WEC8500 (APC)

Operation Manual

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INTRODUCTION

Purpose

This manual describes the overview, management, and setup of Samsung's WEC8500 Wireless Enterprise Access Point Controller (APC). This manual is written for WEC8500 version 1.3.0.

Document Content and Organization

This manual consists of ten Chapters, three Annexes, and a list of Abbreviations.

CHAPTER 1. WEC8500 System Overview

Describes the main functions, network configuration, external configuration and service scenario of the WEC8500.

CHAPTER 2. Basic System Configuration

Describes how to configure using the CLI and Web UI.

CHAPTER 3. Data Network Function

Describes how to set up the data network such as interface, VLAN, L3, or QoS, etc. of WEC8500.

CHAPTER 4. AP Connection Management

Describes the connection management function of WEC8500 and Samsung Wireless Enterprise wireless LAN AP.

CHAPTER 5. WLAN Management

Describes how to set up the WLAN of WEC8500.

CHAPTER 6. Wi-Fi Configuration

Describes how to configure the Wi-Fi of WEC8500, QoS, and country code.

CHAPTER 7. WLAN Additional Service

Describes how to set up WLAN additional services available in the WEC8500.

CHAPTER 8. Security

Describes how to set up security related setting such as RADIUS server available in the WEC8500, unauthorized AP detection and blocking function, guest access, WEB pass-through, NAT, firewall function, etc.

CHAPTER 9. IP Application

Describes the IP application functions available in the WEC8500 such as DNS, NTP, FTP/SFTP, or Telnet/SSH.

CHAPTER 10. System Management

Describes the various system management functions available in the WEC8500.

ANNEX A. CLI Command Structure

Command structure available in the CLI of WEC8500.

ANNEX B. Open Source Announcement (WEC8500)

Open source list used in the WEC8500 and its license notice.

ANNEX C. Open Source Announcement (WEA302, WEA303)

Open source list used in the WEA302 and WEA303 that is a Samsung WIRELESS ENTERPRISE wireless LAN AP and its license notice.

ABBREVIATION

Describes the acronyms used in this manual.

Conventions

The following types of paragraphs contain special information that must be carefully read and thoroughly understood. Such information may or may not be enclosed in a rectangular box, separating it from the main text, but is always preceded by an icon and/or a bold title.

NOTE

Indicates additional information as a reference.

Console Screen Output

- The lined box with '`Courier New`' font will be used to distinguish between the main content and console output screen text.
- '**`Bold Courier New`**' font will indicate the value entered by the operator on the console screen.

Revision History

VERSION	DATE OF ISSUE	REMARKS
2.1	09.2013	Grammar, spelling, headers, footers and copyright info updated for the U.S. Same content as 2.0
2.0	06. 2013.	- Updated the content overall in accordance with the package version 1.3.0 - Added contents ・3.4.6 OS-AWARE ・7.4.2 DPC Configuration ・7.4.3 DCS Configuration ・7.4.4 CHDC Configuration - Changed contents ・7.10 Clustering ・10.8.2 System Upgrade
1.0	03. 2013.	First Version

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CHAPTER 1. WEC8500 System Overview

1.1 WEC8500 Overview

The Samsung WEC8500 comprehensively manages user information and traffic while managing an Access Point (AP), i.e. a device that provides wireless connection service for a user terminal in a Wi-Fi environment. It is commonly called an AP Controller (APC) because it comprehensively manages all the APs and provides services in a wireless LAN environment. Because AP and APC are connected in tunneling, all the user traffic is exchanged and processed.

The WEC8500 is typically installed at a position where it can be connected to a backbone switch, core switch or router in a network of enterprise environment and it controls a wireless LAN AP and provides the functions for Wireless LAN (WLAN) services such as handover and QoS, security/authentication, etc. The WEC8500 provides its services up to 500 APs. It can provide its services up to 10,000 connected user devices.

The WEC8500 provides a WLAN network environment through AP management and also provides various communication services required by enterprise customers in a wireless environment by interoperating with other enterprise solutions. It provides a Wireless Enterprise solution in an enterprise environment by making the collaboration applications such as telephone, message, or communicator, etc., that has been used in a legacy wire environment, be able to be used in a wireless terminal such as smart phone, tablet PC, or notebook.

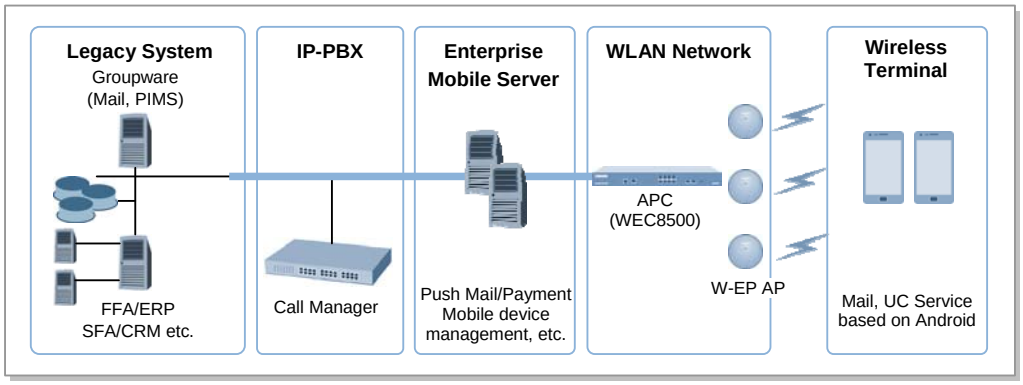


Figure 1. System Structure for Wireless Enterprise Solution

The Samsung WIRELESS ENTERPRISE solution, as shown in figure, comprehensively includes various enterprise applications which are provided by wire/wireless infrastructure products and wireless terminals. The WLAN network, a wireless infrastructure solution that provides mobility in an enterprise environment, consists of WIRELESS ENTERPRISE wireless LAN Access Point (AP), WIRELESS ENTERPRISE AP Controller (APC), and Wireless Enterprise WLAN Manager (WEM).
The Samsung APC and WIRELESS ENTERPRISE wireless LAN AP are core devices that provide various services such as user authentication, wireless management, voice and data service, etc. in the 802.11-based Wi-Fi environment. The WEM provides convenient configuration environment, various statistics, and event information to an operator.


NOTE

Term

In this manual, the WEC8500 and APC commonly represent Samsung AP Controller. In addition, the AP means Samsung WIRELESS ENTERPRISE wireless LAN AP.

1.2 Network Configuration

The network configuration of Samsung WIRELESS ENTERPRISE solution that includes WEC8500 is shown below.

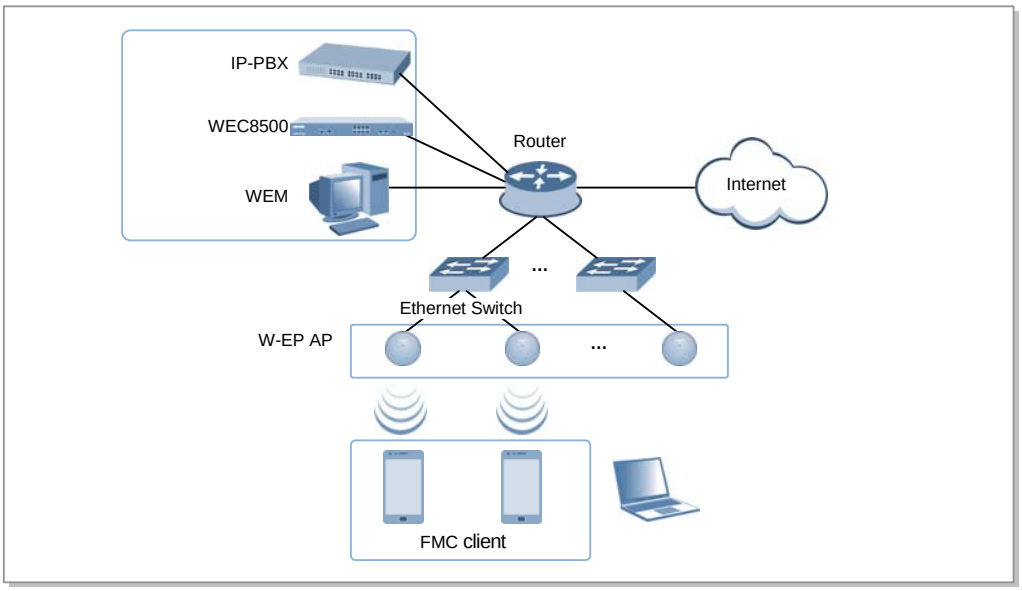


Figure 2. WIRELESS ENTERPRISE Network Configuration

IP-PBX

As an enterprise call manager, it is a switch required to provide the Fixed Mobile Convergence (FMC) function to a wireless terminal (optional).

APC (WEC8500)

The APC manages all the WIRELESS ENTERPRISE wireless LAN APs installed in an enterprise communication environment and it also manages user information and traffics. Because the WIRELESS ENTERPRISE wireless LAN network configuration uses a centralized structure where all the wireless user traffics are in tunneling through the APC, the APC is one of the most important elements related to traffic management and throughput in the WIRELESS ENTERPRISE environment.
An APC is typically installed at a position where it can be connected to a backbone switch, core switch or router in a network. It controls the WIRELESS ENTERPRISE wireless LAN AP and provides handover, QoS, and security/authentication functions.

WEM

In the WIRELESS ENTERPRISE wireless LAN environment, various services are provided through a complex network configuration. As many users are involved, its management is complex and difficult. A normal network administrator can hardly handle any problematic issue as well as a normal management task. The WEM is a Network Management System (NMS) that efficiently manages this kind of WIRELESS ENTERPRISE wireless LAN network and service environment.

It manages a WLAN network, retrieves and configures the status of APC or WIRELESS ENTERPRISE wireless LAN AP.

WIRELESS ENTERPRISE AP (WIRELESS ENTERPRISE Wireless LAN AP)

The WIRELESS ENTERPRISE wireless LAN AP is a device that provides wireless connection service to a user terminal. It should be installed by considering the service area or region that will be provided in an enterprise environment. Typically, the number of WIRELESS ENTERPRISE wireless LAN APs is determined by considering the size of installation area and the number of users to secure service coverage.

Ethernet Switch

Typically, because an AP is installed in a user area, use a Power over Ethernet (PoE) switch that does not use a power line for the beauties of environment, etc. Install the WIRELESS ENTERPRISE wireless LAN APs by considering current consumption and the power capacity PoE switch. In addition, because power drop may occur if the distance between the switch and WIRELESS ENTERPRISE wireless LAN AP, the relationship between distance and power must be considered. Typically, the distance between these two must be 100 m or less in order to avoid power drop.

Wireless terminal/FMC Client

Terminal that provides the 802.11a/b/g/n interface such as smart phone, tablet PC, or notebook computer, etc. In an Android smart phone, an enterprise VoIP application equipped with the Samsung voice engine is called a FMC client (The FMC client is an option).

Wireless additional service

In the WIRELESS ENTERPRISE environment, various application services are required as well as basic wireless connection services.
The Wireless Intrusion Prevention System (WIPS) provides a security service that is one of the most important elements in an enterprise environment. The WIPS can seamlessly receive wireless connection service through the security services such as unauthorized terminal, unauthorized AP, or ad hoc connection blocking, etc.
Location service that manages the location of a terminal in a wireless environment is also an application service required in an enterprise environment. With this, it is possible to manage the location of an effective user or an unauthorized user.

IP application service

The IP application servers required in an existing wire network including Dynamic Host Configuration Protocol (DHCP) server, DNS server, web server, or RADIUS authentication server are also used in the WIRELESS ENTERPRISE environment. Especially, the DHCP server and RADIUS authentication server play a critical role in the wireless environment.

1.3 WEC8500 Configuration and Functions

The Configuration and the purpose of each item of WEC8500 are as follows:

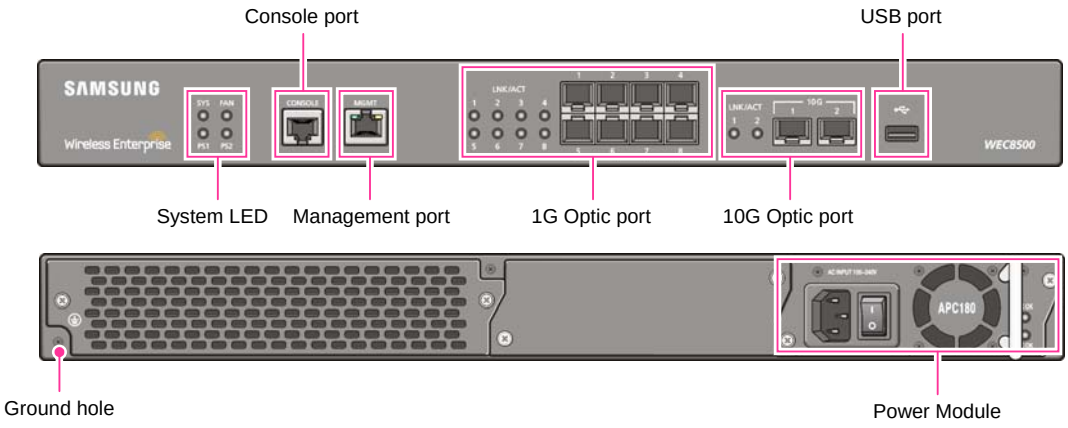


Figure 3. WEC8500 Interface-Front/Back

System LED

Indicates the various statuses of system. Each LED displays the following information.

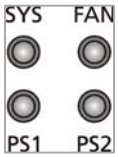


Figure 4. System LED Configuration

LED	Status	Description
SYS	Green	System is operating normally
	Orange	During system booting
	Red	Preparing for system booting
FAN (fan module)	Green	Installed fan module is operating normally
	Orange	During system booting
	Red	Fan module fault has occurred
PS1 (power module 1)	Green	Normal operation of installed power module 1
	Red	Power is turned off or a fault occurred while the power module 1 is installed.
	Off	Power module 1 is not installed.
PS1 (power module 2)	Green	Normal operation of installed power module 2
	Red	Power is turned off or a fault occurred while the power module 2 is installed.
	Off	Power module 2 is not installed.

Console port (RS232C)

A console port is used to check the operational status of WEC8500 or for input through the CLI. Its basic requirements are as follows:

- Baud rate: 115200 bps
- Character size: 8 characters
- Parity: None
- Stop bit: 1, Data bit: 8
- Flow control: None

Management port (1GE UTP)

The WEC8500 provides a 1 GbE/100 base-T UTP port (RJ-45) for management purpose. It is working in 10/100 Mbps half duplex/full duplex mode or in 1000 Mbps full duplex mode. Because it supports the automatic MDI/MDI-X function, you can use a straight-through cable for all the network connections to a PC, server, switch, or network hub.

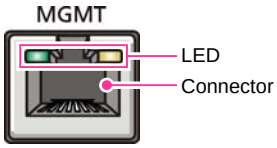


Figure 5. Management Port Configuration

Configuration item	Status	Description
LED	Green	Turned on for link connection
	Orange	Blinking for data exchange
Connector	-	Connector for UTP cable connection

When connecting a cable to the management port, make sure to check if the cable complies with the 10 BASE-T, 100 BASE-TX, or 1000 BASE-T.

- Cable type: UTP or STP cable using RJ-45 connector
  - 10 BASE-T: Category 3 or higher
  - 100 BASE-TX: Category 5 or higher
  - 1000 BASE-T: Category 5 or higher (Category 5e or higher is recommended)
- Isolate from wireless frequency disturbing waves
- Shut down electrical surge
- Separate the electrical wiring of a switch or related devices and the electromagnetic area of network data line
- Cable or connector and safe connection without damaged cable sheath

NOTE

The 1000 BASE-T standard does not support the forced mode.
The auto-negotiation function must be always used for 1000 BASE-T port or trunk connection.

Optic port

It provides two 10 GbE Optic ports and eight 1 GbE Optic ports and the operational status of each port is displayed in LED.

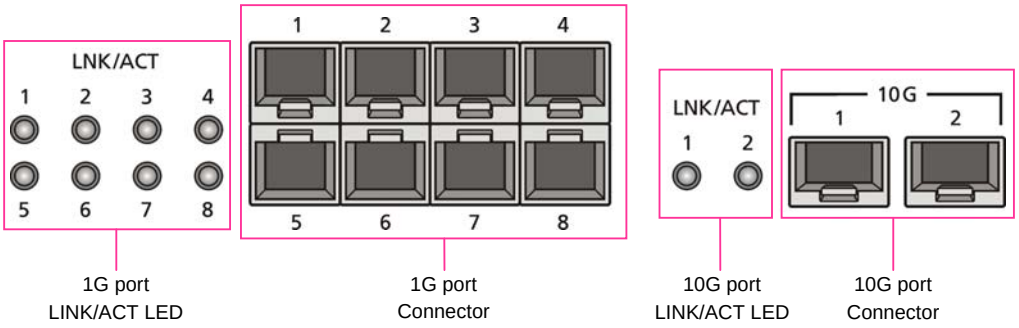


Figure 6. Optic port configuration

Configuration item	Port/LED	Description
10 GE ports	LINK/ACT 1, LINK/ACT 2	LINK/ACT status of each port - Turned on for link connection - Blinking for data exchange
	10G 1, 10G 2	10 GbE Optic module connector
1 GE port	LINK/ACT 1~LINK/ACT 8	LINK/ACT status of each port - Turned on for link connection - Blinking for data exchange
	1G 1~1G 8	1 GbE Optic module connector

USB port (Host 2.0)

The WEC8500 provides a USB host port that supports the upgrade of WEC8500 operation software.
A typical USB memory stick is supported.

Power module

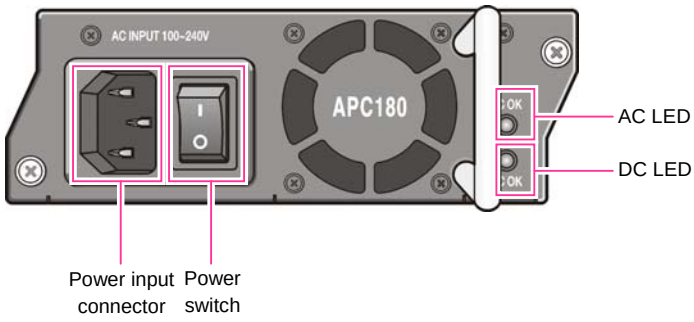


Figure 7. Power module configuration

Configuration item	Description
Power input connector	Connector to connect the power cable to
Power switch	Switch to turn on/off power
AC LED	Turned on when there is a normal AC power input.
DC LED	Turned on when there is a normal DC power output.

1.4 WEC8500 Application Configuration and Service Scenario

1.4.1 Basic Configuration

To provide wireless connection service using a wireless LAN in the WIRELESS ENTERPRISE environment, the WIRELESS ENTERPRISE wireless LAN AP that helps a terminal connect to the network through wireless and an AP such as WEC8500 that controls the terminal are basically required. Especially, the role of APC is critical to guarantee QoS of various services and provide high level of security functions in an Enterprise communication environment. As various elements are required in the WIRELESS ENTERPRISE environment, it is necessary to intuitively or organically manage each element via WEM.

In addition, the IP application servers including authentication server, DHCP server, or DNS server which is a basic network configuration element in a wire enterprise environment are also interoperated to provide more convenient and various mobile services to users. One outstanding example is the FMC service that provides enterprise level VoIP in a wireless LAN. With this, the wire/wireless integrated voice service can be provided.

An example of service configuration diagram using the WIRELESS ENTERPRISE wireless LAN system is shown in the below figure.

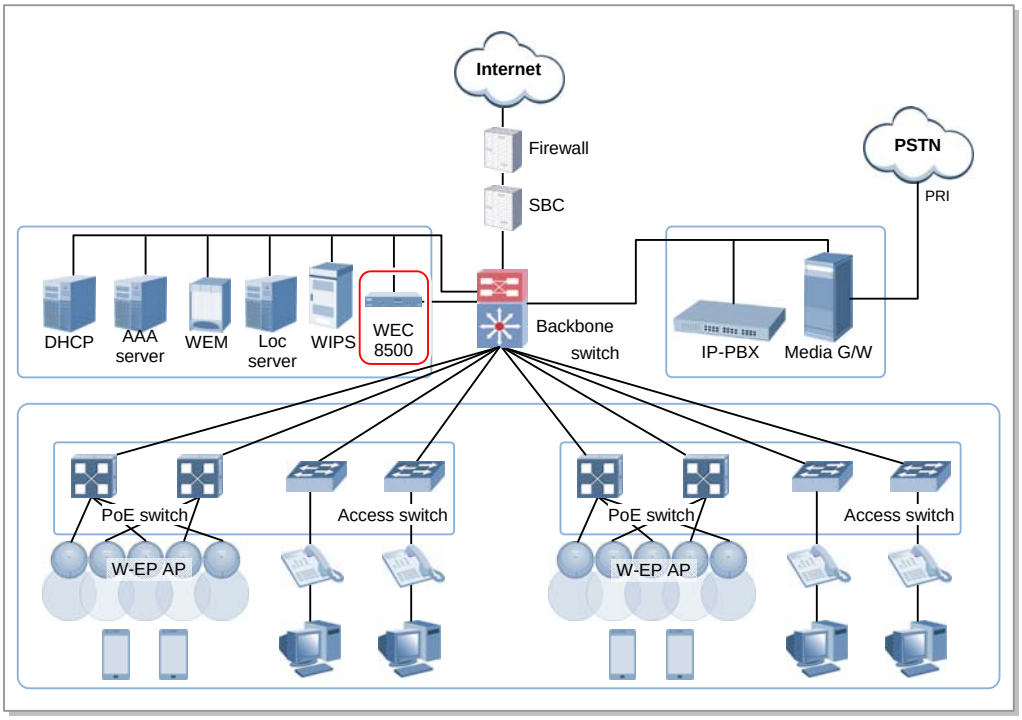


Figure 8. Basic Configuration of WIRELESS ENTERPRISE Wireless LAN System

The basic WIRELESS ENTERPRISE wireless LAN network configuration is a centralized structure where all the wireless user traffics go through tunneling between WEC8500 and WIRELESS ENTERPRISE wireless LAN AP. Therefore, the network information such as subnet information allocated to a wireless user depends on the configuration of backbone network where the WEC8500 is connected.

