THRESHOLD(LEVEL) 5
- Temperature Alarm:** MONITOR  Enable  Disable, THRESHOLD(°C) 88

An 'Apply' button is located in the top right corner of the form.

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.

| NO. | SEVERITY | GROUP    | LOCATION     | PROBABLE CAUSE                            | ALARM TIME          |
|-----|----------|----------|--------------|---|---------------------|
| 0   | MIN      | security | 002666d94cc  | Rogue AP Detected (mac=00:26:66:d9:4c:cc) | 2013-01-02 14:49:22 |
| 1   | MIN      | security | 061f1fbd0d4  | Rogue AP Detected (mac=06:1f:1f:bd:a0:d4) | 2013-01-02 14:49:22 |
| 2   | MIN      | security | 001f1fbd0d4  | Rogue AP Detected (mac=00:1f:1f:bd:a0:d4) | 2013-01-02 14:49:22 |
| 3   | MIN      | security | f4d9b23c3cc  | Rogue AP Detected (mac=f4:d9:b2:3c:3c:cc) | 2013-01-02 14:49:22 |
| 4   | MIN      | security | f4d9b24d06f  | Rogue AP Detected (mac=f4:d9:b2:4d:06:f)  | 2013-01-02 14:49:22 |
| 5   | MIN      | security | f4d9b23f3e2  | Rogue AP Detected (mac=f4:d9:b2:3f:3e:2)  | 2013-01-02 14:49:22 |
| 6   | MIN      | security | e80462777443 | Rogue AP Detected (mac=e8:04:62:77:74:43) | 2013-01-02 14:44:09 |
| 7   | MIN      | security | f4d9b23bc02  | Rogue AP Detected (mac=f4:d9:b2:3b:c0:2)  | 2013-01-02 14:38:56 |
| 8   | MIN      | security | 000000000000 | Rogue AP Detected (mac=00:00:00:00:00:00) | 2013-01-02 14:38:56 |
| 9   | MIN      | security | f4d9b23f6a2  | Rogue AP Detected (mac=f4:d9:b2:3f:6a:2)  | 2013-01-02 14:38:56 |
| 10  | MIN      | security | f4d9b23f4a2  | Rogue AP Detected (mac=f4:d9:b2:3f:4a:2)  | 2013-01-02 14:38:56 |
| 11  | MIN      | security | f4d9b2401a2  | Rogue AP Detected (mac=f4:d9:b2:40:1a:2)  | 2013-01-02 14:38:56 |
| 12  | MIN      | security | e8046277a5d2 | Rogue AP Detected (mac=e8:04:62:77:a5:d2) | 2013-01-02 14:33:43 |
| 13  | MIN      | security | e80462768553 | Rogue AP Detected (mac=e8:04:62:76:85:53) | 2013-01-02 14:28:30 |
| 14  | MIN      | security | e80462777440 | Rogue AP Detected (mac=e8:04:62:77:74:40) | 2013-01-02 14:28:30 |
| 15  | MIN      | security | e80462777442 | Rogue AP Detected (mac=e8:04:62:77:74:42) | 2013-01-02 14:28:30 |
| 16  | MIN      | security | e80462777441 | Rogue AP Detected (mac=e8:04:62:77:74:41) | 2013-01-02 14:28:30 |
| 17  | MIN      | security | f4d9b24d010  | Rogue AP Detected (mac=f4:d9:b2:4d:01:0)  | 2013-01-02 14:12:51 |
| 18  | MIN      | security | dc7144eede7a | Rogue AP Detected (mac=dc:71:44:ee:de:7a) | 2013-01-02 14:07:38 |
| 19  | MIN      | security | a00bba0f0f84 | Rogue AP Detected (mac=a0:0b:ba:0f:0f:84) | 2013-01-02 14:02:25 |

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.

This chassis refreshes every 5 seconds.



This page refreshes every 30 seconds.