This provides the following advantages during network configuration and setup.

- Installing the WEC8500 is just adding it to a legacy data center or backbone network. Therefore, the possibility of physical change of core network can be reduced.
  In addition, separate design of wire/wireless network is easy using the WEC8500 as a boundary.
- No dramatic network change is required to install the WIRELESS ENTERPRISE wireless LAN AP.
  An AP installed in a user area is located in various local network environments in a wide region. Although it is unavoidable to install or expand a PoE switch, the modification of local network where wire users are already configured can be minimized.
- Because the WEC8500 relays all the user traffics, it can restrict a wireless attacker's effects and provide differentiated service for each user.

1.4.2 Configuration of Multiple WEC8500 for Redundancy

The WEC8500 provides the redundancy function to guarantee QoS for various services and provide service stability in the WIRELESS ENTERPRISE environment.

An example of service configuration diagram for redundancy is shown in the below figure.

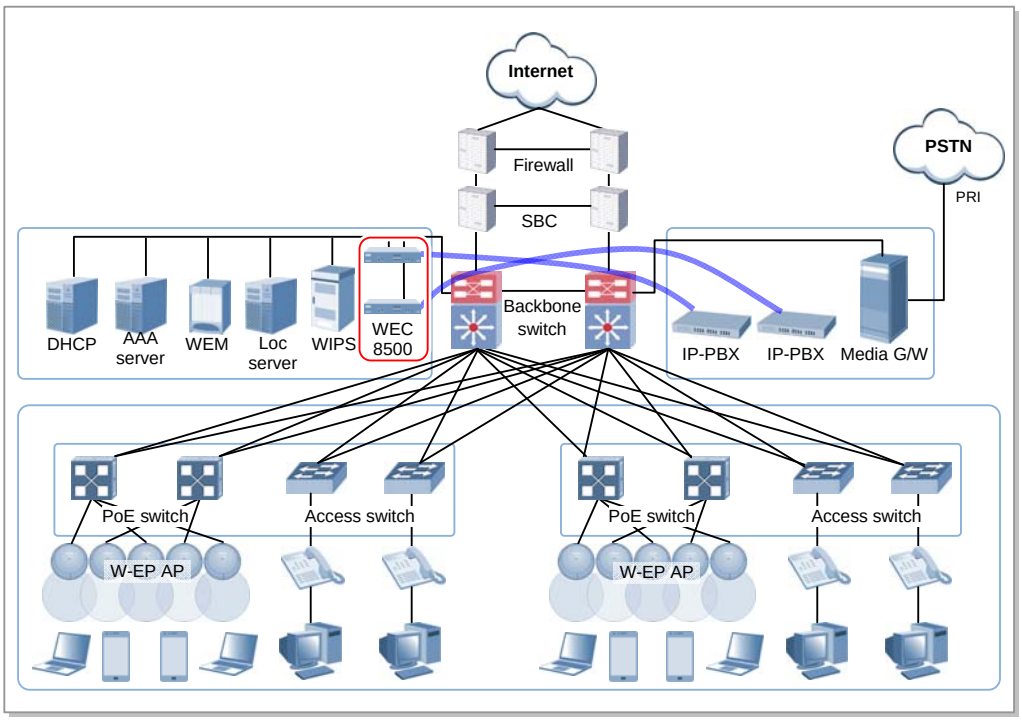


Figure 9. Example of WIRELESS ENTERPRISE Wireless LAN System Configuration for Redundancy

In this configuration, several WEC8500s are used to minimize service disruption caused by a disconnected WEC8500 and to enhance service sustainability. Basically, two or more WEC8500s must be installed in the same site for APC redundancy. The redundancy configuration includes active-active configuration, active-standby configuration, and many-to-one configuration. An operator can select a configuration based on the number of available WEC8500s and redundancy level...

1.4.3 Clustering Configuration using Multiple WEC8500

The WIRELESS ENTERPRISE environment has various area sizes, user density and number of users. If only a single WEC8500 is required for service and management, the complexity of network configuration or management is not high. However, if the capacity of a single WEC8500 is not sufficient, multiple WEC8500s must be installed for service. To set up a wireless LAN network in an environment where multiple WEC8500s are installed, the integrated management system and user service must be provided through clustering configuration between the WEC8500s. This allows inter APC handover.
The WEC8500s configured in a cluster provides a service just like a single WEC8500 through periodic information exchange.

Inter APC handover

The inter APC handover is a handover between APCs. A clustering group is used to provide this function and this clustering group means a virtual area.
Maximum six WEC8500s can be bound to a single group. An APC in a group cannot be added to another group.
It provides layer 3 handover and the handover is supported when a terminal moves to an APC which have different subnets. A serving APC is called as an anchor APC and a target APC is called as a foreign APC. The control path and also the tunnel for data traffic between APCs provide security using IPSec.
The inter APC handover provides this function both in the standard Wi-Fi handover and Samsung's unique AirMove method.

1.4.3.1 Configuration of Distributed Clustering Service

The configuration of distributed clustering is to install each WEC8500 in a building or a local site according to its capacity. This option can be used when there is no integrated backbone configuration in a site or networks are separated for each building. It is suitable for a site where several buildings are apart from each other.
An example of service configuration diagram is shown in the below figure.

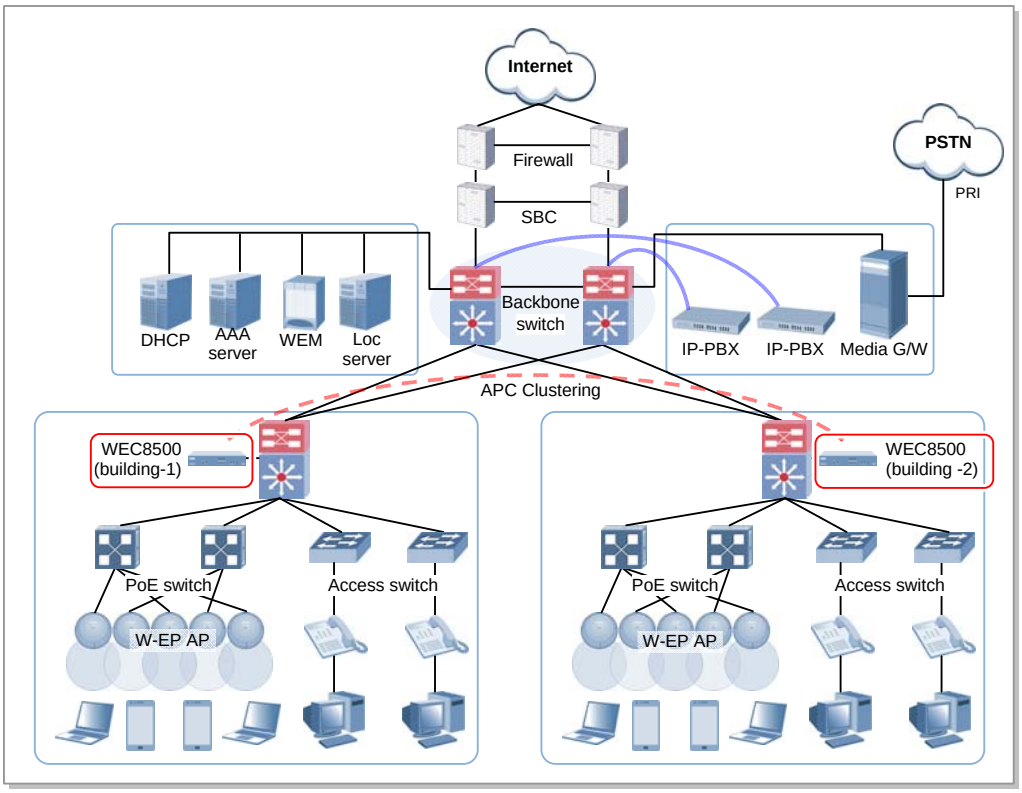


Figure 10. Example of WIRELESS ENTERPRISE Wireless LAN System Configuration for Distributed Clustering Service

1.4.3.2 Configuration of Centralized Clustering Service

In the centralized cluster configuration, all the WEC8500s in a site are installed in the center. This is suitable when all the networks in a site are configured around the backbone. This option is suitable for a site where several buildings are close to each other or a large building where a seamless handover service is required using one or more WEC8500s. Better performance can be obtained if there is a single backbone network and it is preferable in terms of installation or maintenance because its service configuration is simple.

An example of service configuration diagram is shown in the below figure.

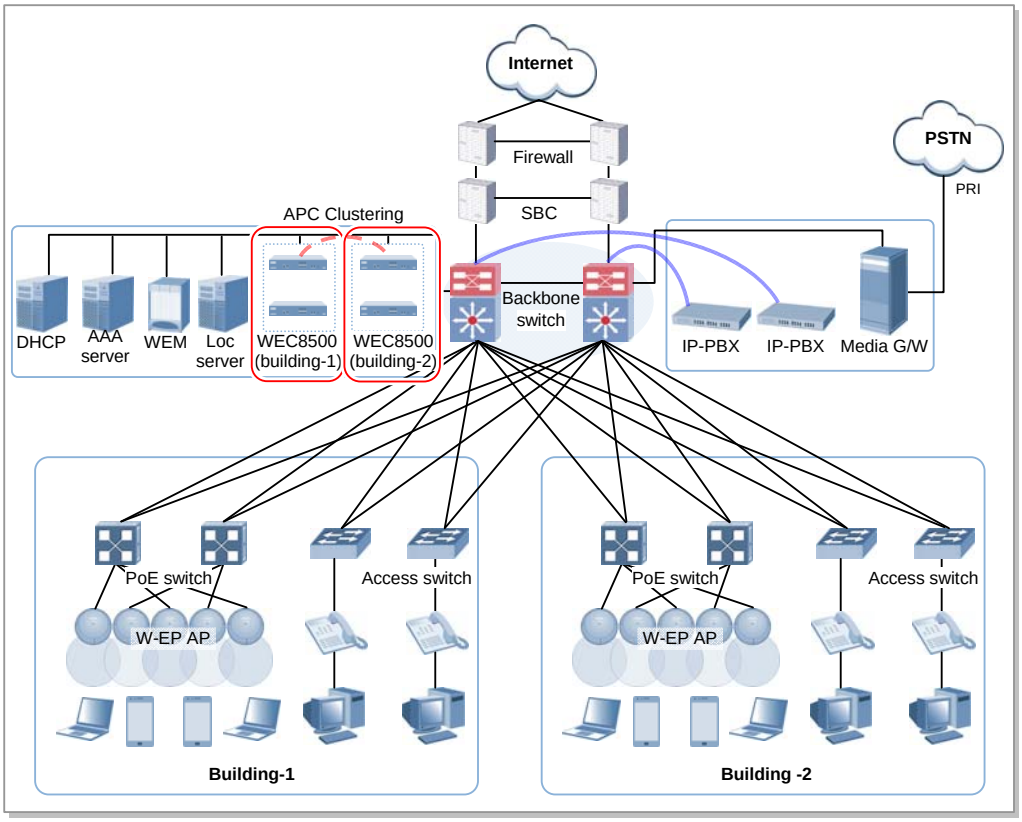


Figure 11. Example of WIRELESS ENTERPRISE Wireless LAN System Configuration for Centralized Clustering Service

1.4.4 Configuration of Multiple Sites Consisting of Headquarter and Branches

The WIRELESS ENTERPRISE wireless LAN network environment usually consists of one headquarter and several branches.
In this case, there are two types of network configuration.

- Hierarchical type: A WEC8500 is installed in a branch as well as headquarter.
- Branch AP type: A WEC8500 is installed only in a headquarter and only a WIRELESS ENTERPRISE wireless LAN AP is installed in a branch.

In the hierarchical type, it is advantageous that each branch can use each different service policy. However, the management in a headquarter is complex and many low-capacity APCs must be installed, so the branch AP type is commonly used.
The branch AP type has the same structure as a basic WIRELESS ENTERPRISE wireless LAN configuration.
A single difference is that a WIRELESS ENTERPRISE wireless LAN AP installed in a branch is located at a remote place. The APC in a headquarter provides a wireless LAN service in the headquarter building and also provides a wireless LAN service to a remote WIRELESS ENTERPRISE wireless LAN AP installed in a branch. As the APC in a headquarter manages all the WIRELESS ENTERPRISE wireless LAN APs using the same policy, it is easy to use and cost-effective.

An example of service configuration diagram for the branch AP type is shown in the below figure.

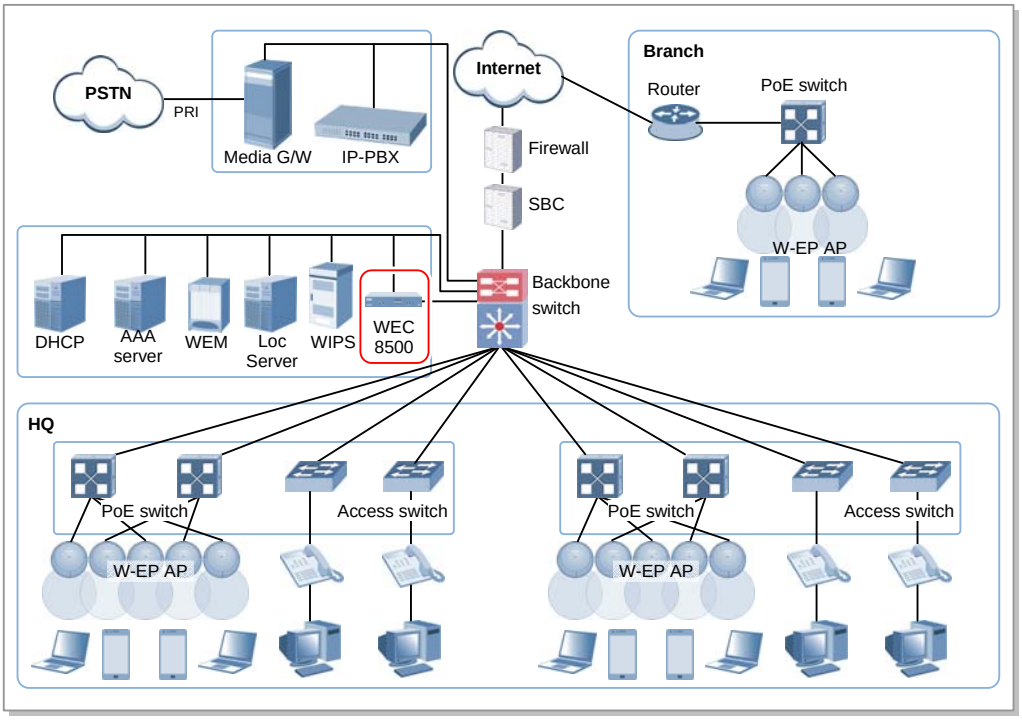


Figure 12. Example of WIRELESS ENTERPRISE Wireless LAN System Configuration for Multiple Sites consisting of Headquarter and Branches

If user traffics are concentrated on a single centralized APC when there are many branches or they are far from a headquarter, performance may be deteriorated due to the time delay of packet transmission, etc. Therefore, use different operation schemes according to the location of WIRELESS ENTERPRISE wireless LAN AP in the configuration of headquarter and branches.
In other words, the local WIRELESS ENTERPRISE wireless LAN AP in a headquarter does traffic tunneling to an APC and the branch AP installed in a branch switches a user traffic directly to a destination address without tunneling to the APC. Even at this time, the APC in a headquarter manages all the WIRELESS ENTERPRISE wireless LAN APs and users.

CHAPTER 2. Basic System Configuration

In this chapter, the basic system configuration using web and Command Line Interface (CLI) is introduced and how to use CLI and Web UI is described.

2.1 Basic System Configuration

2.1.1 CLI Connection

Connecting to WEC8500 using CLI is as follows:

- Direct connection to the system console port
- Telnet or SSH connection through an Ethernet port

When the booting of WEC8500 is completed, log into the system as follows:

1) For the first connection, log in using ID: ‘samsung’ and Password: ‘samsung’.

```
USERNAME : samsung
PASSWORD : samsung

THIS IS YOUR FIRST LOGIN AFTER USER ACCOUNT HAS BEEN CREATED.

YOU MUST CHANGE YOUR PASSWORD.

 ENTER LOGIN PASSWORD  : samsung
 ENTER NEW PASSWORD    : ********
 CONFIRM NEW PASSWORD  : ********
 PASSWORD SUCCESSFULLY CHANGED
WEC8500 #
```

2) After the first login, you must change the password. Use the changed password for the next login.
For a newly added account, a password must be changed during the first login.


NOTE

The default ID of WEC8500 is set to ‘samsung’ that has an administrator privilege.

2.1.2 Managing User Account

An operator who has an administrator privilege (level 1) can create or delete a new user account and change a user's password. When creating an account, specify the account's privilege level (level 1-4).

To set up user account related functions, go to configure mode by executing the following command.

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

Adding or deleting an account

The commands used to create or delete an account are as follows:

- mgmt-user [USERNAME] password [PASSWORD] [USERLEVEL] description [DESCRIPTION]: Adds a user
- no mgmt-user [USERNAME]: Deletes a user

Parameter	Description
USERNAME	User ID
PASSWORD	Password
USERLEVEL	User level
DESCRIPTION	Adds user information

Retrieving account information

To check user account information, use the 'show mgmt-users' command.

Changing Password

mgmt-user-password [USERNAME] [OLD_PASSWORD] [NEW_PASSWORD]

Parameter	Description
USERNAME	User ID
OLD_PASSWORD	Old password
NEW_PASSWORD	New password

2.1.3 Management Port Configuration

To connect to the WEC8500 remotely using telnet/SSH or web, it is necessary to set up an IP address to the management port.

Set up the management port as follows:

1) Go to configure → 'mgmt0' interface configuration mode of CLI.

```
WEC8500# configure terminal
WEC8500/configure# interface mgmt0
```

2) Set up an IP address.

```
WEC8500/configure/interface mgmt0# ip address 100.100.100.1/24
```

2.1.4 SNMP Community Configuration

To connect to the web server of WEC8500, it is necessary to add SNMP community through CLI. For more information, see '10.1 SNMP Configuration'.

2.1.5 CLI Basic Usage

The CLI is a text command based interface used to change or retrieve the system settings. Several users can change the settings at the same time using the CLI of the same system. Because privilege per user is already configured, a user can execute a command allowed by the user's privilege. Various commands are available for each system function. For more information, see ANNEX 'CLI Command Structure'.

Command Help

The CLI provides a help for all the commands. To see a help for a command and parameter, enter '?'. Based on an input character, it shows a help for a command or parameter that can be entered.

Category	Description
?	Displays the command list and help at the current level
Command ?	Displays the parameter and help required for a command

A usage example is given below.

```
WEC8500# show ?

     80211a                  Display 802.11a network settings
     80211bg                 Display 802.11bg network settings
     80211h                  Display 802.11h configuration
     access-list             List IP access lists
     alarm                   Show alarm information
     ap                      Show ap information
     ap-debug                Show ap debug information
     ...
     vap                     Show vap information
     version                 Show package version information
     vlan                    Display VLAN information
     vqm                     Show vqm command
     vrrp                    VRRP information
     wids                    Wids command
     wips                    Wips command
     wireless-acl-list       Show wireless-acl-list
     wlan                    Show wlan information

WEC8500#
```

Command automatic completion function

The CLI supports the command automatic completion function using the TAB key. When you press the TAB key after entering the first few characters of a command, the rest characters of the command that starts with the entered characters is automatically entered. If there are several commands that start with the entered characters, press the TAB key to jump to the next command. The below example shows the ‘show’, ‘save’, or ‘ssh’ command is entered in order by entering ‘s’ and pressing the TAB key.

```
WEC8500# s
```

[When the TAB key is pressed]

```
WEC8500# show
```

[When the TAB key is pressed once again]

```
WEC8500# save
```

Command error

When a command that is not supported by the system is entered, an error message is displayed.

```
WEC8500# command-unknown
         ^
Error : Command ‘command-unknown’  does not exist
```

When a parameter that is not supported by a command is entered, an error message according to the situation is displayed.

```
WEC8500# configure test
                    ^
% Invalid parameter (mandatory)
```

Command modes

When the ‘exit’ command is entered, the mode is changed to the upper command mode.

2.2 Using Web UI

2.2.1 Web UI Connection

To use the WEC, i.e. Web UI of WEC8500 system, the IP address of Management port must be set up. When connecting to the IP address of WEC8500 in a web browser, the below login window is displayed. Log in using a default connection account ‘samsung’.

Figure 13. Web UI Connection Window

2.2.2 WEC Main Window

The WEC Main window is a screen that appears first after connecting to an ACP and it consists of menu bar, sub-menus, and detail windows of each menu.

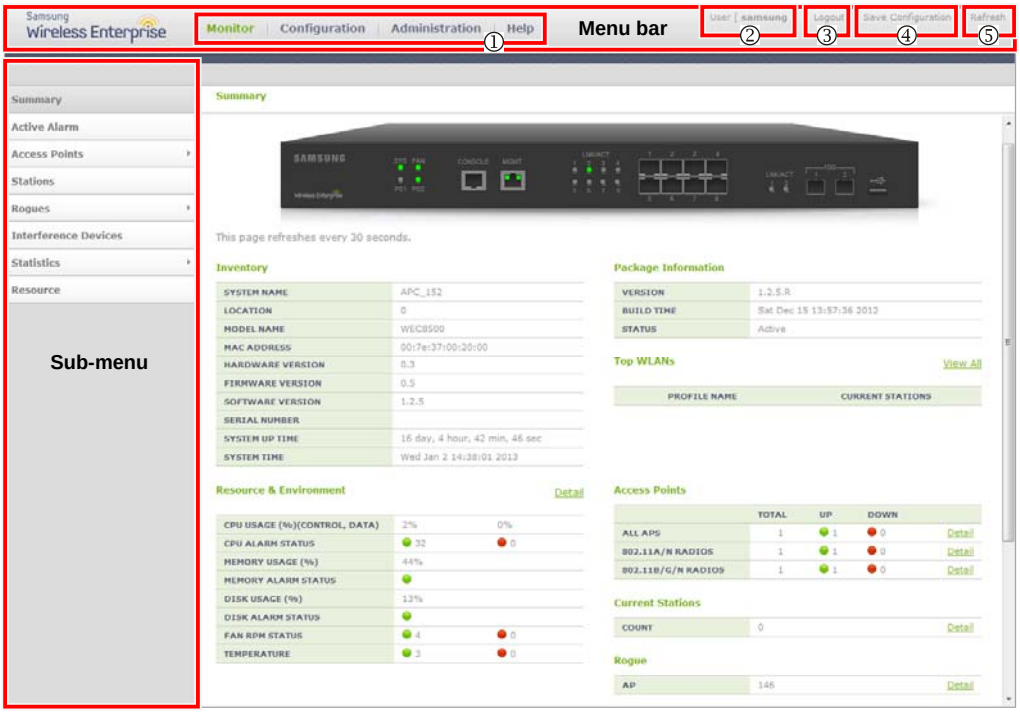


Figure 14. WEC Main Window

Menu bar

The menu bar consists of the following items:

- ①: Provides detail configuration or retrieval function for each item. When you select each item, lower menus in the sub-menus area are displayed.
- ②: Displays a user login ID.
- ③: Logs out from the WEC.
- ④: Saves the current configuration information into the system.
- ⑤: Refreshes the screen.

Sub-menus

Provides the detail menus for Monitor, Configuration, Administrator, or Help in the menu bar.

2.2.3 Managing User Account

To add a user account in Web UI, follow the below procedure.

In the menu bar of **<WEC Main window>**, select **<Administrator>** and then select **<Local Management Users>** menu in the sub menu.

You can add or delete a user account in the WEC.

Figure 15. Account Management Window

1) To add an account, click the **<Add>** button.

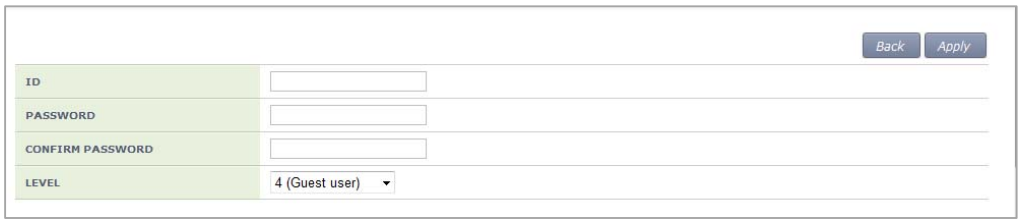


Figure 16. Account Addition Window

2) Enter an item according to each parameter description, and click the **<Apply>** button.
   - ID: Username to add
   - PASSWORD: User's initial password
   - CONFIRM PASSWORD: Re-enter the initial password
   - LEVEL: User privilege
     - 1 (admin): Administrator privilege that allows to execute all the commands
     - 2 (configure): Can change system configuration.
     - 3 (normal): Can retrieve system status.
     - 4 (guest): Temporary user

CHAPTER 3. Data Network Function

In this chapter, how to set up the data network functions of WEC8500 including VLAN, link aggregation, and layer 3 protocol is described.

3.1 Interface Configuration

The WEC8500 interface consists of the following physical interface and virtual interface.

- Physical interface of 11 ports except console port
- 1500 virtual interfaces using VLAN

3.1.1 Interface management


NOTE

The WEC8500 Management port is used to manage the WEC8500. It does not support VLAN and its interface name is 'mgmt0'. The 8 ports at the right side of Management port are 10/100/1000 BASE T-ports and their names are GE1-8. To the right side of the 10/100/1000 BASE T-ports, there are two Gigabit ports, i.e. XE1 and XE2.

Configuration using CLI

To configure the interface related function, go to the interface mode by entering the 'interface [INTERFACE_NAME]' command in the configure mode. An example of entering into the interface mode of the management port is shown below.

```
WEC8500# configure terminal
WEC8500/configure# interface mgmt0
WEC8500/configure/interface mgmt0#
```

The interface related CLI commands are as follows:

[ip address]
This is a command that configures a static IP address. The 'no' parameter is used to delete the configuration.

- ip address {A.B.C.D/mask length}
- no ip address {A.B.C.D} {A.B.C.D}
- no ip address {A.B.C.D/mask length}

[ip address dhcp]
This is a command that configures a dynamic IP address using DHCP. The 'no' parameter is used to delete the configuration.

- ip address dhcp
- no ip address dhcp

[shutdown]
This is a command that makes the interface not working. The 'no' parameter is used to restart the interface.

- shutdown
- no shutdown

Configuration using Web UI

In the menu bar of **<WEC Main window>**, select **<Configuration>** and then select the **<Controller>** → **<Interfaces>** menu in the sub-menus. You can configure an interface and VLAN.

The Interface initial window is shown below.

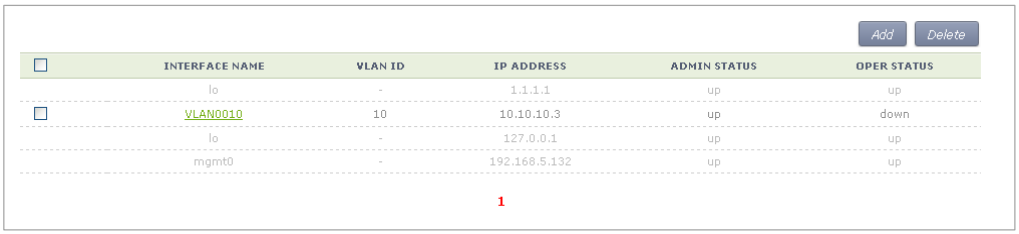


Figure 17. Interfaces Window (1)

[Adding VLAN]

1) In the Interface initial window, click the **<Add>** button to go to VLAN creation window.

2) Enter an INTERFACE NAME and VLAN ID in the VLAN creation window.
The INTERFACE NAME describes a VLAN to create and English characters without a space, numbers, and '_' can be used. The VLAN ID is the number from 1 to 4094 and it specifies a unique VLAN value.
Click the **<Apply>** button to go to detail configuration screen.

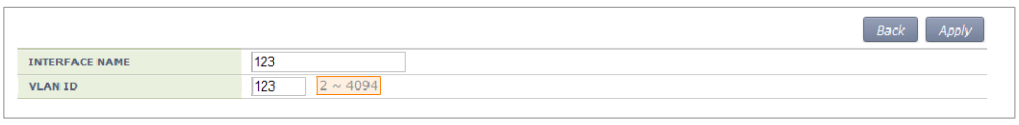


Figure 18. Interfaces Window (2)

3) Perform detail configuration in the VLAN detail configuration window.
If you specify PRIMARY DHCP SERVER or SECONDARY DHCP SERVER in the DHCP area, you can specify the configuration of a DHCP server.
After configuration, click the **<Apply>** button to apply it to the system.

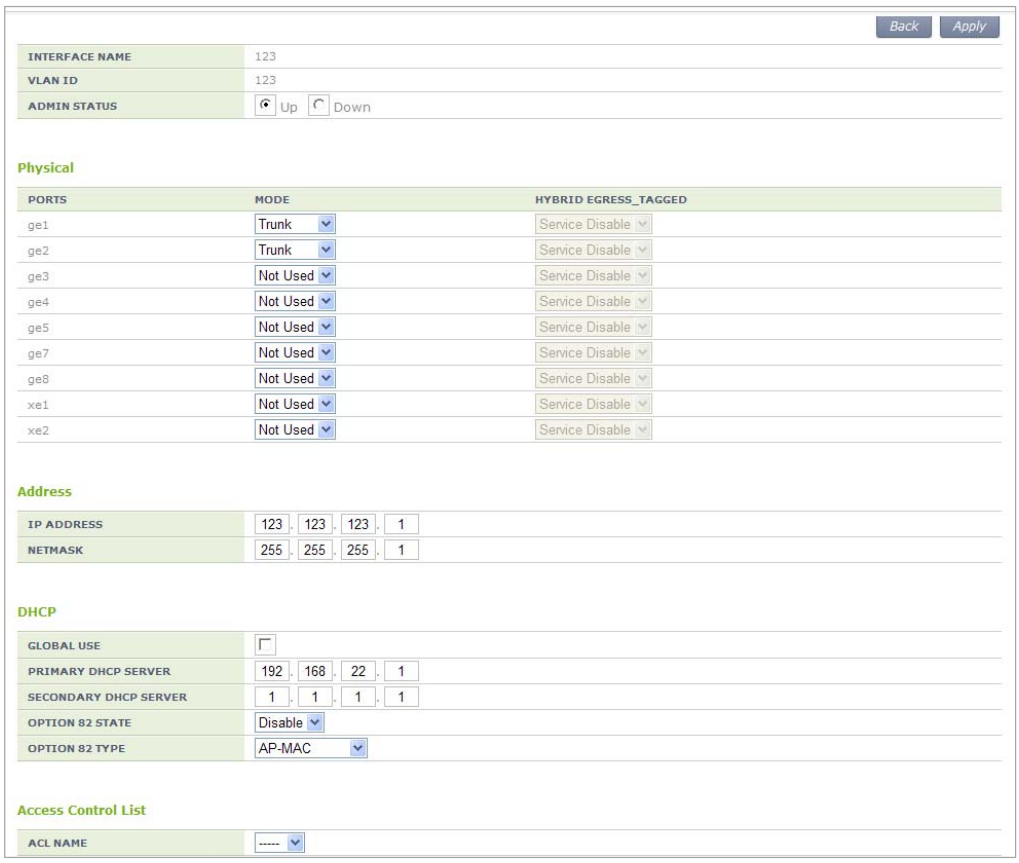


Figure 19. Interfaces Window (3)

[Deleting VLAN]

In the Interface initial window, click the **<Delete>** button to delete a selected VLAN. The select VLAN cannot be deleted if it is being used in the system.

3.1.2 Managing Interface Group

To use WLAN and other services, it is necessary to configure an interface into an interface group.

Configuration using CLI

An example of entering into the group configuration mode of ifg_01 interface is shown below.

```
WEC8500# configure terminal
WEC8500/configure# if-group ifg_01
```

Interface Group related commands are as follows:

[Creating or Deleting Interface group]
Creates an interface group. Use 'no' parameter to delete an interface group.

- if-group [INTERFACE_GROUP_NAME]
- no if-group [INTERFACE_GROUP_NAME]

[Adding or deleting Interface]
Adds an interface to an interface group being configured. Use 'no' parameter to delete an interface.

- add-if [INTERFACE_GROUP_NAME]
- no add-if [INTERFACE_GROUP_NAME]

[Retrieving Interface Group Status]
Retrieves the configuration status of an interface group.

- show if-group

Configuration using Web UI

In the menu bar of **<WEC Main window>**, select **<Configuration>** and then select the **<Controller>** → **<Interfaces Groups>** menu in the sub-menus. **Click the <Add>** or **<Delete>** button to add or delete an interface group.

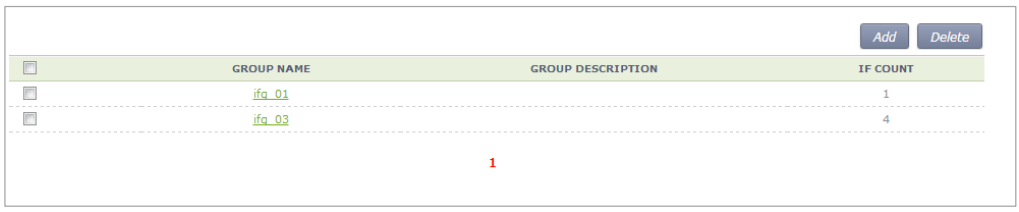


Figure 20. Interface Group Window (1)

Follow the below procedure to add an interface group.

1) In the Interface group initial window, click the <**Add**> button.

2) Enter the GROUP NAME and GROUP DESCRIPTION information and then select the VLAN interface.

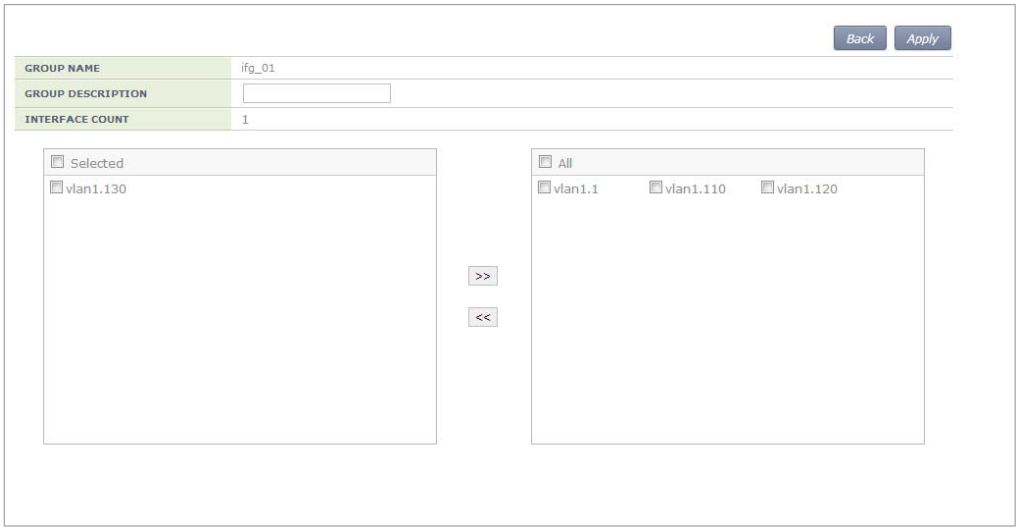


Figure 21. Interface Group Window (2)

3) Click the <**Apply**> button to apply the configuration.

3.2 VLAN Configuration

3.2.1 VLAN

Configuration using CLI

To configure VLAN, go to the VLAN interface mode by executing the following command.

```
WEC8500# configure terminal
WEC8500/configure# interface vlan
WEC8500/configure/interface vlan#
```

The related command is shown below and the range of VLAN ID is 1-4094.

[vlan bridge]
Creates VLAN. The ‘no’ parameter is used to delete VLAN.

- vlan [VLAN_ID] bridge 1
- no vlan [VLAN_ID] bridge 1

[switchport access vlan]
Set the VLAN mode to the access or hybrid mode. The ‘no’ parameter is used to delete the VLAN configuration.

- switchport {access/hybrid} vlan [VLAN_ID]

[switchport mode]
Configure the mode of switch port. The ‘no’ parameter is used to delete the configuration.

- switchport mode {access/hybrid/trunk}
- no switchport mode

[switchport hybrid allowed vlan]
Configure the mode of switch port to hybrid. The ‘no’ parameter is used to delete the configuration.

- switchport hybrid allowed vlan: Configures VLAN to hybrid.
- switchport hybrid allowed vlan all: Configures all the allowed VLANs to hybrid.
- switchport hybrid allowed vlan none: Stops VLAN data transmission/reception.
- switchport hybrid allowed vlan add [VLAN_ID]: Adds VLAN to the hybrid mode.
- switchport hybrid allowed vlan remove [VLAN_ID]: Deletes VLAN from the hybrid mode.
- no switchport hybrid vlan: Deletes all the hybrid settings.

[switchport trunk allowed vlan]
Configure the mode of switch port to trunk. The 'no' parameter is used to delete the configuration.

- switchport trunk allowed vlan: Configure VLAN to the trunk mode.
- switchport trunk allowed vlan all: Configure all the VLANs to the trunk mode.
- switchport trunk allowed vlan none: Stops VLAN data transmission/reception.
- switchport trunk allowed vlan add [VLAN_ID]: Adds VLAN to the trunk mode.
- switchport trunk allowed vlan remove [VLAN_ID]: Removes VLAN with the trunk mode.
- no switchport trunk vlan: Removes all the trunk settings.

[show vlan]
Retrieves VLAN configuration status.

- show vlan [VLAN_ID]: Displays specific VLAN information.
- show vlan all bridge 1: Displays all the VLAN information.
- show vlan brief: Displays all the VLAN information briefly.
- show vlan dynamic bridge 1: Displays dynamic VLAN information.
- show vlan static bridge 1: Displays static VLAN information.

[Typical configuration procedure]
The typical configuration procedure of VLAN is as follows:

```
WEC8500# configure terminal
WEC8500/configure# bridge 1 protocol mstp
WEC8500/configure # vlan database
WEC8500/configure/vlan#vlan {2-4094} bridge 1
WEC8500/configure/vlan# exit
WEC8500/configure# interface vlan1.{2-4094}
```

Configuration using Web UI

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

For more information about configuration procedure, see '3.1.1 Interface Management'.

3.2.2 Bridge

To set up bridge related functions, go to configure mode by executing the following command

```
WEC8500# configure terminal
```

The bridge related commands are as follows:

[bridge address]
Configures a bridge address. The ‘no’ parameter is used to clear the configuration.

- bridge 1 address [MAC] [forward/discard] [IFNAME]
- no bridge 1 address [MAC] [forward/discard] [IFNAME]

Parameter	Description
MAC	MAC address. Entered in the format of HHHH.HHHH.HHHH.
forward/discard	- forward: Configures forward matching frame. - discard: Configures discard matching frame.
IFNAME	Interface name of a bridge.

[bridge ageing time]
Configures the age-out time of a bridge. The ‘no’ parameter is used to clear the configuration.

- bridge-group 1 ageing-time [AGEINGTIME]
- no bridge-group 1 ageing-time

Parameter	Description
AGEINGTIME	age-out time (range: 10-1000000 s)

[bridge protocol]
Creates a bridge in one of the IEEE 802.1Q Spanning-Tree Protocol (STP), IEEE802.1s multiple STP (MSTP), or IEEE 802.1W Rapid STP (RSTP) protocol.

- bridge 1 protocol [PROTOCOL]
- no bridge 1 protocol

Parameter	Description
PROTOCOL	Protocol to configure (ieee/ mstp/rstp) - ieee: STP - mstp: MSTP - rstp: RSTP

[clear mac address-table]

Deletes the filtering database of a default bridge.

- clear mac address-table [OPTION] [KIND] [WORD]

Parameter	Description
OPTION	Filtering database option (static/multicast) - static: Filtering database item that is configured as static - multicast: Filtering database item that is automatically configured by the multicast protocol
KIND	Filtering database type (address/vlan/interface) - address: Filtering database using a MAC address - vlan: Filtering database using the VLAN information. - interface: Filtering database using the interface information
WORD	Option

[clear mac address-table dynamic]

Deletes bridge operation among the filtering database of a default bridge.

- clear mac address-table dynamic [KIND] [WORD]

Parameter	Description
KIND	Filtering database type (address/vlan/interface) - address: Filtering database using a MAC address - vlan: Filtering database using the VLAN information. - interface: Filtering database using the interface information
WORD	Option

[clear mac address-table dynamic bridge]

Deletes the filtering database of bridge operation.

- clear mac address-table dynamic bridge [BRIDGE_NAME]
- clear mac address-table dynamic [address/interface/vlan] [WORD] bridge [NAME]

Parameter	Description
KIND	Filtering database type (address/vlan/interface) - address: Filtering database using a MAC address - vlan: Filtering database using the VLAN information. - interface: Filtering database using the interface information
WORD	Option
BRIDGE_NAME	Bridge name

[show bridge]
Retrieves bridge information.

- show bridge

[show interface switchport bridge]
Retrieves the bridge information, i.e. the layer 2 protocol characteristic information of the current VLAN, of a switch port.

- show interface switchport bridge [BRIDGE_NAME]

Parameter	Description
BRIDGE_NAME	Bridge name

[switchport]
Configures a switch port, i.e. the layer 2 protocol characteristic information of the current VLAN. The ‘no’ parameter is used for default configuration. Go to interface mode and then execute the command.

- switchport
- no switchport

3.2.3 Spanning Tree

Configuration using CLI

To set up spanning tree related functions, go to configure mode by executing the following command.

```
WEC8500# configure terminal
```

The related command is as follows.

[bridge forward-time]
Configures the forward time of a bridge. The 'no' parameter is used for default configuration.

- bridge 1 forward-time [FORWARD_DELAY]
- no bridge 1 forward-time

Parameter	Description
FORWARD_DELAY	Forward time delay (range: 4-30 s, default: 15)

[bridge hello-time]
Configures the hello time of a bridge. The time required when a bridged LAN is changed to Bridge Protocol Data Units (BPDUs) is called as hello-time. The 'no' parameter is used for default configuration.