#### Inventory

|                  |                                |
|------------------|--------------------------------|
| SYSTEM NAME      | APC_152                        |
| LOCATION         | 0                              |
| MODEL NAME       | WEC8500                        |
| MAC ADDRESS      | 00:7e:37:00:20:00              |
| HARDWARE VERSION | 0.3                            |
| FIRMWARE VERSION | 0.5                            |
| SOFTWARE VERSION | 1.2.5                          |
| SERIAL NUMBER    |                                |
| SYSTEM UP TIME   | 16 day, 4 hour, 54 min, 54 sec |
| SYSTEM TIME      | Wed Jan 2 14:50:09 2013        |

#### Package Information

|            |                          |
|------------|--------------------------|
| VERSION    | 1.2.5.R                  |
| BUILD TIME | Sat Dec 15 13:57:36 2012 |
| STATUS     | Active                   |

#### Resource & Environment [Detail](#)

|                               |     |    |
|-------------------------------|-----|----|
| CPU USAGE (%) (CONTROL, DATA) | 4%  | 0% |
| CPU ALARM STATUS              | 32  | 0  |
| MEMORY USAGE (%)              | 44% |    |
| MEMORY ALARM STATUS           |     |    |
| DISK USAGE (%)                | 13% |    |
| DISK ALARM STATUS             |     |    |
| FAN RPM STATUS                | 4   | 0  |
| TEMPERATURE                   | 3   | 0  |

#### Access Points

|                    | TOTAL | UP | DOWN |                        |
|--------------------|-------|----|------|------------------------|
| ALL APs            | 1     | 1  | 0    | <a href="#">Detail</a> |
| 802.11A/N RADIOS   | 1     | 1  | 0    | <a href="#">Detail</a> |
| 802.11B/G/N RADIOS | 1     | 1  | 0    | <a href="#">Detail</a> |

#### Current Stations

|       |   |                        |
|-------|---|------------------------|
| COUNT | 0 | <a href="#">Detail</a> |
|-------|---|------------------------|

#### Rogue

|    |     |                        |
|----|-----|------------------------|
| AP | 148 | <a href="#">Detail</a> |
|----|-----|------------------------|

[View All](#)

#### Latest Trap Lists

| NO. | SEVERITY | GROUP    | LOCATION     | PROBABLE CAUSE   | TIME                | STATUS  |
|-----|----------|----------|--------------|--|---------------------|---------|
| 1   | MIN      | security | 002666d94cc  | Rogue AP Detected (mac=00:26:66:d9:4c:cc, ClassType=1, Ch=8, Radio=2, SSID=)             | 2013-01-02 14:49:22 | Declare |
| 2   | MIN      | security | 061f1fdae0d4 | Rogue AP Detected (mac=06:1f:1f:bd:a0:d4, ClassType=1, Ch=9, Radio=2, SSID=KT_WLAN_SCB1) | 2013-01-02 14:49:22 | Declare |
| 3   | MIN      | security | 001f1fdae0d4 | Rogue AP Detected (mac=00:1f:1f:bd:a0:d4, ClassType=1, Ch=9, Radio=2, SSID=)             | 2013-01-02 14:49:22 | Declare |
| 4   | MIN      | security | f4d9fb23c3cc | Rogue AP Detected (mac=f4:d9:fb:23:c3:cc, ClassType=1, Ch=161, Radio=2, SSID=)           | 2013-01-02 14:49:22 | Declare |
| 5   | MIN      | security | f4d9fb24d08f | Rogue AP Detected (mac=f4:d9:fb:24:d0:8f, ClassType=1, Ch=1, Radio=2, SSID=soyoung_wlan) | 2013-01-02 14:49:22 | Declare |

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.