- bridge 1 hello-time [HELLOTIME]
- no bridge 1 hello-time

Parameter	Description
HELLOTIME	Hello BPDU interval (range: 1-10 s)

[bridge instance priority]
Configures the bridge priority of MST instance. The 'no' parameter is used to delete priority.

- bridge 1 instance [INSTANCE_ID] priority [BRIDGE_PRIORITY]
- no bridge 1 instance [INSTANCE_ID]

Parameter	Description
INSTANCE_ID	Instance ID (range: 1-64)
BRIDGE_PRIORITY	Bridge priority (range: 0-61440)

[bridge max-age]

Configures the max-age of a bridge. The ‘no’ parameter is used for default configuration.

- bridge 1 max-age [MAXAGE]
- no bridge 1 max-age

Parameter	Description
MAXAGE	Configures a maximum time (range: 6-40 s)

[bridge max-hops]

Configures the maximum allowed number of hops of a BPDU bridge in the MST area. The ‘no’ parameter is used for default configuration.

- bridge 1 max-hops [HOP_COUNT]
- no bridge 1 max-hops

Parameter	Description
HOP_COUNT	Maximum allowed number of hops

[bridge multiple-spanning-tree enable]

Configures a MSTP bridge. The ‘no’ parameter is used to clear the configuration.

- bridge 1 multiple-spanning-tree enable
- no bridge 1 multiple-spanning-tree enable

[bridge rapid-spanning-tree enable]

Configures a RSTP bridge. The ‘no’ parameter is used to clear the configuration.

- bridge 1 rapid-spanning-tree enable
- no bridge 1 rapid-spanning-tree enable(bridge-forward)

[bridge spanning-tree enable]

Configures a STP bridge. The ‘no’ parameter is used to clear the configuration.

- bridge 1 spanning-tree enable
- no bridge 1 spanning-tree enable(bridge-forward)

[bridge priority]

Configures the priority of a bridge. The ‘no’ parameter is used to delete a priority.

- bridge 1 priority [PRIORITY]
- no bridge 1 priority

Parameter	Description
PRIORITY	Bridge priority (range: 0-61440)

[bridge shutdown]
Clears bridge settings. The 'no' parameter is used to restart a bridge.

- bridge shutdown [1-32]
- no bridge shutdown [1-32]

Configuration using Web UI

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

The sub-menus of the MTSP menu are as follows:

- Config: Configures the spanning tree.
- Instance: Manages the MSTP VLAN instance.
- Port: Manages the MSTP port.

[Configuring Spanning Tree]
After selecting the <**Config**> menu, enter configuration information and then click the <**Apply**> button.

Figure 22. Spanning Tree Configuration Window (1)

[Managing the MSTP VLAN instance]
When you select the <**Instance**> menu, the configured MSTP VLAN Instance list is displayed on the window. Click the <**Add**> or <**Delete**> button to add or delete an instance.

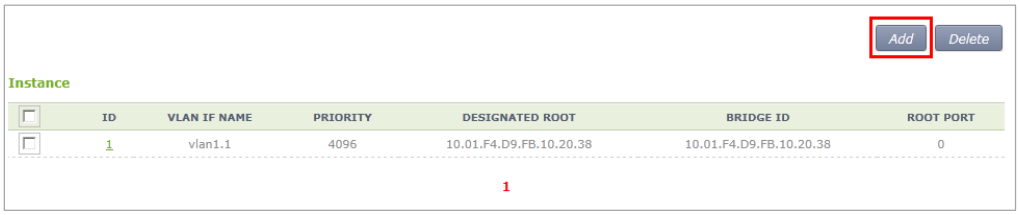


Figure 23. Spanning Tree Configuration Window (2)

[Managing MSTP Port]

When you select the <**Port**> menu, the configured MSTP Port list is displayed on the window. Click the <**Add**> or <**Delete**> button to add or delete a port.

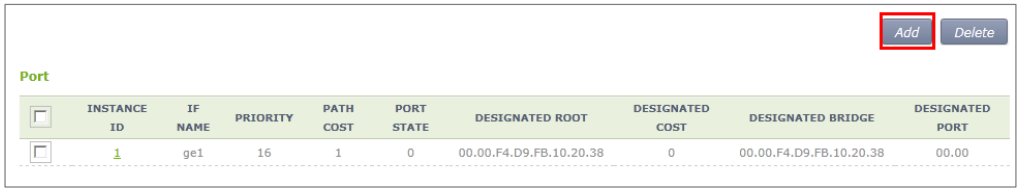


Figure 24. Spanning Tree Configuration Window (3)

3.3 Layer 3 Protocol Configuration

This provides the IP address configuration and static/dynamic routing configuration of an interface. The WEC8500 provides the RIP or OSPF routing protocol.

3.3.1 IP Address Configuration

The procedure for IP address configuration is given below.

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

```
WEC8500# configure terminal
WEC8500/configure# interface ge2
```

2) Set up an IP address.

```
WEC8500/configure/interface ge2# ip address 100.100.100.1/24
```

3) Enable the interface.

```
WEC8500/configure/interface ge2# no shutdown
```

3.3.2 Static Routing Configuration

Configuration using CLI

1) Go to configure mode of CLI.

```
WEC8500# configure terminal
```

2) Configure static routing.

```
WEC8500/configure# ip route 10.2.3.0/24 30.30.30.2
```

Configuration using Web UI

In the menu bar of **<WEC Main window>**, select **<Configuration>** and then select the **<Controller>** → **<Network>** → **<Static Route>** menu in the sub-menus.
The configured static route list is displayed on the window. When you click the **<Add>** or **<Delete>** button, you can add or delete a static routing entry.

Figure 25. Static Routing Configuration Window

After adding or deleting an entry, check if the information is reflected to the list in the Static Route window. If the added information is not displayed, it means the added routing information is not enabled. If the operational status of an interface that will be used as a routing result is not UP, check the interface status through CLI or Web UI.
Because only enabled routing entries are listed in the Web UI, you cannot remove a disabled routing entry.

3.3.3 RIP Configuration

1) Go to configure mode of CLI.

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

2) Configure RIP using the ‘router rip ‘command.
   - router rip cisco-metric-behavior: Metric updation configuration (as Cisco)
   - router rip default-information: Distribution control of a default route
   - router rip default-metric: Metric configuration of a Redistribute route.
   - router rip distance: Administrative distance
   - router rip distribute-list: Filter networks in routing updates
   - router rip exit: Exits the route mode.
   - router rip maximum-prefix: Specifies maximum number of RIP routes.
   - router rip neighbor: Specifies neighbor router.
   - router rip network: Configures routing in an IP network.
   - router rip offset-list: RIP metric configuration
   - router rip passive-interface: Suppress routing updates on an interface
   - router rip recv-buffer-size: Configures RIP UDP receiving buffer size.
   - router rip redistribute: Redistribute information from another routing protocol
   - router rip route: Static route advertisement (debugging purpose)
   - router rip timers: Configures a routing timer.
   - router rip version: Configures routing protocol version.

3) Configure a basic network for RIP configuration.
   - network [A.B.C.D]/[length]

3.3.4 IP Multicast Routing Configuration

1) Go to configure mode of CLI.

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

2) Enable or disable multicast-routing.
   - ip multicast-routing
   - no multicast-routing

3) Check multicast-routing using the ‘show running-config network’ command.

3.3.5 PIM Configuration

The procedure for PIM configuration is given below.

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

```
WEC8500# configure terminal
WEC8500/configure# interface ge2
```

2) Configure the PIM sparse mode to an interface.

```
WEC8500/configure/interface ge2# ip pim sparse-mode
```

3) Check a configured PIM using the ‘show running-config network’ command.
   To check the multicast-routing table, use the ‘show ip mroute’ command.

```
WEC8500# show ip mroute
(90.90.1.242, 224.0.1.1)       Iif: mgmt0     Oifs: pimreg
```

3.3.6 OSPF Configuration

Configuration using CLI

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

```
WEC8500# configure terminal
WEC8500/configure# router ospf
```

2) Proceed redistribute configuration to share a routing table from another service.
   - redistribute connected: Transmits a connected routing table.
   - redistribute kernel: Transmits a routing table configured in the kernel.
   - redistribute rip: Transmits a routing table that is received as rip.
   - redistribute static: Transmits a routing table that is configured as static.

3) Configure network information for OSPF routing. The 'no' parameter is used to delete network configuration.

```
WEC8500/configure/router/ospf # network 192.168.0.0 255.255.0.0 area
0.0.0.
```

```
WEC8500/configure/router/ospf # no network 192.168.0.0 255.255.0.0
area 0.0.0.
```

4) Retrieve the OSPF configuration information.
   - show ip ospf neighbor: Retrieves the OSPF neighbor information.
   - show ip ospf route: Retrieves the OSPF routing information.

Configuration using Web UI

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

The OSPF initial window is shown below.

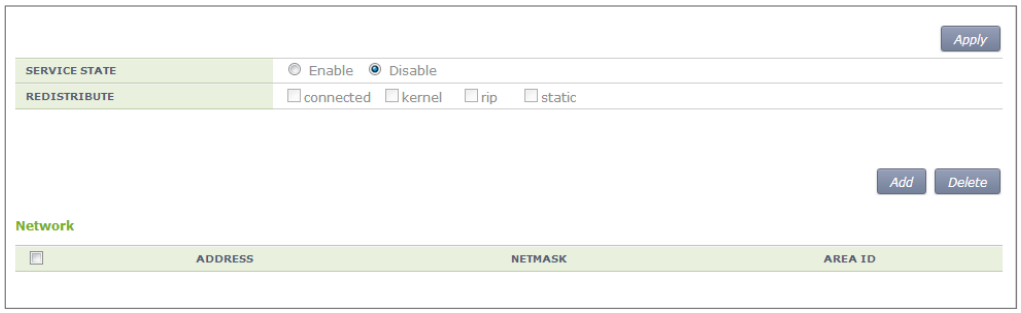


Figure 26. OSPF Configuration Window

[OSPF Configuration]

1) Configure the SERVICE STATE to Enable in the OSPF window and click <**Apply**>. In the Web UI, you can proceed the rest configuration only when you click <**Apply**> after configuring the Service State to Enable.
2) To share a routing table received from another service, select REDISTRIBUTE item and click the <**Apply**> button.
   The description of each item is as follows:
   - connected: Transmits connected routing tables.
   - kernel: Transmits routing tables that are configured in the kernel.
   - rip: Transmits a routing table that is transferred via rip.
   - static: Transmits a routing table that is configured as static.

[Adding or Deleting Network]

When you click the <**Add**> or <**Delete**> button in the OSPF window, you can add or delete a network. After adding or deleting a network, check if the information is reflected to the network list in the window.

3.3.7 VRRP Configuration

The Virtual Router Redundancy Protocol (VRRP) is an Internet protocol that provides the backup router operation method in a LAN. If a fault occurs with a router that transmits a packet from a host in a LAN, decide a virtual IP address in a DHCP manually or by default by using a virtual router fault recovery protocol and share it among routers. Once a primary router and a backup router are decided, the backup router becomes a primary router when a fault occurs with the primary router.

Configuration using CLI

To configure the VRRP related function, go to configure → router mode of CLI, enter a router ID and interface name to go to the VRRP configuration mode.

```
WEC8500# configure terminal
WEC8500/configure# router
WEC8500/configure# router vrrp
WEC8500/configure# router vrrp 1 vlan1.10
WEC8500/configure/router/vrrp#
```

The following commands are provided.

[advertisement-interval]
Configures the advertisement interval of VRRP in second. A user can configure the interval from 1 to 10.

- advertisement-interval [INTERVAL]

Parameter	Description
INTERVAL	Advertisement interval (range: 1-10 s)

[circuit-failover]
Enter an interface to configure and its priority.

- circuit-failover [WORD] [PRIORITY]

Parameter	Description
WORD	Interface name
PRIORITY	Priority setup (range: 1-100)

[enable/disable]
Enables or disables the VRRP session.

- enable
- disable

[preempt-delay]

Configures the preempt delay time.

- preempt-delay [DELAY_TIME]

Parameter	Description
DELAY_TIME	Preempt delay time (range: 0-3600 s)

[preempt-mode]

Configures whether to use the preempt mode.

- preempt-mode [MODE]

Parameter	Description
MODE	- true: Use the preempt mode - false: Stop using the preempt mode.

[priority]

Configures a priority.

- priority [PRIORITY]

Parameter	Description
PRIORITY	Priority setup (range: 1-255)

[virtual-ip]

Configures an IP address to use in the VRRP and configure the IP address as master or backup.

- virtual-ip [A.B.C.D]
- virtual-ip [A.B.C.D] [MODE]

Parameter	Description
A.B.C.D	IP address
MODE	IP configuration mode (backup/master) - backup: Backup router configuration. - master: Master configuration.

[show vrrp]

Retrieves VRRP configuration.

- show vrrp

Configuration using Web UI

In the menu bar of <**WEC Main window**>, select <**Configuration**> and then select the <**Controller**> → <**Network**> → <**VRRP**> menu in the sub-menus.
The VRRP menu provides two sub menus, i.e. Operation and Circuit Failover.

[Operation]
When you click the <**Enable**>/<**Disable**> button, you can Enable or disable VRRP.
In addition, when you click the <**Add**> or <**Delete**> button, you can add or delete VRRP configuration.

Figure 27. VRRP-Operation Window

[Circuit Failover]
When you click the Circuit Failover menu, the VRRP list is displayed on the window.

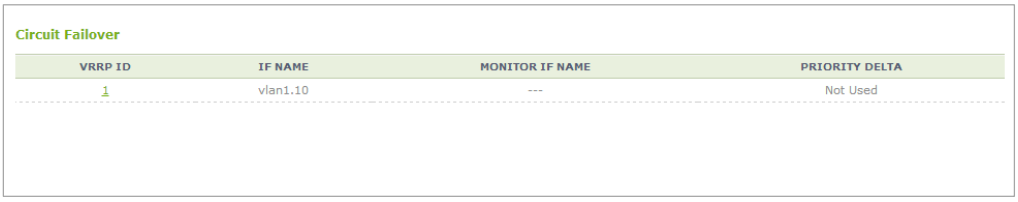


Figure 28. VRRP-Circuit Failover Window (1)

To perform detail configuration, select one of VRRP items.
After selecting a configuration you want, select the <**Apply**> button to apply the configuration.

Figure 29. VRRP-Circuit Failover Window (2)

3.4 QoS

The Access Control List (ACL) allows or blocks a specific network traffic based on an operator's configuration. The WEC8500 provides QoS using ACL.

3.4.1 ACL Configuration

3.4.1.1 Access List Configuration

You can create or delete an access list for ACL configuration. To delete an access list, an operator can enter the name of an access list directly or enter a command by copying a value retrieved from the 'show running-config network'. But, if the access list is being used in the WLAN ACL or Admin ACL, etc., you cannot delete it. Therefore, check if it is being used in the WLAN ACL or Admin ACL first of all..

Configuration using CLI

1) Go to fqm mode where you can configure the configure → rule of CLI.

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

2) Create an access list by entering the 'access-list' command. The 'no' parameter is used to delete an access list.
   - access-list [ip/ipv6/mac] [ACL_NAME] [deny/permit/time-profile] seq [seq_NUM] [1/*/ahp/eigrp/esp/gre/icmp/igmp/igrp/ip/nos/ospf/pcp/pim/17/6/ tcp/udp/1-255] [any/A.B.C.D A.B.C.D] eq [eq_VALUE] [any/A.B.C.D A.B.C.D] eq [eq_VALUE] [[[dscp [*|[0-63]]|precedence [*|[0-7])]]]|]

   An example of entering a command is shown below.
   - Creating Access list 'acl1':

```
WEC8500# configure terminal
WEC8500/configure# fqm-mode
WEC8500/configure# access-list ip acl1 permit seq 1 icmp any any
```

   - Deleting Access list 'acl1':

```
WEC8500# configure terminal
WEC8500/configure# fqm-mode
WEC8500/configure# no access-list ip acl1 permit seq 1 icmp any any
```

3) Check a created access list using the 'show running-config network' command.

Configuration using Web UI

In the menu bar of **<WEC Main window>**, select **<Configuration>** and then select the **<Security>→ <Access Control Lists> → <IP ACL>** menu in the sub-menus.
The initial window of ACL rule configuration is shown below. When you click the **<Add>** or **<Delete>** button, you can add or delete ACL rule.

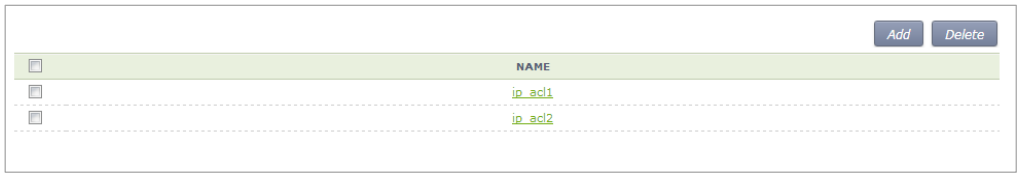


Figure 30. ACL Configuration Window

To change the configuration of ACL rule, click ACLNAME to change. You can change the configuration using the **<Add>** or **<Delete>** button. In addition, if there is a time profile in an ACL name, the IP ALC window is changed as shown below. After selecting a time profile, click the **<Apply>** button to apply the time profile to the ACL.

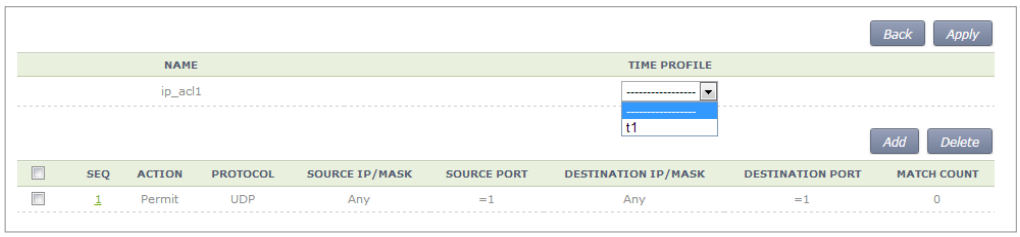


Figure 31. Window where a Time Profile is Applied to ACL

3.4.1.2 ACL Rule Configuration

Configuration using CLI

1) Go to interface configuration mode where you will apply the configure → ACL rule of CLI.

```
WEC8500# configure terminal
WEC8500/configure# interface [name]
WEC8500/configure/interface [name]#
```

2) Configure ACL to an interface.
   - ip access-group [MODE] [DIRECTION] [ACL_NAME]

Parameter	Description
MODE	Configuration mode (fw/fqm)
DIRECTION	Application direction configuration (in/out)
ACL_NAME	ACL name to configure

An example of entering a command that configures ‘acl1’ to the ‘ge2’ interface is shown below.

```
WEC8500# configure terminal
WEC8500/configure# interface ge2
WEC8500/configure/interface ge2#ip access-group fqm in acl1
```

3) To check the configuration information, use the ‘show running-config network’ command.

Configuration using Web UI

In the menu bar of <**WEC Main window**>, select <**Configuration**> and then select the <**Security**>→ <**Access Control Lists**> → <**Access Group(Interface)**> menu in the sub-menus.

The initial window of WLAN ACL configuration is shown below. When you click the <**Add**> or <**Delete**> button, you can add or delete ACL rule.

Figure 32. ACL Interface Configuration Window (1)

To perform detail configuration, select an interface in the list.

Figure 33. ACL Interface Configuration Window (2)

The types of interfaces you can configure are retrieved. In the INTERFACE, select an interface. For DIRECTION, select Ingress or Egress. For ACL NAME, select an item (name) that is configured in the ACL List configuration.
To apply the changed configuration, click the <**Apply**> button.

3.4.1.3 WLAN ACL Configuration

1) Go to the fqm mode to configure the configure → ACL rule of CLI.

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

2) Configure WLAN ACL by entering the 'ip access-group wireless' command.
   - ip access-group wireless [ACL_NAME]

Parameter	Description
ACL_NAME	ACL name to configure

3) To check the configuration information, use the 'show running-config network' command.

3.4.1.4 Admin ACL Configuring

Configuration using CLI

1) Go to the fqm mode to configure the configure → ACL rule of CLI.

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

2) Configure Admin ACL by entering the 'ip access-group wireless' command.
   - ip access-group system [ACL_NAME]

Parameter	Description
ACL_NAME	ACL name to configure

3) To check the configuration information, use the 'show running-config network' command.

Configuration using Web UI

In the menu bar of **<WEC Main window>**, select **<Configuration>** and then select the **<Security>→ <Access Control Lists>** → **<Access Group (System)>** menu in the sub-menus.

The initial window of Access Group is shown below. After selecting a configuration, click the **<Apply>** button to configure Admin ACL.

Figure 34. Admin ACL Configuration Window

3.4.2 Class-map Configuration

1) Go to the fqm mode to configure the configure → ACL rule of CLI.

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

2) Go to Class-map mode.
   - class-map c1

3) Select match-all or match-any.
   - match-type [MODE]

Parameter	Description
MODE	Match mode configuration (match-all/match-any)

4) Perform detail configuration according to match criteria.

Match Criteria	Description
access-group	match access-group [ACCESS_GROUP_NAME]
class	match class [CLASS_NAME]
COS	match cos [COS_VALUE/any]
destination IP range	match dst ip range [A.B.C.D] [A.B.C.D]
IP	match ip dscp [DSCP_VALUE/any] match ip precedence [IP_PRECEDENCE_VALUE/any] match ip tos [TOS_VALUE/any]
protocol	match protocol [PROTOCOL_VALE/any]
source IP range	match src ip range [A.B.C.D] [A.B.C.D]

5) Exit the Class-map mode.
   - exit

6) To check the configuration information, use the ‘show running-config network’ command.

3.4.3 Policy-map Configuration

1) Go to the fqm mode to configure the configure → ACL rule of CLI.

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

2) Go to policy-map mode. To delete a policy map, enter 'no' parameter in front of the command.
   - policy-map [POLICY_MAP_NAME]
   - no policy-map [POLICY_MAP_NAME]

3) By using the class name configured in the class-map, go to the input mode.
   - class [CLASSMAP_NAME]

4) Configure a policy-map using the following command.

   [Bandwidth to a class of traffic]
   - bandwidth percentage [PERCENTAGE_VALUE]

   [Configure set action]
   - mark cos [COS_VALUE]
   - mark ip dscp [DSCP_VALUE]
   - mark ip precedence [PRECEDENCE_VALUE]
   - mark priority [PRIORITY_VALUE]

   [Configure police action]
   - police trtcm cir [1-1000] cbs [125000-125000000] pir [1-1000] pbs [125000-125000000] conform-action(drop|(dscp [0-63]|ip [0-7])|transmit) exceed-action(drop|(dscp [0-63]|ip [0-7])|transmit) violate-action(drop|(dscp [0-63]|ip [0-7])|transmit)(color-aware|color-blind|)

   [Peak rate to a class of traffic]
   - queue-limit [QUEUE_NUM]

   [Peak rate to a class of traffic]
   - shape-peak [PEAK_RATE]

5) Exit the policy-map mode.
   - exit

6) To check the configuration information, use the 'show running-config network' command.

3.4.4 Service Policy Configuration

Apply the policy configured in the policy-map to an interface.

1) Go to configure → interface configuring mode to apply the service policy of CLI.

```
WEC8500# configure terminal
WEC8500/configure# interface ge2
WEC8500/configure/interface ge2#
```

2) Apply the policy configured in the policy-map to an interface. The ‘no’ parameter is used to delete the policy.
   - service-policy [DIRECTION] [POLICY_NAME]
   - no service-policy [DIRECTION] [POLICY_NAME]

Parameter	Description
DIRECTION	Application direction configuration (in/out)
POLICY_NAME	Policy to apply

An example of entering a command is shown below.

```
WEC8500/configure/interface ge2# service-policy in p1
WEC8500/configure/interface ge2# no service-policy in p1
```

3) To check the configuration information, use the ‘show running-config network’ command.

3.4.5 Time Profile

The procedure of configuring a time profile and applying it to ACL is described.

3.4.5.1 Time Profile Configuration

Configuration using CLI

1) Go to configure of CLI→ fqm mode.

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

2) Configure a time profile. The 'no' parameter is used to delete a time profile.
   - time-profile [PROFILE_NAME]
     day-start (any|YY[-MM[-DD[THH[:MM[:SS]]]]])
     day-stop (any|YY[-MM[-DD[THH[:MM[:SS]]]]])
     time-start (any|HH:MM[:SS])
     time-stop (any|HH:[MM:SS])
     monthdays (any|[0-31])
     weekdays (any|VARIABLE))
   - no time-profile [PROFILE_NAME]

Parameter	Description
PROFILE_NAME	Name of a time profile to configure

3) To check the configured time profile, use the 'show running-config network' command.

Configuration using Web UI

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

The configured time profile list is displayed on the window. When you click the **<Add>** or **<Delete>** button, you can add or delete a time profile.

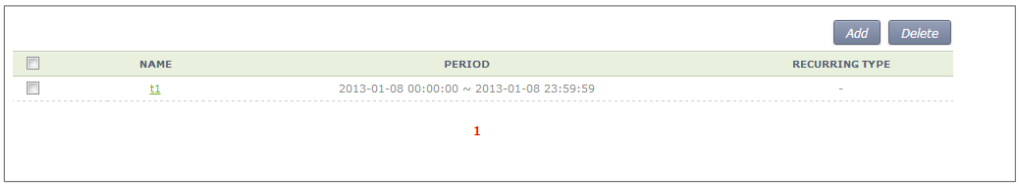


Figure 35. Time Profile Configuration Window (1)

Select an item in the list and perform detail configuration.

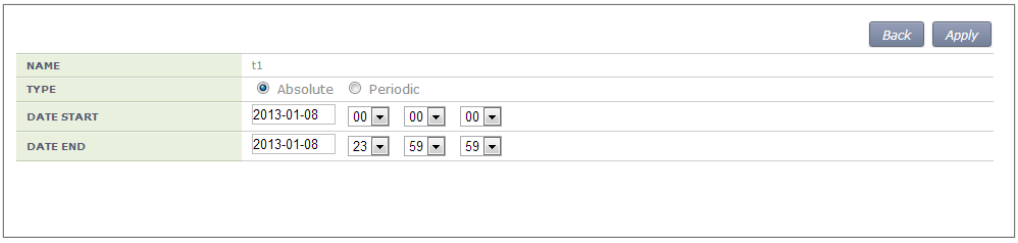


Figure 36. Time Profile Configuration Window (2)

After finishing configuration in the window, click the <**Apply**> button to apply it to the system.

3.4.5.2 Applying to ACL

Configuration using CLI

1) Go to the fqm mode to configure the configure → ACL rule of CLI.

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

2) Apply a time-profile to ACL. The 'no' parameter is used to delete a time profile.
   - access-list ip [ACL_NAME] time-profile [PROFILE_NAME]
   - no access-list ip [ACL_NAME] time-profile [PROFILE_NAME]

Parameter	Description
ACL_NAME	ACL name to configure
PROFILE_NAME	Name of a time profile to configure

An example of applying 't1' to 'acl' is shown below.

```
WEC8500# configure terminal
WEC8500/configure# fqm-mode
access-list ip acl1 time-profile t1
```

3) To check the configuration information, use the 'show running-config network' command.

Configuration using Web UI

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

To change the configuration of ACL rule, click ACLNAME to change. You can change the configuration using the <**Add**> or <**Delete**> button. In addition, if there is a time profile in an ACL name, the IP ALC window is changed as shown below. After selecting a time profile, click the <**Apply**> button to apply the time profile to the ACL.

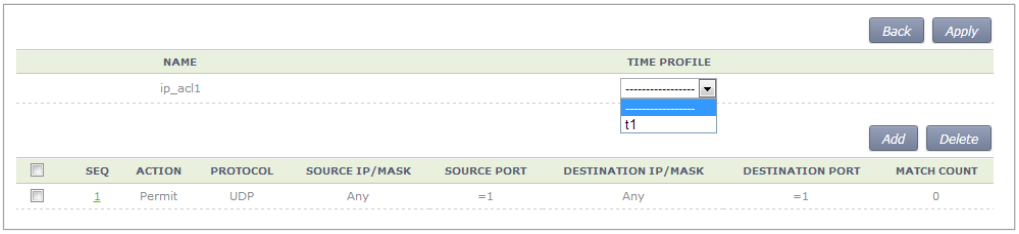


Figure 37. Applying to ACL

3.4.5.3 ACL (Time-Profile) Rule Configuration

Configuration using CLI

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

```
WEC8500# configure terminal
WEC8500/configure# interface ge2
```

2) Configure ACL to the interface. The ‘no’ parameter is used to delete ACL.
   - ip access-group [MODE] [DIRECTION] [ACL_NAME]
   - no ip access-group [fw/fqm] [DIRECTION] [ACL_NAME]

Parameter	Description
MODE	Configuration mode (fw/fqm) For ACL rule configuration, select ‘fqm’ (The ‘fw’ is used for firewall configuration.)
DIRECTION	Application direction configuration (in/out)
ACL_NAME	ACL name to configure

3) To check the configuration information, use the ‘show running-config network’ command.

Configuration using Web UI

In the menu bar of **<WEC Main window>**, select **<Configuration>** and then select the **<Security>→ <Access Control Lists> → <Access Group (Interface)>** menu in the sub-menus.

Perform configuration by referring to ‘ACL Rule Configuration’.

3.4.6 OS-AWARE

OS-AWARE is a function to use the option value of the DHCP Discover/Request transmitted from a station to check the type of the operating system used by the station.

The procedures to set OS-AWARE and apply the OS-AWARE settings to ACL are described below.

3.4.6.1 OS-AWARE Configuration

Configuration using CLI

1) Go to configure → os-aware mode of CLI.

```
WEC8500# configure terminal
WEC8500/configure# os-aware
WEC8500/configure/os-aware # ?

     delete                 Os-aware delete operation
     exit                   Exit from os-aware mode
     os-aware               Os-aware add operation
     update                 Os-aware update
```

2) Set the OS-AWARE. Use the ‘delete’ parameter to delete the OS-AWARE.
   - os-aware [OS_AWARE NAME] dhcp-option [OPTION_NUM] eq [VALUE]
   - delete os-aware [OS_AWARE NAME]
   - update os-aware [OS_AWARE NAME] dhcp-option [OPTION_NUM] eq [VALUE]

Parameter	Description
OS_AWARE NAME	os-aware name to configure
OPTION_NUM	dhcp option value (1~255)
VALUE	Fingerprint value

os-aware ‘window7’ creation:

```
WEC8500# configure terminal
WEC8500/configure# os-aware
WEC8500/configure/os-aware # os-aware window7 dhcp-option 1 eq AA
```

os-aware ‘window7’ deletion:

```
WEC8500# configure terminal
WEC8500/configure# os-aware
WEC8500/configure/os-aware # no os-aware window7
```

3) Check the settings by using the ‘show OS-AWARE-all’ or ‘show OS-AWARE-[OS_AWARE NAME]’ commands.
‘show OS-AWARE-all’ retrieves all OS-AWARE information and ‘show OS-AWARE-[OS_AWARE NAME]’ only retrieves user defined information out of all OS-AWARE information.

```
================================================================================================
====
PLD_INDEX     OS_NAME       TYPE       REFCNT       OPTION       LENGTH      FINGERPRINT
================================================================================================
====
     1        window7        0           0           5            2           1234
```

3.4.6.2 Applying to ACL

Configuration using CLI

1) Go to configure → fqm mode to set the ACL rule of CLI.

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

2) Apply the OS-AWARE to ACL. Use the ‘no’ parameter to delete the OS-AWARE
   - access-list [ip/ipv6/mac] [ACL_NAME] [deny/permit/time-profile] seq [seq_NUM] [1/*/ahp/eigrp/esp/gre/icmp/igmp/igrp/ip/nos/ospf/pcp/pim/17/6/tcp/udp/1-255] [any/A.B.C.D A.B.C.D] eq [eq_VALUE] [any/A.B.C.D A.B.C.D] eq [eq_VALUE] os-aware[OS_AWARE NAME] [[[dscp [*|[0-63]]|precedence [*|[0-7])]]]|]
   - no access-list [ip/ipv6/mac] [ACL_NAME] [deny/permit/time-profile] seq [seq_NUM] [1/*/ahp/eigrp/esp/gre/icmp/igmp/igrp/ip/nos/ospf/pcp/pim/17/6/tcp/udp/1-255] [any/A.B.C.D A.B.C.D] eq [eq_VALUE] [any/A.B.C.D A.B.C.D] eq [eq_VALUE] os-aware[OS_AWARE NAME] [[[dscp [*|[0-63]]|precedence [*|[0-7])]]]|]

Parameter	Description
OS_AWARE NAME	os-aware name to configure

An example of applying ‘window7’ to ‘acl’ is as follows.

```
WEC8500# configure terminal
WEC8500/configure# fqm-mode
access-list ip acl1 permit seq 1 icmp any any os-aware window7
```

3) To check the configuration information, use the ‘show running-config network’ command.

3.5 Multicast to Unicast

Execute the ‘show multi2uni-list’ command to check the list of wireless terminals that use the multicast to unicast function.

3.6 IP Multicast Configuration

3.6.1 IP Multicast Routing Configuration

Configuration using CLI

1) Go to configure mode of CLI.

```
WEC8500# configure terminal
```

2) Enable or disable the routing function for IP multicast.
   - ip multicast-routing: Enable
   - no ip multicast-routing: Disable

Configuration using Web UI

In the menu bar of <WEC Main window>, select <Configuration> and then select the <Controller> → <Multicast> → <IP Multicast> menu in the sub-menus.
After selecting Enable/Disable in the IP Multicast window, click the <Apply> button to apply the configuration.

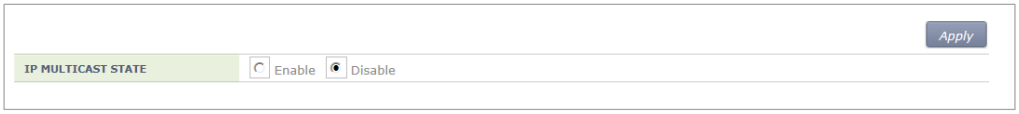


Figure 38. IP Multicast Configuration Window

3.6.2 PIM Configuration

As a multicast layer3 transmission protocol, the PIM has two modes, i.e. Dense mode and Sparse mode. The WEC8500 supports only PIM Sparse mode and the PIM Sparse mode can be configured for each interface.

Configuration using CLI

1) Go to configure of CLI → mode where you want to perform configuration.

```
WEC8500# configure terminal
WEC8500/configure# interface ge2
```

2) Perform PIM configuration.
   - ip pim sparse-mode: Enable
   - no ip pim sparse-mode: Disable

Configuration using Web UI

In the menu bar of **<WEC Main window>**, select **<Configuration>** and then select the **<Controller>** → **<Multicast>** → **<PIM-SM>** menu in the sub-menus. When you click the **<Add>** or **<Delete>** button, you can add or delete PIM-SM configuration.

Figure 39. PIM-SM Configuration Window (1)

Follow the below procedure to add a PIM.

1) In the PIM-SM initial window, click the **<Add>** button.

2) Click the **<Select Interface>** button.

Figure 40. PIM-SM Configuration Window (2)

3) Select an interface to add.

Figure 41. PIM-SM Configuration Window (3)

4) The selected interface is displayed on the window. Click the <**Apply**> button to apply the configuration.

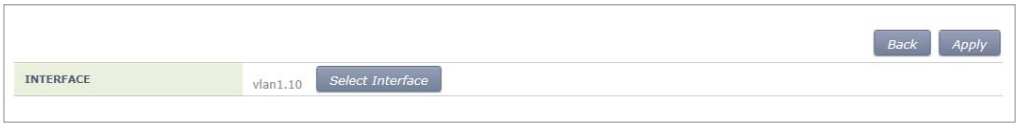


Figure 42. PIM-SM Configuration Window (4)

3.7 IGMP Snooping

Configuration using CLI

Use the 'ip igmp snooping' command to enable or disable Internet Group Management Protocol (IGMP) Snooping.

- ip igmp snooping
- no ip igmp snooping

When this command is executed in the Configure mode, the IGMP Snooping of a bridge is enabled or disabled. If it is executed in the interface mode, the IGMP Snooping of an interface is enabled or disabled.

Configuring the IGMP Snooping of a bridge:

```
WEC8500# configure terminal
WEC8500/configure# ip igmp snooping
```

Configuring the IGMP Snooping of a VLAN interface:

```
WEC8500# configure terminal
WEC8500/configure# interface vlan1.10
WEC8500/configure/interface vlan1.10# ip igmp snooping
```

In addition, a specific function of the IGMP Snooping functions of a VLAN interface can be enabled or disabled as shown in the below command.

[ip igmp snooping fast-leave]
Enables or disables the Fast-Leave function. (Default: Enable status)

- ip igmp snooping fast-leave
- no ip igmp snooping fast-leave

[ip igmp snooping querier]
Enables or disables the Querier function. (Default: Enable status)

- ip igmp snooping querier
- no ip igmp snooping querier

[ip igmp snooping report-suppression]
Enables or disables the Report-suppression function. (Default: Enable status)

- ip igmp snooping report-suppression
- no ip igmp snooping report-suppression

[ip igmp snooping mroute]
Enables or disables the Mroute function.

- ip igmp snooping mroute [INTERFACE]
- no ip igmp snooping mroute [INTERFACE]

Configuration using Web UI

In the menu bar of <**WEC Main window**>, select <**Configuration**> and then select the <**Controller**> → <**Multicast**> → <**IGMP Snooping**> menu in the sub-menus.

[Config]
Enables or disables the IGMP Snooping function or configures related functions.
To perform configuration for STATE, FAST LEAVE, QUERIER STATE, or REPORT SUPRESSION STATE, select Enable or Disable and click the <**Apply**> button.

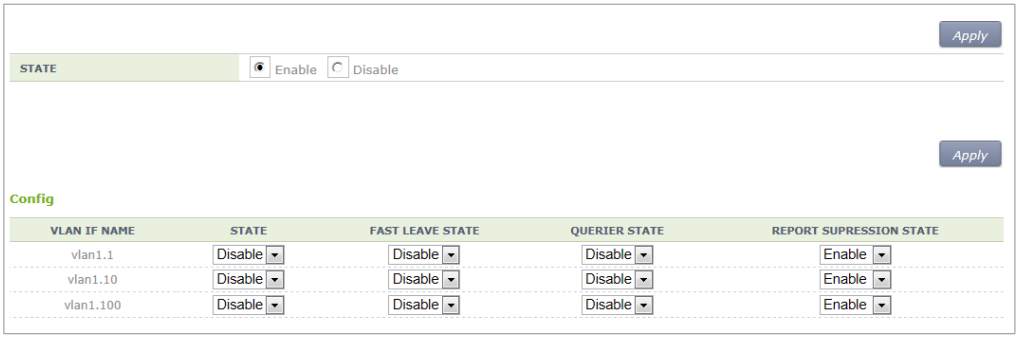


Figure 43. IGMP Snooping Config Window

[Mroute]
The PIM-SM initial window is shown below. When you click the <**Add**> or <**Delete**> button, you can add or delete PIM-SM configuration.

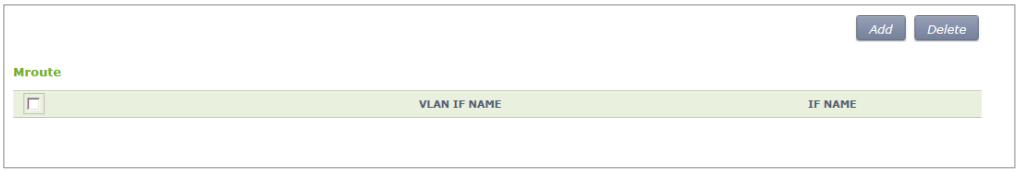


Figure 44. IGMP Snooping Mroute Creation Window (1)

1) In the PIM-SM initial window, click the <**Add**> button.

2) Click the <**Select Vlan**> button.

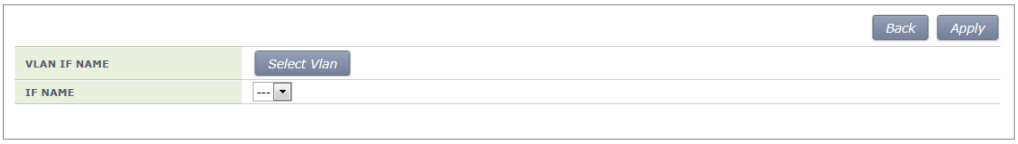


Figure 45. IGMP Snooping Mroute Creation Window (2)

3) Select a VLAN interface that will be added to the Mroute.

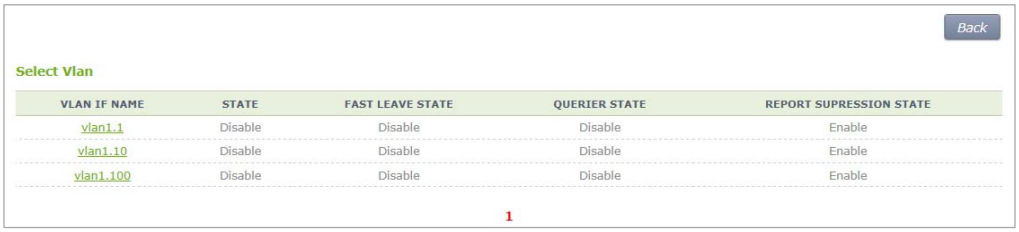


Figure 46. IGMP Snooping Mroute Creation Window (3)

4) The selected interface is displayed on the window. Click the <**Apply**> button to apply the configuration.

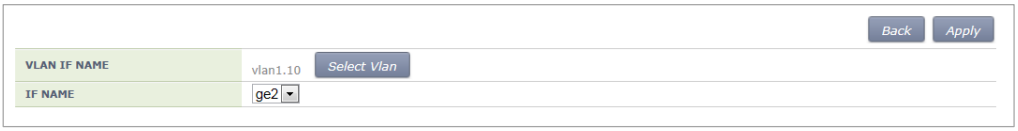


Figure 47. IGMP Snooping Mroute Creation Window (4)

CHAPTER 4. AP Connection Management

This chapter describes the various configuration methods to manage the connection between the WEC8500 and AP.

4.1 APC Management

4.1.1 Descriptor Management

It manages the number of APs and wireless terminals which are interoperating with the WEC8500 and maximum number of APs that can be supported. And it also provides the following configuration function for communication with AP.

- R-MAC Support
- Security authentication

The Descriptor configuration procedure of WEC8500 is as follows:

1) Go to configure of CLI→ APC mode.