**Alarm Group**  
Selected groups will be activated by clicking apply button.

System
  Pm
  Ap
  Wlan
  wifi
  Security
  Network
  Interface
  Se
  All

**Alarm Severity**  
Selected level and higher levels will be activated by clicking apply button.

Critical
  Major
  Minor

**Alarm Information**  
Assign severity level to each alarm.

| INDEX | ALARM NAME                 | GROUP  | ALARM ID | DESCRIPTION                                     | SEVERITY |
|-------|----------------------------|--------|----------|---|----------|
| 1     | Software Down              | system | 856      | Software is down                                | major    |
| 2     | Cpu Load Alarm             | system | 863      | CPU Load is higher than the Threshold           | major    |
| 3     | Memory Usage Alarm         | system | 864      | Memory Usage is higher than the Threshold       | major    |
| 4     | Disk Usage Alarm           | system | 865      | Disk Usage is higher than the Threshold         | major    |
| 5     | Fan Rpm Alarm              | system | 866      | Fan Usage is higher than the Threshold          | major    |
| 6     | System Temperature Alarm   | system | 867      | System Temperature is higher than the Threshold | critical |
| 7     | System Thermal Runaway     | system | 868      | Thermal shutdown                                | critical |
| 8     | DHCP Sever Connect Failure | system | 877      | Failed to connect to DHCP server                | major    |
| 9     | DNS Server Connect Failure | system | 878      | Failed to connect to DNS server                 | major    |
| 10    | NTP Server Connect Failure | system | 879      | Failed to connect to NTP server                 | major    |
| 11    | Fan Fail alarm             | system | 931      | FAN rpm is lower than fan Standard RPM          | critical |
| 12    | Temperature Sensor Fail    | system | 936      | Detecting breakdown on TEMP sensor              | critical |
| 13    | Power Module Fail          | system | 937      | Detecting failure of power module               | major    |
| 14    | Duplicated IP              | ap     | 1001     | Duplicate IP addresses detected                 | critical |
| 15    | No Radio                   | ap     | 1002     | No description                                  | critical |
| 16    | License Expired            | ap     | 1009     | AP's license has expired                        | critical |

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)<br>- start: Starts real-time information collection<br>- 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’.

| License Key Status <sup>1</sup> |           | Current System Status |        |
|---------------------------------|-----------|-----------------------|--------|
| OFFICIAL KEY                    | Valid     | NUMBER OF AP          | 500    |
| TEMPORARY KEY                   | Not valid | VQM                   | Enable |
|                                 |           | FIREWALL              | Enable |

| SLM License Key Status |                     |  |
|------------------------|---------------------|--|
| SLM LICENSE KEY 1      | Activation(apply)   | NWMIS1-3DC52V-WTEBZL-6ESN                                      |
| SLM LICENSE KEY 2      | Deactivation(apply) | NWMIS1-3DC52V-WTEBZL-6ESNBQ-ZCEHYP-NXDWMN-DEHFTG-EMRTGZ-RTAMO7 |

| License Control             |   |
|-----------------------------|---|
| CONTROL TYPE <sup>2</sup>   | <input checked="" type="radio"/> Activation <input type="radio"/> Deactivation    |
| UPLOAD ACTIVATION KEY FILE  | <input type="text"/> <input type="button" value="찾아보기..."/>                       |
| REBOOT CONTROL <sup>4</sup> | <input type="radio"/> With Reboot <input checked="" type="radio"/> Without Reboot |

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.



NOTE

### 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.



NOTE

### 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.



NOTE

### 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           : YNHSHWPW-5MNMTE04-UJHKDO4U-A2WGSBGX-
OJZ2MJ5R-7Z5DBYMT
  MAC Address           : F4D9FB236C01
  System Model          : Any
  Lifetime              : Permantet
  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.

| License                                |   |
|--|---|
| <b>License Key Status</b> <sup>1</sup> |   |
| OFFICIAL KEY                           | Valid   |
| TEMPORARY KEY                          | Not valid   |
| <b>Current System Status</b>           |   |
| NUMBER OF AP                           | 500   |
| VQM                                    | Enable  |
| FIREWALL                               | Enable  |
| <b>SLM License Key Status</b>          |   |
| SLM LICENSE KEY 1                      | None  |
| SLM LICENSE KEY 2                      | None  |
| <input type="button" value="Apply"/>   |   |
| <b>License Control</b>                 |   |
| CONTROL TYPE <sup>2</sup>              | <input checked="" type="radio"/> Activation <input type="radio"/> Deactivation    |
| UPLOAD ACTIVATION KEY FILE             | <input type="text"/> <input type="button" value="찾아보기..."/>                       |
| REBOOT CONTROL <sup>4</sup>            | <input type="radio"/> With Reboot <input checked="" type="radio"/> Without Reboot |

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.