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

2) Configure Radio MAC address (R-MAC) support.
   - apc R-MAC

3) Configure the authentication method.
   - apc security-auth-type [AUTHENTICATION]

Parameter	Description
AUTHENTICATION	Authentication method (x509/pre-shared/both) - x509: X.509 Certificate authentication - pre-shared: Pre-shared secret authentication - both: Both X.509 and pre-shared are supported simultaneously.

4) To check the configured information, use the ‘show apc summary’ command.

4.1.2 Managing APC List

When a fault occurs with the WEC8500, the backup APC provides a service instead. The backup APC supports a backup primary controller and a backup secondary controller.

Configuration using CLI

The procedures for configuration are as follows.

1) Go to configure mode of CLI.

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

2) Configure a backup APC.
   - apc BackupPrimaryController [APC_NAME] [IP_ADDRESS]
   - apc BackupSecondaryController [APC_NAME] [IP_ADDRESS]

Parameter	Description
APC_NAME	Backup APC name (ApcName output parameter value of the ‘show apc summary’ command in a backup APC)
IP_ADDRESS	Backup APC IP address (AP Mgnt interface IP output parameter value of the ‘show apc summary’ command in a backup APC)

3) To check the configured backup APC, use the ‘show apc summary’ command.

Configuration using Web UI

In the menu bar of **<WEC Main window>**, select **<Configuration>** and then select the **<Controller>** → **<General>** menu in the sub-menus. You can manage WEC8500 list and configure redundancy.

After entering a configuration in the Backup APC List in the window, click the **<Apply>** button.

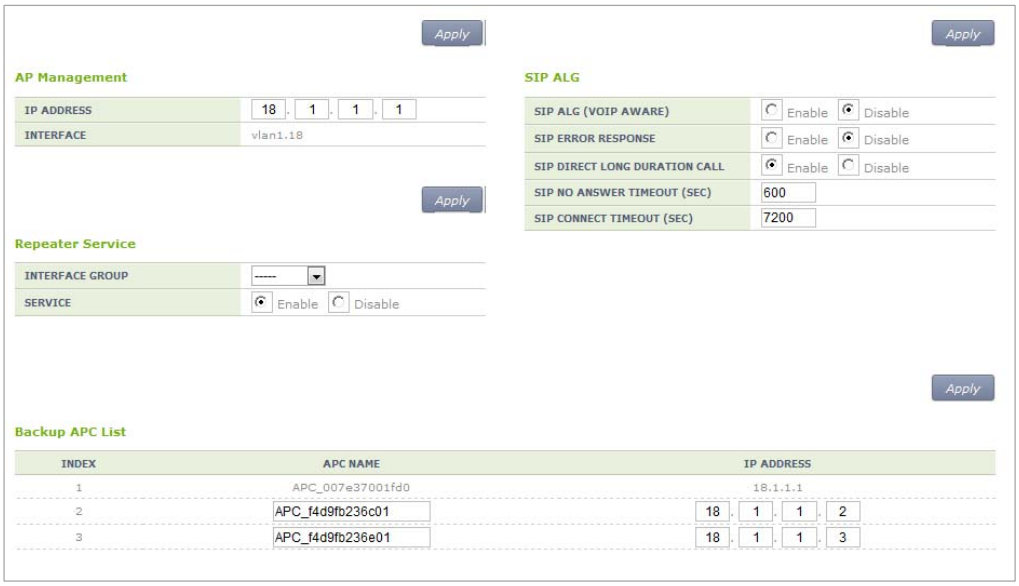


Figure 48. Managing APC list

4.1.3 Management Interface Configuration

Because the WEC8500 communicates with a WIRELESS ENTERPRISE wireless LAN AP using management interface, this is one of the information that must be configured first of all for wireless LAN service.

Configuration using CLI

To configure management interface, execute the command as follows:

1) Go to configure mode of CLI.

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

2) Configure a management interface.
   - apc ap-mgmt-if [IP_ADDRESS]

Parameter	Description
IP_ADDRESS	IP address of WEC8500 that is used for communication with a WIRELESS ENTERPRISE wireless LAN AP

3) To check the configured IP information, use the ‘show apc summary’ command.

Configuration using Web UI

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

After entering a configuration in the AP Management of the window, click the **<Apply>** button.

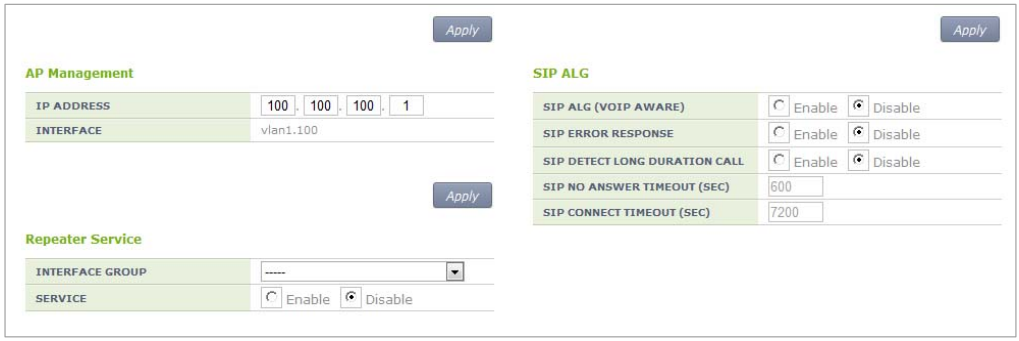


Figure 49. Management interface configuration

4.1.4 CAPWAP Configuration

A secured tunnel is created between WEC8500 and WIRELESS ENTERPRISE wireless LAN AP using CAPWAP, i.e. a standard protocol, and data is transmitted through the tunnel. An encrypted data is used for both wire and wireless sections, high security is provided.

The CAPWAP consists of control channel and data channel. The control channel handles provisioning and configuration/control messages and the data channel transmits the data traffic exchanged with a wireless terminal through CAPWAP tunneling. Because the control channel transmits the wireless LAN configuration information, there should be no data loss. Therefore, the re-transmission function is basically provided. In addition, the Datagram Transmission Layer Security (DTLS) is mandatorily used for the security of transmitted data. Meanwhile, as a user data traffic is transmitted through the data channel, a faster response is preferred instead of packet transmission reliability. Therefore, the re-transmission function is not provided and the DTLS function is also optional.

For CAPWAP configuration, execute the following commands.

1) Go to configure → apc→ capwap of CLI.

```
WEC8500# configure terminal
WEC8500/configure# apc
WEC8500/configure/apc/capwap#
```

2) Configure the CAPWAP function using the following commands.
   - ctr-src-port [port]: Changes CAPWAP control port.
   - window-size [size]: Configures the maximum number of packets that can be transmitted without response during CAPWAP control packet transmission.
   - change-state-pending-timer [TIMER]: Configures maximum waiting time until the WEC8500 receives the Change State Event Request message from an AP after it transmits the Configuration Status Response message to the AP.
   - date-check-timer[TIMER]: Configures maximum waiting time until the WEC8500 receives Data Channel Keep-alive. (default: 30 seconds).
   - discovery-del-timer: if the Join message is not received after receiving a Discovery message, this configures the timeout to discard the Discovery message that is received before the Join message
   - max-retransmit [COUNT]: Configures maximum number of retransmission when there is no answer for CAPWAP control packet transmission.
   - retransmit-interval [INTERVAL]: Configures a retransmission interval when a CAPWAP control packet is re-transmitted.
   - wait-dtls-timer [TIMER]: Configures maximum waiting time until an AP receives the DTLS handshake message from the WEC8500 (RFC 5415) (default: 60 s).
   - wait-join-timer [TIMER]: Configures maximum waiting time until the WEC8500 receives the Join message after finishing DTLS handshake (RFC 5415) (default: 60 s).
   - discovery-by-broadcast: Configures whether to allow CAPWAP broadcast connection.
   - discovery-by-multicast: Configures whether to allow CAPWAP multicast connection. (The ‘add-multicast-if’ must be configured before configuring whether to allow multicast connection.)
   - add-multicast-if [VLAN_ID]: Configures VLAN ID for the multicast interface.
   - dtls-session-delete [TIMER]: Configures a waiting time until the DTLS connection is terminated during the release of AP and CAPWAP connection.

   An example of entering a command is shown below.

```
WEC8500/configure/apc/capwap# date-check-timer 30
```

3) To check the configured CAPWAP information, use the ‘show apc capwap summary’ command.

4.1.5 Auto Discovery Configuration

The WEC8500 provides the AP auto-discovery function that automatically finds and registers APs in the same network. To configure the function, execute the following commands.

1) Go to configure → apc→ capwap of CLI.

```
WEC8500# configure terminal
WEC8500/configure# apc
WEC8500/configure/apc # capwap
WEC8500/configure/apc/capwap #
```

2) Configure the automatic registration function.
   - auto-discovery

3) Configure an AP group that will be working after AP automatic registration.
   - auto-discovery-ap-group [AP_GROUP_ID]

Parameter	Description
AP_GROUP_ID	ap-group that will be working after AP automatic registration

4) To check the configured information, use the ‘show apc capwap summary’ command.

4.1.6 Managing AP File Transmission

It provides the configuration and transmission management function for the history statistics or tech support file of the AP.

4.1.6.1 Transmitting Statistics Information File

1) Go to configure → APC mode of CLI.

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

2) Configure the history statistics information collection function of the AP.
   - ap-stats-history enable: Enable
   - ap-stats-history no enable: Disable

3) Configure a file transmission method to collect statistics information
   - ap-stats-history [MODE]

Parameter	Description
MODE	Selects file transmission method (ftp/sftp/http) - tftp is not supported.

4) If statistics collection is failed, configure maximum number of retries.
   - ap-stats-history max-retry [COUNT]

Parameter	Description
COUNT	Number of retries.

5) Configure a collection interval.
   - ap-stats-history [PERIOD]

Parameter	Description
PERIOD	Information collection interval (unit: s)

6) To check the configuration information, use the ‘show ap stats-history’ command.

4.1.6.2 Tech Support Information File

1) Go to configure → APC mode of CLI.

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

2) Configures a file transmission method to collect the AP Tech support information.
   - tech-support [MODE]

Parameter	Description
MODE	Selects file transmission method (ftp/sftp/http). - tftp is not supported.

3) If AP debug information collection is failed, configure maximum number of retries.
   - tech-support max-retry [COUNT]

Parameter	Description
COUNT	Number of retries.

4) To check the configuration information, use the ‘show ap tech-support’ command.

4.1.7 APC Dual Homing Configuration

When a fault occurs with the WEC8500, the backup APC provides a service instead. At this time, the APs attempt to connect to the new APC according to priority by referring to the configured APC name.

4.1.7.1 APC Configuration

To set the backup APC in the WEC8500, you must add an APC that you want to set as a backup APC to the APC list and then add the APC to the backup APC list. The APC information is added to the APC list automatically.
You can also set the fallback to return to the original APC from the backup APC during the service.

Configuration using CLI

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

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

2) Configure an APC list.
   - add-apc [APC_NAME] [MAC_ADDRESS]

Parameter	Description
APC_NAME	APC name to be added to APC list
MAC_ADDRESS	System MAC address to be added to APC list (Enter system mac address output parameter value of the 'show system info' command in the APC you want to add.)

3) Go to redundancy configure mode of CLI.

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

4) Set a backup APC.
   - add-apc [APC_NAME] [IP_ADDRESS] [PORT]

Parameter	Description
APC_NAME	APC name added to the APC list
IP_ADDRESS	IP address of APC to be added to Redundancy (Enter AP Mgnt interface IP output parameter value of the 'show apc summary' command in the APC you want to add.)
PORT	Port of APC to be added to Redundancy (Enter capwap control source port number-output parameter value of the 'show apc capwap summary' command in the APC you want to add.)

5) Choose whether to use fallback and set the fallback type.
   - fallback-enable [TYPE] [TIME]: Enable
   - no fallback-enable: Disable

Parameter	Description
TYPE	Select fallback type(now/at-time) - now: Initiates fallback as soon as failover occurs. - at-time: Initiates fallback only at the set time.
TIME	Sets operating time when the TYPE is at-time - hh:mm-hh:mm (start hour:start minute-end hour:end minute)

6) Set fallback interval.
   - fallback-interval [INTERVAL]

Parameter	Description
INTERVAL	Fallback interval (unit: s)

Configuration using Web UI

1) Configure an APC list.
In the menu bar of <**WEC Main window**>, select <**Configuration**> and then select the <**Controller**> → < **APC Lists** > menu in the sub-menus. You can manage APC lists that will be used in Redundancy/Cluster.

Click the <**Add**> button to add an APC to the APC Lists window. Select an APC and click the <**Delete**> button to delete.

Figure 50. APC Lists

2) Set the redundancy.
In the menu bar of <**WEC Main window**>, select <**Configuration**> and then select the <**Controller**> → < **Redundancy** > menu in the sub-menus.
To set fallback-related functions, set the desired Fall Back options and click the <**Apply**> button. To configure a backup APC list, click the <**Add**> or <**Delete**> button to add or delete an APC from the Backup APC list.

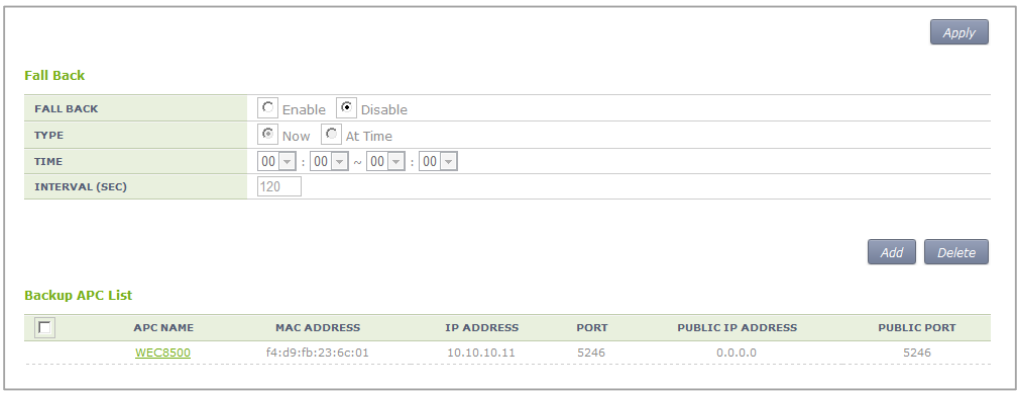


Figure 51. Backup APC List

4.1.7.2 AP Configuration

Configuration using CLI

1) Go to configure → AP configuration → AP profile mode of CLI.

```
WEC8500# configure terminal
WEC8500/configure# ap ap_1
WEC8500/configure/ap ap_1# profile
WEC8500/configure/ap ap_1/profile#
```

2) Configure discovery type.
   - discovery [DISCOVER_TYPE]

Parameter	Description
DISCOVERY_TYPE	Discovery Type - ap-referal: Discovery type is set by AP. - apc-referal: Discovery type is set by APC using the backup APC lists. To apply the APC priority, which is used by AP for connection, it should be set to apc-referal. - multicast: multicast discovery type - broadcast: broadcast discovery type - DHCP: Discovery type is interoperating with the DHCP server. To use this mode, IP ADDRESS POLICY of the AP must be set to DHCP.

3) Configure APCs where APs will be connected using the following commands according its priority.
   - primary-apc [APC_NAME]: Configures a primary APC name.
   - secondary-apc [APC_NAME]: Configures a secondary APC name.
   - tertiary-apc [APC_NAME]: Configures a tertiary APC name.

Parameter	Description
APC_NAME	APC name - primary apc: APC to which AP attempts to connect first. Typically currently connected APC - secondary-apc, tertiary-apc: APC to connect when there is no response from a primary-apc. You must select an APC configured either in the BackupPrimary-Controller or BackupSecondaryController.

When a primary-apc is rebooted, an AP attempts to connect with a secondary-apc. If there is no response from the secondary-apc, it can be connected to a tertiary-apc.

4) To check the information of a configured AP profile, use the ‘show ap detail [AP_PROFILE_NAME]’ command.

Configuration using Web UI

In the menu bar of **<WEC Main window>**, select **<Configuration>** and then select the **<Access Points> → AP selection → <General>** menu in the sub-menus.

After selecting the DISCOVERY TYPE/PRIMARY/SECONDARY/TERTIARY CONTROLLER NAME item, click the **<Apply>** button to apply the configuration.

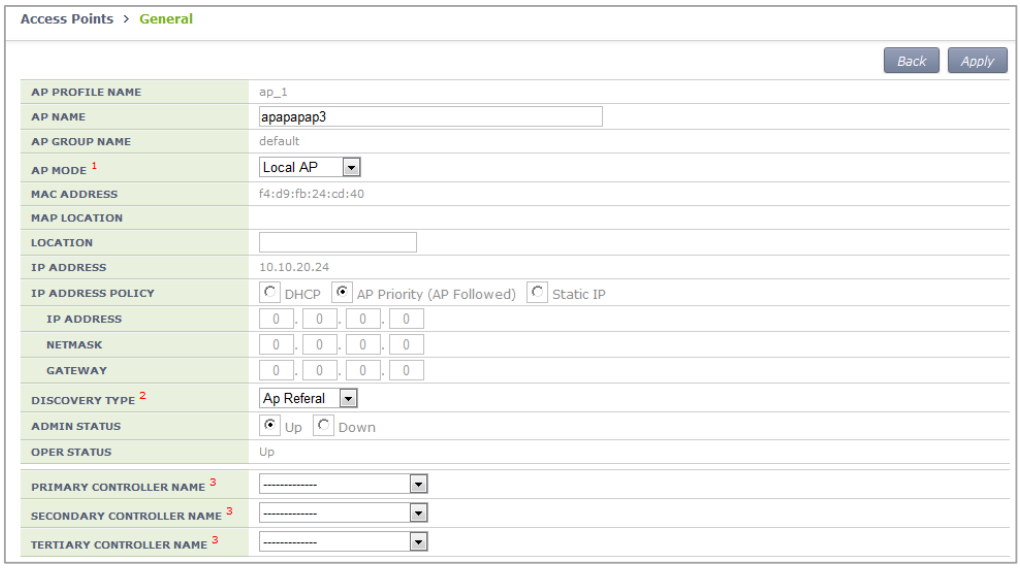


Figure 52. AP configuration

4.2 AP Management

4.2.1 AP Group Configuration

The WEC8500 provides the AP group management function that manages the services of AP per group using a profile.

Configuration using CLI

To manage an AP group, execute the command as follows.

1) Go to configure mode of CLI.

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

2) Create or delete an AP group. Use ‘no’ parameter in front of the command to delete an AP group.
   - ap-group [AP_GROUP_NAME]
   - no ap-group [AP_GROUP_NAME]

3) Add or delete an AP to or from the created AP group. Use ‘no’ parameter in front of the command to delete an AP from the AP group. But, for a default AP group, you cannot delete an AP from the group. If you delete an AP from other AP groups other than the default group, the deleted AP is included into the default AP group.
   - add-ap [AP_NAME]
   - no add-ap [AP_NAME]

4) Use the ‘show ap-group summary’ command to check the AP group information.

Configuration using Web UI

In the menu bar of **<WEC Main window>**, select **<Configuration>** and then select the **<AP Groups>** menu in the sub-menus. It provides the group configuration of the AP. Click the **<Add>** or **<Delete>** button to add or delete a group.

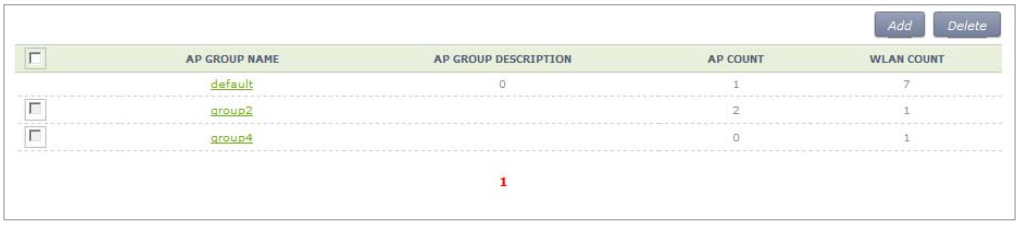


Figure 53. AP groups configuration

4.2.2 AP Time Synchronization per Group

You can manage time synchronization per AP group.

Configuration using CLI

1) Go to configure → AP group mode of CLI.

```
WEC8500# configure terminal
WEC8500/configure# ap-group apg_01
WEC8500/configure/ap-group apg_01#
```

2) Configure time synchronization to an AP group.
   - time-config [SYNC_METHOD] [URL] [COUNTRY_CODE] [CITY](INTERVAL)

Parameter	Description
SYNC_METHOD	Selects AP time synchronization method (ntp/ac-stamp) - ntp: NTP - ap-stamp: Time stamp of WEC8500
URL	Configures NTP server URL information.
COUNTRY_CODE	Configures a country to use for time synchronization.
CITY	Configures a city to use for time synchronization.
INTERVAL	Interval to set the time synchronization (Unit: s)

3) To check the time synchronization information per configured AP group, use the ‘show ap-group time-config’ command.

4.2.3 AP Group Profile

The system provides the function of configuring the profile of an AP group.

Configuration using CLI

1) Go to configure → AP group configuration → AP group profile mode of CLI.

```
WEC8500# configure terminal
WEC8500/configure# ap-group apg_01
WEC8500/configure/ap-group apg_01# profile
WEC8500/configure/ap-group apg_01/profile#
```

2) Use the 'profile' command to configure the profile of an AP group.
   - profile discovery-interval [INTERVAL]: Configures a waiting time until the CAPWAP discovery response message is received (Unit: s).
   - profile echo-interval [INTERVAL]: Configures the time when an echo request message is transmitted to the WEC8500 where an AP joins (Unit: s).
   - echo-retransmit-interval: Configures a waiting time until re-transmitting an echo request message for which there is no response (Unit: s).
   - profile ip-mode [dhcp/static]: Configures the IP address of an AP as DHCP or Static or AP Followed.
   - profile max-echo-retransmit [INTERVAL]: Configures the maximum number of re-transmission of echo request message.
   - profile report-interval [INTERVAL]: Configures the time when an AP transmits a description error to the WEC8500 (Unit: s).
   - profile retransmit-interval [INTERVAL]: Configures a waiting time until re-transmitting a CAPWAP control packet for which there is no response (Unit: s).
   - profile statistics-timer [TIMER]: Configures a statistics timer.
   - profile ssh-enable: Configures whether to enable the SSH server of the AP.
   - profile telnet-enable: Configures whether to enable the telnet server of the AP.
   - profile vlan-support: Configures whether to enable the native VLAN of the AP.
   - profile native-vlanId [VLAN_ID]: Configures a native VLAN value in the AP.
   - profile primary-apc [APC_AME]: Configures a primary APC name.
   - profile secondary-apc [APC_AME]: Configures a secondary APC name.
   - profile tertiary-apc [APC_AME]: Configures a tertiary APC name.
   - profile description [STRING]: Adds a description of the AP group.
   - profile discovery [ap-referal/apc-referal/multicast/broadcast/DHCP]: Sets the discovery type in the AP.
   - profile fragment-size [SIZE]: Sets the fragment-size in the AP.
   - profile time-config [ntp/ac-stamp] [URL] [COUNTRY_CODE] [CITY] (INTERVAL): Sets the time synchronization method in the AP.
   - profile vlan-support: Sets whether to enable the native VLAN in the AP.

3) To check the profile of a configured AP group, use the 'show ap-group detail [AP_GROUP_NAME]' command.

Configuration using Web UI

In the menu bar of **<WEC Main window>**, select **<Configuration>** and then select the **<Access Points> → AP selection → <Advanced>** menu in the sub-menus.

The configuration items in the Advance tab are as follows: To apply the configuration after entering each item, click the **<Apply>** button.

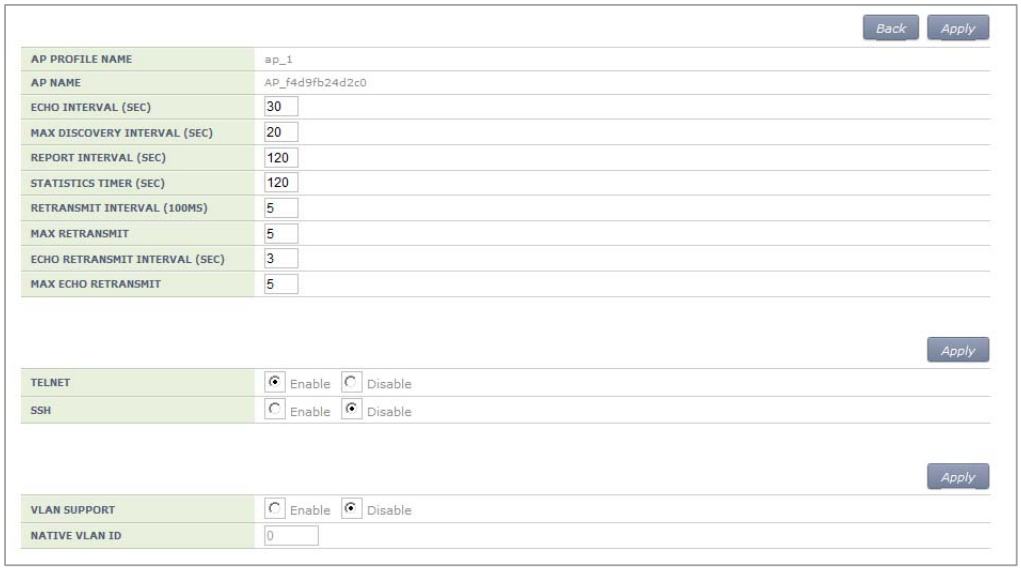


Figure 54. Configuring AP group profile

4.2.4 AP Configuration

> NOTE
>
> The management interface of WEC8500 must be configured for the connection between WEC8500 and WIRELESS ENTERPRISE AP.

4.2.4.1 Configuring MAC address

Configuration using CLI

To configure AP information, execute the command as follows:

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

```
WEC8500# configure terminal
WEC8500/configure# ap [ap config name]
WEC8500/configure/ap ap_1#
```

2) Register the MAC address of the AP.
   - profile mac [MAC_ADDRESS]

3) To check the information of a configured AP, use the 'show ap summary' command.

Configuration using Web UI

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

1) Click the <**Add**> button.
2) Set AP PROFILE NAME and MAC ADDRESS and click the <**Apply**> button.

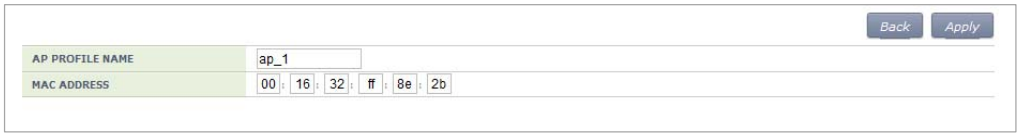


Figure 55. Adding Access Points

4.2.4.2 Configuring AP Profile

Configuration using CLI

To manage an AP group configuration, execute the command as follows:

1) Go to configure → AP configuration → AP profile mode of CLI.

```
WEC8500# configure terminal
WEC8500/configure# ap ap_1
WEC8500/configure/ap ap_1# profile
WEC8500/configure/ap ap_1/profile#
```

2) Configure the profile of an AP using the below command.
   - name [STRING]: Configures an AP name.
   - location [STRING]: Configures the location information of the AP.
   - discovery-interval [INTERVAL]: Configures a waiting time until the CAPWAP discovery response message is received (Unit: s).
   - echo-interval [INTERVAL]: Configures the time when an echo request message is transmitted to the WEC8500 where an AP joins (Unit: s).
   - echo-retransmit-interval [INTERVAL]: Configures a waiting time until re-transmitting an echo request message for which there is no response (Unit: s).
   - max-echo-retransmit [COUNT]: Configures the maximum number of re-transmission of echo request message.
   - retransmit-interval [INTERVAL]: Configures a waiting time until re-transmitting a CAPWAP control packet for which there is no response (Unit: s).
   - max-retransmit [COUNT]: Configures the maximum number of re-transmission of capwap control packet for which there is no response.
   - statistics-timer [TIMER]: Configures the time interval of transmitting the statistics information provided by the CAPWAP (Unit: s).
   - ip-mode [dhcp/static/ap]: Configures the IP address of the AP as DHCP or Static or AP Followed.
   - static-ip [IP_ADDRESS] [NETMASK] [GATEWAY]: Configures the static ip address of the AP.
   - ssh-enable: Configures whether to enable the SSH server of the AP.
   - telnet-enable: Configures whether to enable the telnet server of the AP.
   - vlan-support: Configures whether to enable the native VLAN of the AP.
   - native-vlanId [VLAN_ID]: Configures a native VLAN value in the AP.
   - primary-apc [APC_NAME]: Configures a primary APC name.
   - secondary-apc [APC_NAME]: Configures a secondary APC name.
   - tertiary-apc [APC_NAME]: Configures a tertiary APC name.
   - sync-group: Configures whether to follow the profile configuration of ap-group where the AP is belonged.
   - ap-mode [localAp/rootAp/repeaterAp/snifferAp/remoteAp]: Sets the AP operation mode.

- ap-stats-history-enable: Sets whether to enable the AP-statistics history.
- client-ip [IP_ADDRESS]: Sets the client ip address, if the AP operation mode is set to Sniffer AP.
- discovery [ap-referal/apc-referal/multicast/broadcast/DHCP]: Sets Discovery type of the AP.
- dtls-policy: Sets the DTLS Policy of the AP.
- edge-ap: Sets whether to enable the Edge AP.
- fragment-size [SIZE]: Sets the fragment-size of the AP.
- report-interval [INTERVAL]: Sets the time interval for transmitting the description error to the WEC8500 (Unit: s).

3) To check the information of a configured AP profile, use the 'show ap detail [AP_NAME]' command.

Configuration using Web UI

In the menu bar of **<WEC Main window>**, select **<Configuration>** and then select the **<Access Points> → AP selection → <General>** menu in the sub-menus.
The setting options in the General tab are as follows. Click the **<Apply>** button to apply the settings.

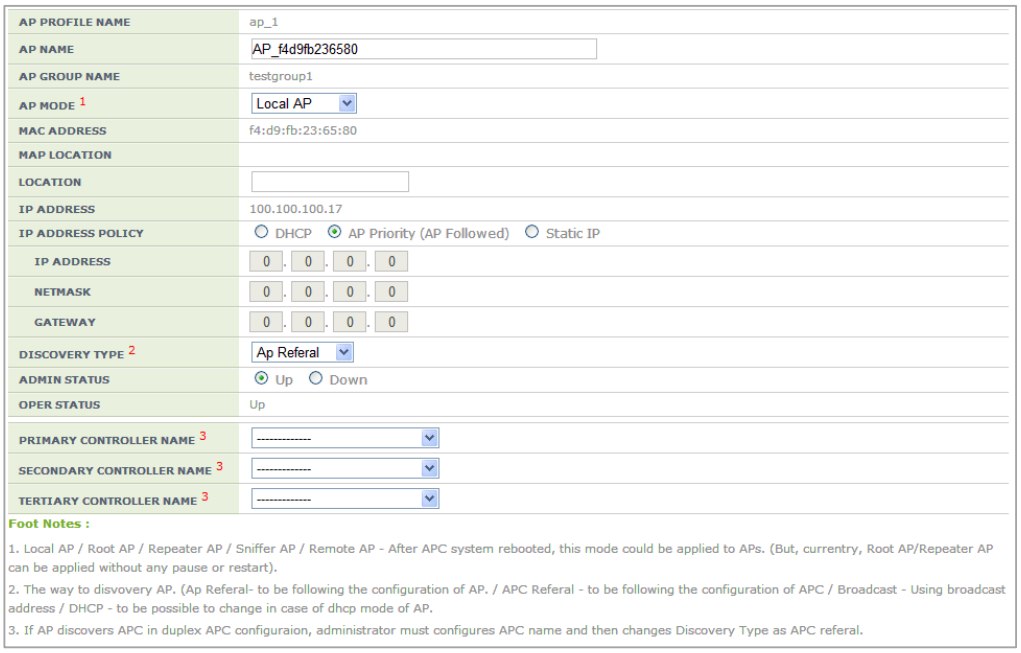


Figure 56. AP Profile Setting (1)

- AP NAME: AP name
- AP MODE: AP operational mode
- MAC ADDRESS: MAC address of AP

- MAP LOCATION
- LOCATION: Location
- IP ADDRESS: IP address
- IP ADDRESS POLICY: IP address mode
- DISCOVERY TYPE: AP discovery type
- ADMIN STATUS: AP administrative status
- OPER STATUS: Current AP operational status
- PRIMARY CONTROLLER NAME, SECONDARY CONTROLLER NAME, TERTIARY CONTROLLER NAME: Redundancy mode

In the menu bar of **<WEC Main window>**, select **<Configuration>** and then select the **<Access Points>→ AP → <Advanced>** menu in the sub-menus.
The setting options in the Advance tab are as follows. Fill in each item and click the **<Apply>** button to apply the settings.

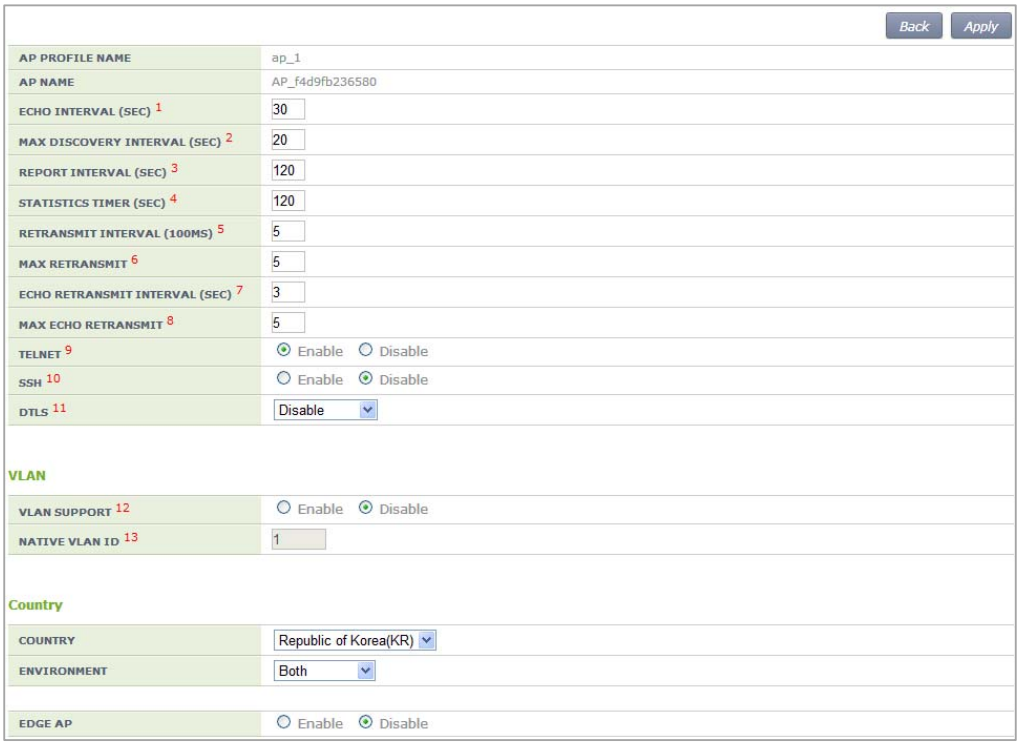


Figure 57. AP Profile Setting (2)

4.2.4.3 AP Mode Configuration

Configuration using CLI

To configure AP mode, execute the command as follows.

1) Go to configure → AP configuration → AP profile mode of CLI.

```
WEC8500# configure terminal
WEC8500/configure# ap ap_1
WEC8500/configure/ap ap_1# profile
WEC8500/configure/ap ap_1/profile#
```

2) Configure the AP mode.
   - ap-mode [MODE]

Parameter	Description
MODE	AP operation mode (localAp/rootAp/repeaterAp/snifferAp/remoteAp) - localAp: Typical operation mode. Default value. - rootAp: AP mode where a repeater AP can be connected. - repeasterAp: AP mode that is connected to a wireless area and the WEC8500 through the root AP. - snifferAp: AP mode where the packets operating in a wireless environment can be captured. - remoteAp: AP mode that is used in a branch office.

3) To check the information of a configured AP, use the ‘show ap detail [AP_NAME]’ command.

Configuration using Web UI

In the menu bar of **<WEC Main window>**, select **<Configuration>** and then select the **<Access Points> → AP selection → <General>** menu in the sub-menus.
After selecting the AP MODE NAME item, click the **<Apply>** button to apply the configuration.

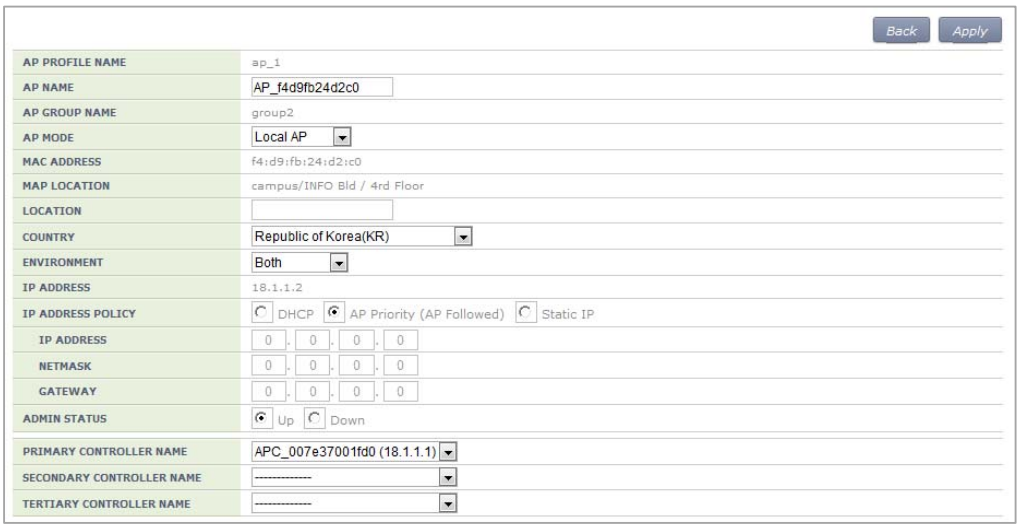


Figure 58. AP mode configuration

4.2.5 Information Management

This manages the history statistics information, real-time interface statistics information, and tech support information of the AP. For more information about environment configuration to collect each information, refer to the file transmission management of WEC8500.

4.2.5.1 History Statistics Information

1) Go to configure → AP configuration → AP profile mode.

```
WEC8500# configure terminal
WEC8500/configure# ap ap_1
WEC8500/configure/ap ap_1# profile
```

2) Configure to make history statistics information updated periodically.

```
WEC8500/configure/ap ap_1/profile# ap-stats-history-enable
```

3) To check the history statistics information of an AP, use the ‘show ap stats-history’ command.

4.2.5.2 Real-time Interface Statistics Information

Configuration using CLI

1) Go to configure → AP configuration → AP profile mode.

```
WEC8500# configure terminal
WEC8500/configure# ap ap_1
WEC8500/configure/ap ap_1# profile
```

2) Configure to make real-time interface statistics information updated periodically.

```
WEC8500/configure/ap ap_1/profile# get-if-stats
```

3) To check the interface statistics information of an AP, use the ‘show ap if-stats [AP_NAME]’ command.

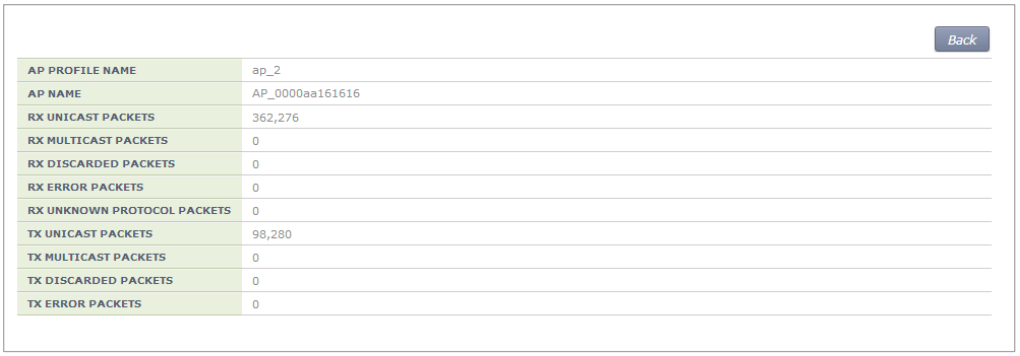
Configuration using Web UI

In the menu bar of **<WEC Main window>**, select **<Monitor>** and then select the **<Statistics>** → **<AP Ports>** menu in the sub-menus.
As shown below, you can retrieve the real-time interface statistics of the AP.

Select an item in the list, then you can check detail information.

AP PROFILE NAME	AP NAME	MODEL	VERSION	MAC ADDRESS	IP ADDRESS	MODE	ADMIN STATUS	OPER STATUS	MAP LOC.	CONTROLLER		
										PRIMARY	SECONDARY	TERTI
ap_1	AP_0000aa363640			00:00:aa:36:36:40	0.0.0.0	Local AP	Up	Down		temp		
ap_2	AP_0000aa161616	WEA303i	1.2.7.R	00:00:aa:16:16:16	10.10.20.102	Local AP	Up	Up		temp		
ap_3	AP_0000aa272727	WEA303i	1.2.7.R	00:00:aa:27:27:27	10.10.20.103	Local AP	Up	Up		temp		
ap_4	AP_0000aa292929	WEA303i	1.2.7.R	00:00:aa:29:29:29	10.10.20.104	Local AP	Up	Up		temp		
ap_5	AP_0000aa373737	WEA303i	1.2.7.R	00:00:aa:37:37:37	10.10.20.105	Local AP	Up	Up		temp		
ap_6	AP_0000aa343434	WEA303i	1.2.7.R	00:00:aa:34:34:34	10.10.20.106	Local AP	Up	Up		temp		
ap_7	AP_0000aa222222	WEA303i	1.2.7.R	00:00:aa:22:22:22	10.10.20.107	Local AP	Up	Up		temp		
ap_8	AP_0000aa313131	WEA303i	1.2.7.R	00:00:aa:31:31:31	10.10.20.108	Local AP	Up	Up		temp		
ap_9	AP_0000aa353535	WEA303i	1.2.7.R	00:00:aa:35:35:35	10.10.20.109	Local AP	Up	Up		temp		
ap_10	test12345	WEA303i	1.2.7.R	00:00:aa:30:30:30	10.10.20.110	Local AP	Up	Up		temp		
ap_11	apapapap4	WEA303i	1.2.7.R	00:16:33:05:00:20	10.10.20.21	Local AP	Up	Up		temp		

Figure 59. AP Ports window



Back

AP PROFILE NAME	ap_2
AP NAME	AP_0000aa161616
RX UNICAST PACKETS	362,276
RX MULTICAST PACKETS	0
RX DISCARDED PACKETS	0
RX ERROR PACKETS	0
RX UNKNOWN PROTOCOL PACKETS	0
TX UNICAST PACKETS	98,280
TX MULTICAST PACKETS	0
TX DISCARDED PACKETS	0
TX ERROR PACKETS	0

Figure 60. AP Ports detail information window

4.2.5.3 Tech Support Information

Execute the below command to manage AP debug and coredump information.