The screenshot displays the SysLog Configuration window in the Samsung Wireless Enterprise Web UI. The left sidebar contains a navigation menu with categories like SNMP, Trap Control, and Logs. The main content area is titled 'Logs > SysLog Configuration' and includes the following elements:

- SysLog Mode:** A section with a radio button for 'enable' (selected) and a radio button for 'disable'. Below it is a 'SEVERITY' dropdown menu set to 'notice'. An 'Apply' button is located to the right.
- SysLog Server:** A table with columns for 'INDEX', 'IP ADDRESS', and 'UDP PORT'. It contains two entries:
 

| INDEX | IP ADDRESS    | UDP PORT |
|-------|---------------|----------|
| 1     | 0   0   0   0 | 514      |
| 2     | 0   0   0   0 | 514      |

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<br>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.<br>2) Execute the 'show system cpu detail' command to check the CPU status.<br>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.<br>2) Execute the 'show system cpu detail' command to check the CPU status.<br>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.

Package Upgrade > APC Apply

**Select Package File**

|                                   |                     |
|-----------------------------------|---------------------|
| CURRENT VERSION                   | 2.0.0.T             |
| PACKAGE NAME                      | wec8500_1.5.4.R.bin |
| COMPATIBILITY                     | Compatible          |
| BACKUP CONFIGURATION <sup>1</sup> | exist               |

Model: WEC8500  
Version: 1.5.4  
AddInfo: R  
BuildTime: Wed Jan 8 13:19:57 2014  
Builder: apcbuid  
Directory: /home2/apcbuid/release/wec8500\_1.5.5  
PLD Version: R1.01.040;  
MD5Sum: 0c88d0206d51036b7c499d7a3d319ccd

**Saving Control <sup>2</sup>**

Save and Package Upgrade  Package Upgrade Without Save

**Package Upgrade Status**

|        |      |
|--------|------|
| STATUS | None |
|--------|------|

**Foot Notes :**

1. If the backup configuration exists, apply the configuration.  
If you select "Restore Backup Configuration", the backup configuration of previous upgrade operations will be restored.
2. It is recommended that you save the configuration before upgrade.  
If you select "Save and Package Upgrade", configuration is saved and also backup under the name of the package version.  
You can apply the configuration in "Backup Configuration".
3. The system will be reboot after upgrade operations.

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.

The screenshot displays a web interface for database backup and restore operations. It is divided into two main sections: 'DB Backup' and 'DB Restore'. Each section has a table with columns for 'FILE NAME' and 'STATUS'. The 'DB Backup' section has a text input field for the file name and an 'Apply' button. The 'DB Restore' section has a dropdown menu for selecting a file name and an 'Apply' button.

| DB Backup |                      |
|-----------|----------------------|
| FILE NAME | <input type="text"/> |
| STATUS    |                      |

| DB Restore |                    |
|------------|--------------------|
| FILE NAME  | Select File Name ▾ |
| STATUS     |                    |

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 | apcluster    | 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)<br>- id: A specific CDR ID value to view<br>- 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.<br>- id: A specific CDR ID value to delete<br>- 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
00000000 7f45 4c46 0202 0100 0000 0000 0000 0000 |.ELF.....|
00000010 0002 0008 0000 0001 0000 0001 2000 4950 |..... .IP |
00000020 0000 0000 0000 0040 0000 0000 0002 9600 |.....@.....|
00000030 808d 0007 0040 0038 0007 0040 001e 001d |.....@.8...@...|
00000040 0000 0006 0000 0005 0000 0000 0000 0040 |.....@ |
00000050 0000 0001 2000 0040 0000 0001 2000 0040 |..... .@.... .@ |
00000060 0000 0000 0000 0188 0000 0000 0000 0188 |.....|
00000070 0000 0000 0000 0008 0000 0003 0000 0004 |.....|
00000080 0000 0000 0002 5b40 0000 0001 2002 5b40 |.....[@.... .[@ |
00000090 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.<br>(basic path)                                      |
| USB memory | usb [N]:/ | Uses a USB memory as a storage media.<br>(‘N’ represents a partition number in a USB memory.) |

To 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.

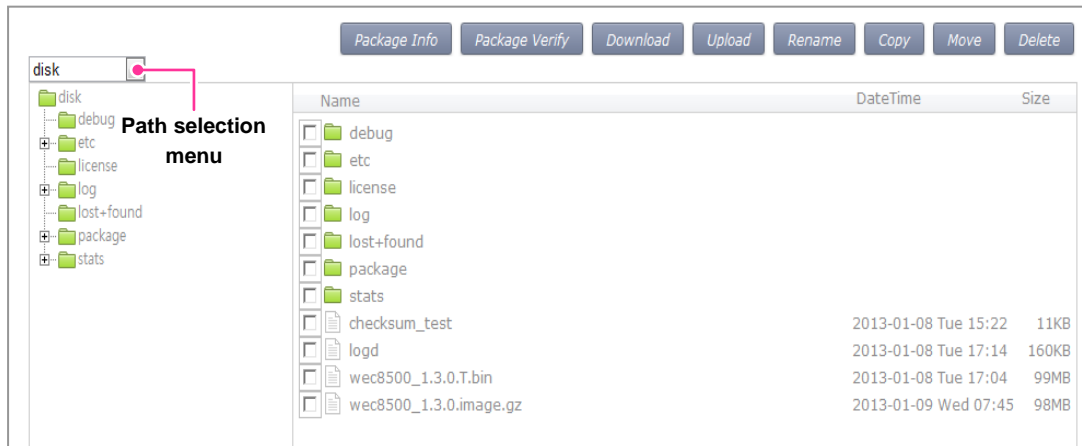


Figure 245. File management window

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.

File Management > Character Encoding

Apply

Character Encoding Type of Exporting File

CHARACTER ENCODING TYPE KOREAN(UHC) ▼

Foot Notes :

1. This setting only affects the exporting csv file

### 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# threshold 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.

Statistics > Network Quality > Radios > 802.11a/n/ac > VoIP

Radio Switch

Last updated : Mon Dec 08 15:55:10 2014

Call count statistics <sup>1</sup>

Current calls : 0

|                                    | 5 MIN | 1 HOUR | 1 DAY     | TOTAL    |
|------------------------------------|-------|--------|-----------|----------|
| TOTAL <sup>2</sup>                 | 0     | 5      | 35        | 49       |
| SETUP SUCCESS <sup>3</sup>         | 0     | 5      | 35        | 49       |
| SUCCESS <sup>4</sup>               | 0     | 4      | 22        | 34       |
| FAILURE <sup>5</sup>               | 0     | 2      | 13        | 15       |
| CANCEL                             | 0     | 1      | 11        | 12       |
| 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     | 1      | 2         | 2        |
| ETC                                | 0     | 0      | 0         | 1        |
| DROP, RATE                         | 0(-%) | 0(0%)  | 3(13.64%) | 3(8.82%) |
| DISASSOCIATION                     | 0     | 0      | 0         | 0        |
| NO MEDIA                           | 0     | 0      | 3         | 3        |
| UNREGISTRATION                     | 0     | 0      | 0         | 0        |
| TIMEOUT                            | 0     | 0      | 0         | 0        |
| INTER-APC HANDOVER-OUT             | 0     | 0      | 0         | 0        |
| INTER-APC HANDOVER-IN <sup>6</sup> | 0     | 0      | 0         | 0        |

Call setup time

|                       | 5 MIN | 1 HOUR | 1 DAY | TOTAL  |
|-----------------------|-------|--------|-------|--------|
| SETUP TIME MIN (MSEC) | 0     | 902    | 237   | 5      |
| SETUP TIME MAX (MSEC) | 0     | 1,961  | 2,117 | 12,583 |
| SETUP TIME AVG (MSEC) | 0     | 1,354  | 1,307 | 1,224  |

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.

Statistics > Network Quality > APs > 802.11a/n/ac > VoIP

Radio Switch Back

Last updated : Mon Dec 08 16:17:26 2014

|              |         |
|--------------|---------|
| PROFILE NAME | AP-7F02 |
| AP NAME      | AP-7F02 |

Call count statistics <sup>1</sup>

Current calls : 0

|                                    | 5 MIN | 1 HOUR | 1 DAY | TOTAL |
|------------------------------------|-------|--------|-------|-------|
| TOTAL <sup>2</sup>                 | 0     | 0      | 1     | 1     |
| SETUP SUCCESS <sup>3</sup>         | 0     | 0      | 1     | 1     |
| SUCCESS <sup>4</sup>               | 0     | 0      | 0     | 0     |
| FAILURE <sup>5</sup>               | 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 <sup>6</sup>           | 0     | 0      | 0     | 0     |
| INTER-APC HANDOVER-OUT             | 0     | 0      | 0     | 0     |
| INTER-APC HANDOVER-IN <sup>7</sup> | 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 <sup>1</sup> | 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 <sup>1</sup> | 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 <sup>2</sup> | 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/Multicast/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<br>- enable: Setting<br>- 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<br>- enable: Set (by default)<br>- 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
=====
=====
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
=====
DisassocIn
DeathIn
DisassocOut
DeathOut

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

```

| Reason      | Total | 5Min | 1Hour | 1Day |
|-------------|-------|------|-------|------|
| DisassocIn  | 0     | 0    | 0     | 0    |
| DeathIn     | 0     | 0    | 0     | 0    |
| DisassocOut | 0     | 0    | 0     | 0    |
| DeathOut    | 0     | 0    | 0     | 0    |

| 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    |
| DeathInReason                  |       |      |       |      |
| 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    |
| STATION_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         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

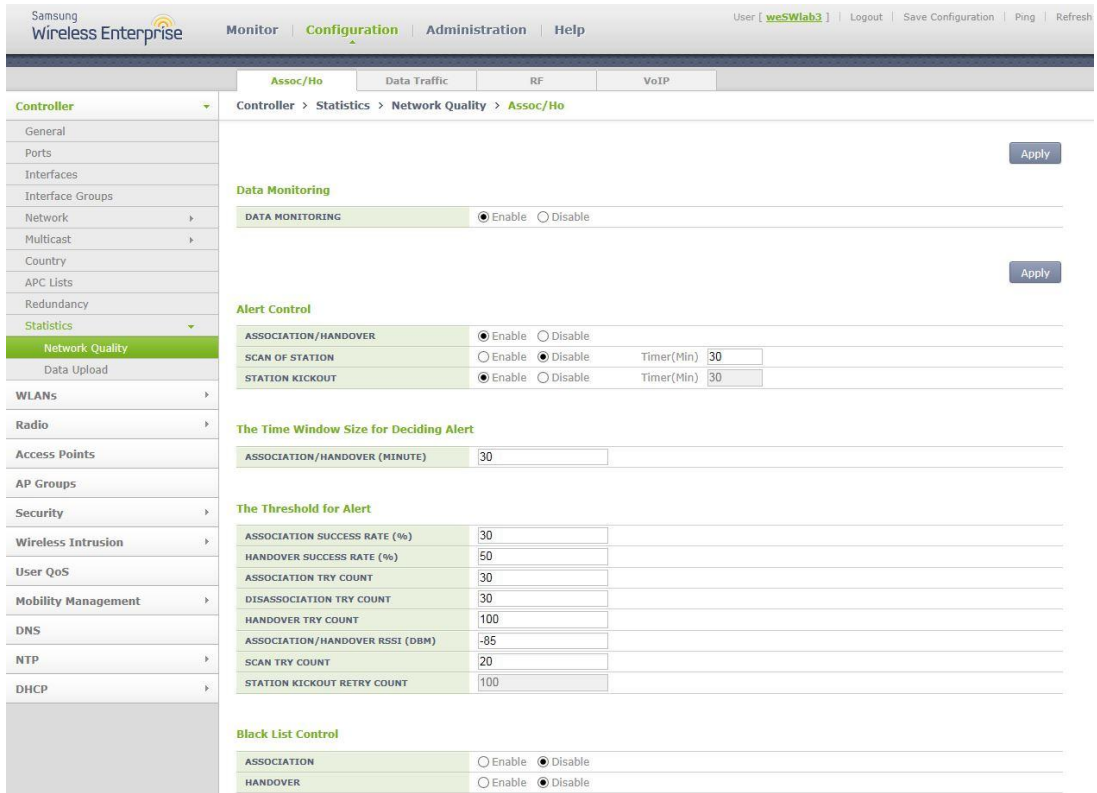
Station Statistics for AP Packet Loss Raw Data [AP ID (1)]:
[RADIO 5-GHz]
  AP Total Transmitted Success Data Frame Count .... 0
  AP Total Transmission Failure Data Frame Count ... 0
  AP Total Retry Success Data Frame Count ..... 0
  AP Total Transmitted Success Mgmt Frame Count .... 0
    
```

```

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**

The screenshot shows the Samsung Wireless Enterprise Monitor interface. The top navigation bar includes 'Monitor', 'Configuration', 'Administration', and 'Help'. The user is logged in as 'weSWlab3'. The main content area is titled 'Alert List' and shows a list of alerts with columns for TIME, LOCATION, ALERT NAME, and DESCRIPTION. The table contains 20 entries, including various success rates and error thresholds.

| TIME                    | LOCATION              | ALERT NAME                       | DESCRIPTION   |
|-------------------------|-----------------------|----------------------------------|---|
| 2014-12-08 15:29:49.817 | STA_00:21:6a:17:1a:86 | Station Assoc Threshold Reached  | Threshold(30) Value   |
| 2014-12-08 15:29:49.651 | STA_00:21:6a:17:1a:86 | Station Dissoc Threshold Reached | Threshold(30) Value   |
| 2014-12-08 15:29:49.649 | STA_00:21:6a:17:1a:86 | Station Low Assoc Success Rate   | Success Rate(0.000000)                                      |
| 2014-12-08 15:27:16.121 | STA_00:21:6a:17:1a:86 | Station Low Assoc Success Rate   | Success Rate(0.000000)                                      |
| 2014-12-08 15:25:44.904 | STA_00:21:6a:17:1a:86 | Station Low Assoc Success Rate   | Success Rate(0.000000)                                      |
| 2014-12-08 15:24:13.687 | STA_00:21:6a:17:1a:86 | Station Low Assoc Success Rate   | Success Rate(0.000000)                                      |
| 2014-12-08 15:22:42.437 | STA_00:21:6a:17:1a:86 | Station Low Assoc Success Rate   | Success Rate(0.000000)                                      |
| 2014-12-08 15:22:32.493 | AP_f4:d9:fb:35:45:6d  | RF error threshold exceeded      | Air-Quality 2.4GHz Ch(2) Error Count(60) for 1 Hour         |
| 2014-12-08 15:22:32.494 | AP_f4:d9:fb:35:45:6d  | RF error threshold exceeded      | Channel-Utilization 2.4GHz Ch(2) Error Count(60) for 1 Hour |
| 2014-12-08 15:21:25.862 | APC                   | Call Drop Error                  | [AP:f4:d9:fb:35:a7:6d] AP(1) Radio(1) Drop Call Rate: 100   |
| 2014-12-08 15:20:25.620 | STA_00:21:6a:17:1a:86 | Station Low Assoc Success Rate   | Success Rate(0.000000)                                      |
| 2014-12-08 15:18:54.416 | STA_00:21:6a:17:1a:86 | Station Low Assoc Success Rate   | Success Rate(0.000000)                                      |
| 2014-12-08 15:17:23.389 | STA_00:21:6a:17:1a:86 | Station Assoc Threshold Reached  | Threshold(30) Value   |
| 2014-12-08 15:17:23.199 | STA_00:21:6a:17:1a:86 | Station Dissoc Threshold Reached | Threshold(30) Value   |
| 2014-12-08 15:17:23.196 | STA_00:21:6a:17:1a:86 | Station Low Assoc Success Rate   | Success Rate(0.000000)                                      |
| 2014-12-08 15:13:38.217 | STA_00:21:6a:17:1a:86 | Station Low Assoc Success Rate   | Success Rate(0.000000)                                      |
| 2014-12-08 15:11:18.084 | STA_00:21:6a:17:1a:86 | Station Low Assoc Success Rate   | Success Rate(0.000000)                                      |
| 2014-12-08 15:09:46.955 | STA_00:21:6a:17:1a:86 | Station Low Assoc Success Rate   | Success Rate(0.000000)                                      |
| 2014-12-08 15:08:15.822 | STA_00:21:6a:17:1a:86 | Station Low Assoc Success Rate   | Success Rate(0.000000)                                      |
| 2014-12-08 15:07:32.519 | AP_f4:d9:fb:35:45:6d  | RF error threshold exceeded      | Air-Quality 2.4GHz Ch(2) Error Count(60) for 1 Hour         |

- 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 ▾

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     |
| STATION 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.

Station Disassoc ▾

**Disassoc And Deauth Count**

|                  | 5 MIN | 1 HOUR | 1 DAY | TOTAL |
|------------------|-------|--------|-------|-------|
| STATION DISASSOC | 0     | 7      | 81    | 95    |
| STATION DEAUTH   | 0     | 0      | 1     | 1     |
| SYSTEM DISASSOC  | 10    | 77     | 601   | 806   |
| SYSTEM DEAUTH    | 0     | 0      | 0     | 0     |

- 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     |
| STATION 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 | 0     | 0 | 0     | 0 |
| AUTH         | 0     | 2 | 0      | 0 | 32    | 0 | 37    | 0 |
| AUTH SUCCESS | 0     | 0 | 0      | 0 | 0     | 0 | 0     | 0 |
| AUTH FAILURE | 0     | 0 | 0      | 0 | 0     | 0 | 0     | 0 |
| IPFAIL       | 0     | 0 | 0      | 0 | 11    | 0 | 11    | 0 |
| NORMAL       | 0     | 5 | 0      | 0 | 38    | 0 | 47    | 0 |

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
| | |-- nhoststats-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-prereq
|  |  |  |-- 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-prereq
| | | | -- 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
```





```

|   |   |   |-- 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
| | | | | | | -- precedence
| | | | | | | -- 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
|   |   |-- rogestation
|   |   |-- 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
| | | -- roquestation
| | -- 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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| compcache                     | GPL 2.0                       |
| DUMA library                  | GPL 2.0                       |
| GnuWin32-gzip                 | GPL 2.0                       |
| GNU Core Utils                | GPL 2.0                       |
| ISC DHCP                      | ISIC License (BSD-)           |
| FTP Lib Alt                   | LGPL 2.1                      |
| libnl-Netlink Library         | LGPL 2.1                      |
| OSIP Library                  | LGPL 2.1                      |
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| libxslt                       | MIT v2 with Ad Clause License |
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Iperf performance test

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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 Daemon                    |
| 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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