1) Go to configure → AP configuration → tech-support of CLI.

```
WEC8500# configure terminal
WEC8500/configure# ap [ap profile name]
WEC8500/configure/ap ap_1# tech-support
WEC8500/configure/ap ap_1/tech-support#
```

2) Request the coredemp file of the AP.

```
WEC8500/configure/ap ap_1/debug# get-coredump (system / radio-
coredump)
```

3) Request the crashfile of the AP.

```
WEC8500/configure/ap ap_1/debug# get-crash-file (system / radio-
coredump)
```

4) Request the log file of the AP.

```
WEC8500/configure/ap ap_1/debug# get-log-file
```

5) To check the debug file information of an AP, use the ‘show ap tech-support’ command.

4.2.6 AP Package Upgrade

Configuration using CLI (Upgrade Function)

To manage the AP upgrade function, execute the command as follows:

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

```
WEC8500# configure terminal
WEC8500/configure# ap ap_1
```

2) Request the image file of an AP to upgrade.

```
WEC8500/configure/ap ap_1# upgrade-request weafama_1.2.4.R.bin

WARNING: AP will be upgrade.
Are you sure you want to continue? (y/n) : y
WEC8500/configure/ap ap_1#
```

3) To check the upgrade file information of the requested AP, use the following command.

```
WEC8500/configure/ap ap_1# show ap upgrade list

   /* (RC/FR/RC) : RetryCount/FailReason/RebootCause
   /* Pri : VersionPriority (MD-model,A-AP config)
 AP_ID   Model  Version(config/current)       Status(RC/FR/RC) Pri
force
    1   WEA302i    1.2.4.R/ 1.2.4.R        Success( 0/ 0/146)  AP  No
```

Configuration using CLI (Upgrade environment)

To configure AP upgrade related environment, the following command is provided.
First of all, go to the configure → AP-all → upgrade mode of CLI.

```
WEC8500# configure terminal
WEC8500/configure# ap-all
WEC8500/configure/ap-all# upgrade
WEC8500/configure/ap-all/upgrade#
```

[select-package]

Configure a package to use during AP upgrade.

- select-package [UPGRADE_TYPE] [FILE_NAME]

Parameter	Description
UPGRADE_TYPE	Configures upgrade type (default/quick-upgrade/predownload) - default: AP image that is referred to during provision upgrade. - quick-upgrade: AP image that is referred to for entire AP upgrade upon an operator's request. - predownload: AP image that is referred to download AP image to AP during entire AP upgrade.
FILE_NAME	Image file name that will be used for AP upgrade

[target]

During entire upgrade, you can select whether to maintain individual configured AP version of an AP or perform upgrade.

- Target [AP UPGRADE TARGET]

Parameter	Description
UPGRADE TARGET	Upgrade target (all/ keeping-individual) - all: Perform upgrade for all the APs. (default) - keeping-individual: While maintaining individually configured ap version, perform upgrade for the rest APs.

[transfer-protocol]

Selects a transmission protocol that is used to transmit the package file of an AP from the WEC8500 to the AP.

- Transfer-protocol [AP TRANSFER MODE]

Parameter	Description
TRANSFER_MODE	File transmission protocol (ftp/sftp) - ftp: ftp is used for file transmission. - sftp: sftp is used for file transmission.

[max-download]
Configures the maximum number of simultaneous downloads when transmitting the package file of an AP from the WEC8500 to the AP.

- Max-download [COUNT]

Parameter	Description
COUNT	Maximum number of simultaneous downloads of AP image file(range: 1-50, default: 10)

[max-retry]
Configures maximum number of re-attempts when AP upgrade is failed.

- Max-retry [COUNT]

Parameter	Description
COUNT	Maximum number of AP upgrade re-attempts (range: 1-10, default: 3)

[start]
Provides the entire AP upgrade function.

- start [UPGRADE_TYPE]

Parameter	Description
UPGRADE_TYPE	Configures upgrade type (quick-upgrade/predownload) - quick-upgrade: Perform entire ap upgrade upon an operator's request. - predownload: Download ap image to ap first during entire ap upgrade.

If you perform package upgrade after configuring ap upgrade type to predownload, restart all the APs in the following methods.

```
WEC8500# configure terminal
WEC8500/configure# ap-all
WEC8500/configure/ap-all# reboot upgrade
```

[stop]
Provides the function of stopping the image upgrade of all the APs.

- stop

[show ap upgrade]
To check the upgrade information of an AP, use the following command.

- show ap upgrade summary

Configuration using Web UI

In the menu bar of **<WEC Main window>**, select **<Administrator>** and then select **<Package Upgrade>** → **<AP>** menu in the sub menu.
You can perform AP upgrade in the AP Upgrade tab and configure upgrade related environment in the Advanced tab.

[AP Upgrade tab]
Upgrades all the APs or a specific AP.

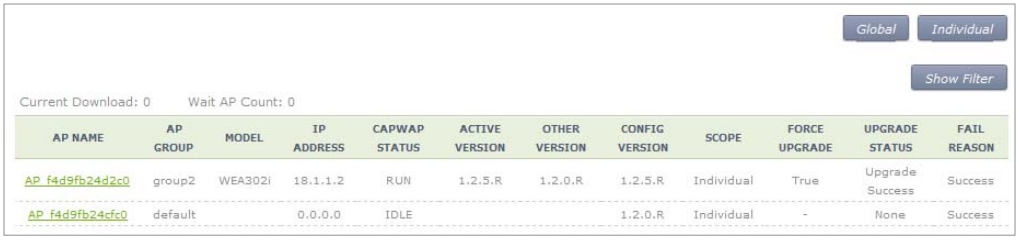


Figure 61. AP upgrade

The procedure of entire AP upgrade is as follows:

1) In the AP Upgrade window, click the **<Global>** button.

2) The **<Global>** area is displayed on the window. After configuring each item, click the **<Apply>** button.

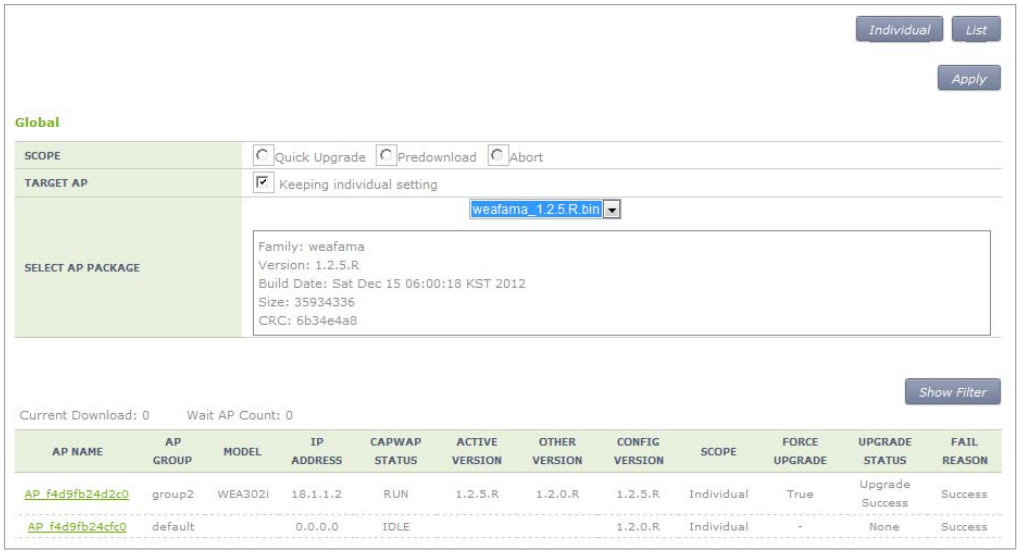


Figure 62. AP upgrade-global

- SCOPE: Selects upgrade method. To make the AP working as the package immediately after upgrade, select Quick Upgrade. To download the package to the AP, select the Predownload menu.
- TARGE AP: Select an AP target to upgrade. If you select <Keeping individual setting>, an AP that is configured as individual is excluded from upgrade.
- SELECT AP PACKAGE: Selects an AP package to upgrade.

3) If the SCOPE setup is Predownload upgrade, you must restart the AP once download is completed. After selecting the **<Administration>** → **<Reboot>** → **<AP>** menu, select Reboot All with Upgrade to restart the AP.

To upgrade a specific AP, follow the below procedure.

1) In the AP Upgrade window, click the **<Individual>** button.
2) The individual area is displayed on the window. After configuring each item, click the **<Apply>** button.

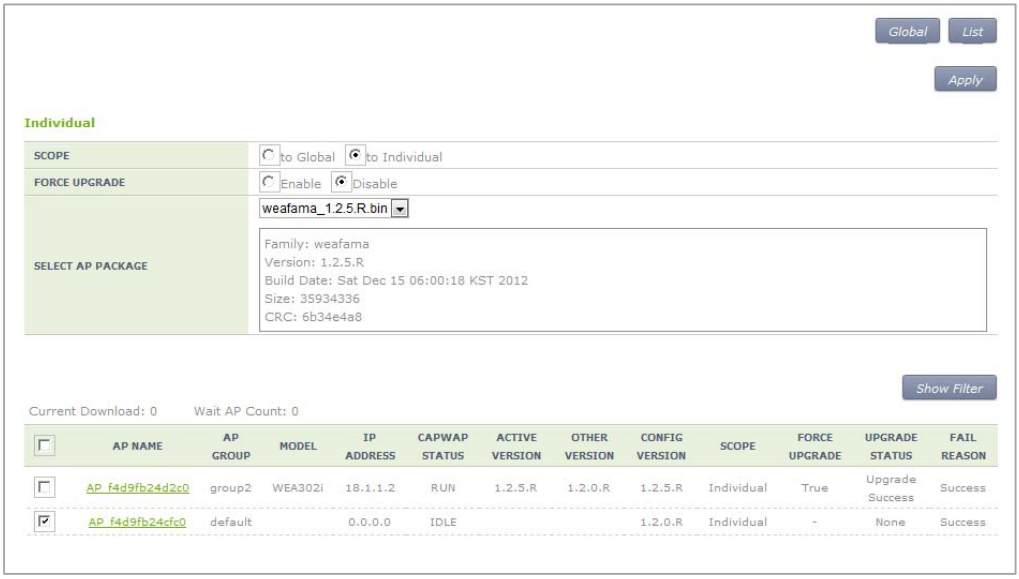


Figure 63. AP upgrade-individual

- SCOPE: Selects upgrade method. The <to individual> upgrades the selected AP to a specific package and the <to global> makes a select AP working as global.
- FORCE UPGRADE: Enable or disable
- SELECT AP PACKAGE: Selects an AP package to upgrade..

[Advanced tab]

Configures AP upgrade related environment settings.

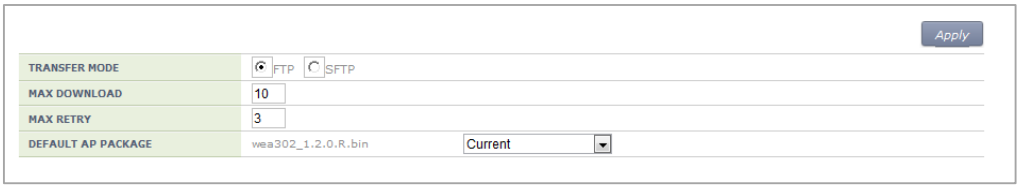


Figure 64. AP upgrade-advanced

- TRANSFER MODE: Selects a protocol that transmits an AP package.
- MAX DOWNLOAD: Configures maximum number of sessions that can be downloaded simultaneously.
- MAX RETRY: Configures maximum number of re-attempts when AP upgrade is failed.
- DEFAULT AP PACKAGE: Select an AP package that will be used for automatic upgrade during AP joint.

CHAPTER 5. WLAN Management

This chapter describes how to create and configure WLAN that is the most fundamental basis for WIRELESS ENTERPRISE wireless LAN service.

5.1 Basic WLAN Configuration

The WLAN profile helps configure and manage the WLAN connection service of an AP in the WEC8500. To use WLAN service, it is necessary to basically configure AP group and interface group and specify Service Set Identifier (SSID).

Configuration using CLI

Go to the wlan configuration mode from the configure mode of CLI.

```
WEC8500# configure terminal
WEC8500/configure# wlan [WLAN ID]
```

Parameter	Description
WLAN_ID	WLAN ID (range: 1-16)

The WLAN configuration procedures are as follows:

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

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

2) Configure an AP group to which WLAN service will be provided. The AP group configuration is only possible in the AP group configuration mode instead of the wlan configuration mode. The below configuration allocates wlan 1 to the apg_01 AP group. Maximum 16 WLANs can be allocated to each AP group.

```
WEC8500# configure terminal
WEC8500/configure# ap-group apg_01
WEC8500/configure/ap-group apg_01# add-wlan 1
```

3) Configure an interface group to which WLAN service will be provided.
Multiple interface groups can be specified to the VLAN interface specified in the WEC8500 and the WLAN service can be provided through the interface.
   - if-group [INTERFACE_GROUP_NAME]

4) Configure a SSID. The SSID is an ID used to connect to each wireless terminal to provide the WLAN service. It must be unique for each WLAN.
Make sure to configure a SSID to use the WLAN service.
   - ssid [SSID_NAME]

5) Configure whether to apply the WLAN service.

```
WEC8500/configure/wlan 1#enable
```

NOTE

To apply the various WLAN services to multiple wireless terminals, create the WLAN service in a profile format. Once the WLAN service is started, make each AP use the WLAN service by downloading the profile.

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 <**General**> tab. In the screen, you can use various functions such as adding or deleting a WLAN.

ID	PROFILE NAME	SSID	INTERFACE GROUP	RADIO AREA	ADMIN STATUS	SECURITY POLICIES
1	wlan1	test_wlan1	ifg_01	5GHz	Enable	None
2	wlan2	test_wlan2	ifg_01	All	Enable	None
3	wlan3	test_wlan3	ifg_01	All	Enable	None
4	wlan4	test_wlan4	ifg_01	All	Enable	None
5	wlan5	test_wlan5	ifg_01	All	Enable	None
6	wlan6	test_wlan6	ifg_01	All	Enable	None
7	wlan7	test_wlan7	ifg_01	All	Enable	None
8	wlan8	test_wlan8	ifg_01	All	Enable	None
9	wlan9	test_wlan9	ifg_01	All	Enable	None
10	wlan10	test_wlan10	ifg_01	All	Enable	None
11	wlan11	test_wlan11	ifg_01	All	Enable	None
12	wlan12	test_wlan12	ifg_01	All	Enable	None
13	wlan13	test_wlan13	ifg_01	All	Enable	None
14	wlan14	test_wlan14	ifg_01	All	Enable	None
15	wlan15	test_wlan15	ifg_01	All	Enable	None
16	wlan16	test_wlan111	ifg_01	All	Enable	None

Figure 65. WLAN basic configuration (1)

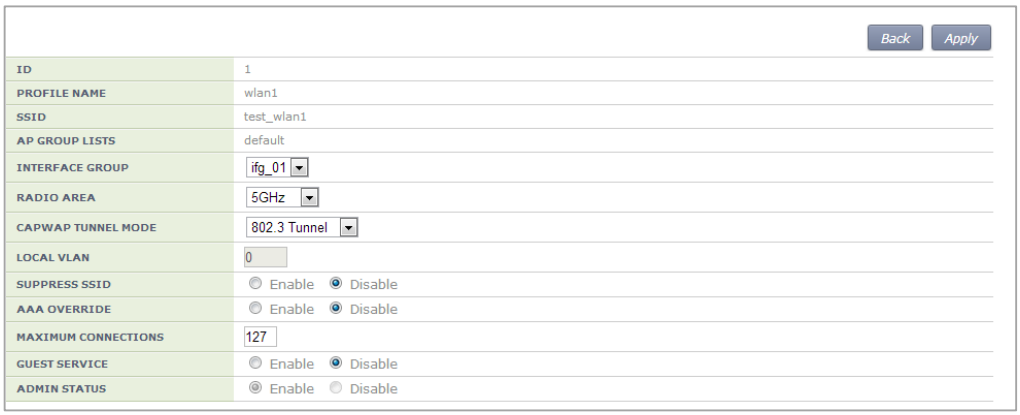


Figure 66. WLAN basic configuration (2)

You can configure various functions such as interface group and SSID, etc.
The configurations available in the General tab are as follows:

- ID
- PROFILE NAME
- SSID
- AP GROUP LISTS
- INTERFACE GROUP: Configures an interface group.
- RADIO AREA: Configures a radio area.
- CAPWAP TUNNEL MODE/LOCAL VLAN: Configures the local switching function.
- SUPRESS SSID: Enables or disables the function.
- AAA OVERRIDE: Enables or disables the function.
- MAXIMUM ONNECTIONS: Limits the number of users per WLAN.
- GUEST SERVICE: Enables or disables the Guest service.
- ADMIN STATUS: Enables or disables the function.

5.1.1 WLAN Additional Configuration

Each wireless terminal can receive a differentiated service according to the WLAN configuration. The procedure of configuring the WLAN additional function is as follows.

Configuration using CLI

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

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

2) Select whether to provide the authentication service using the AAA server.
   - aaa-overide

3) Determine whether to configure the Guest service.
   - guest-flag

4) Configure a VLAN ID to use locally.
   - local-vlan [VLAN_ID]

Parameter	Description
VLAN_ID	VLAN ID (range: 1-4094)

5) Specify the service MAC type.
   - mac-type [MAC_TYPE]

Parameter	Description
MAC_TYPE	- localMac: An AP itself provides data service. - splitMac: Provides data service through the WEC8500.

6) Select a radio bandwidth to provide the WLAN service.
   - radio [RADIO]

Parameter	Description
RADIO	- 1: 5 GHz - 2: 2.4 GHz - 3: Supports both 5/2.4 GHz

7) Select whether to provide the SSID as hidden. If it is set to ‘hidden’, the SSID is not found when other devices do searching.
   - suppress-ssid

8) Select the tunnel mode.
   - tunnel-mode [TUNNEL_MODE]

Parameter	Description
TUNNEL_ MODE	- LocalBridging: Make all the user traffics are bridged at the AP. - 8023Tunnel: Make all the user traffics are transmitted in the 802.3 format (Not supported if the MAC type is split mac). - 80211Tunnel: All the user traffics are transmitted in tunneling in the 802.11 format.

Configuration using Web UI

In the menu bar of **<WEC Main window>**, select **<Configuration>** and then select the **<WLANs>** menu in the sub-menus. For more information about configuration, see '5.1 Basic WLAN Configuration'.

5.1.2 WLAN-based ACL Configuration

To configure ACL to apply to the WLAN service, define IP-based ACL first and then configure it to the WLAN.

Configuration using CLI

The procedures for configuration are as follows.

1) Before applying ACL, retrieve ACL that is configured as WLAN ACL.

```
WEC8500# show running-config network

       fqm-mode
       …
       ip access-group wireless acl1
       !
```

2) Go to configure → wlan configuration mode of CLI.

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

3) Among retrieved ACLs, enter an ACL name to apply to the WLAN with the 'acl' command.
   - acl [ACL-NAME]

4) To check the configured ACL, use the 'show wlan detail' 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.

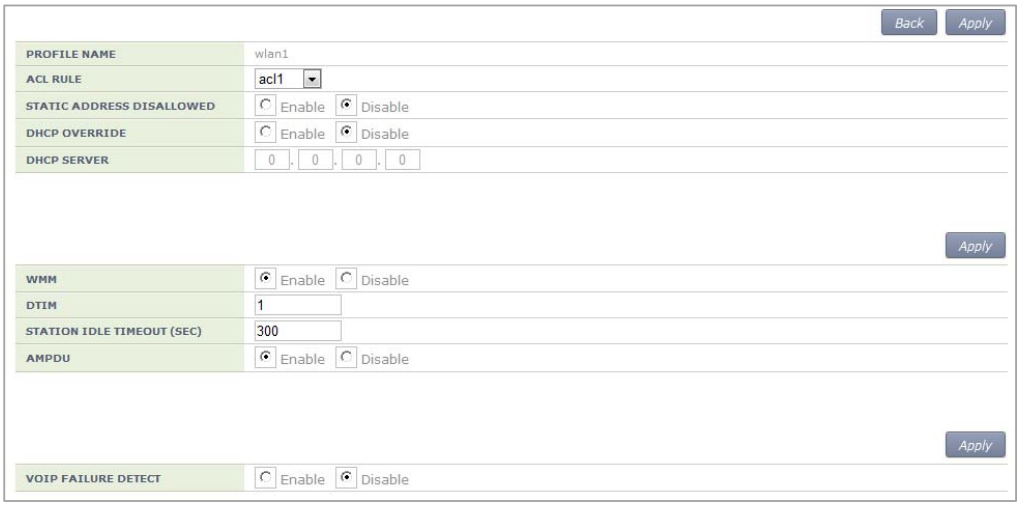


Figure 67. WLAN-based ACL configuration

- ACL RULE: Configures the WLAN-based ACL function.
- DHCP SERVER: Enter a DHCP server IP address.
- WMM: Configures the WMM mode.
- DTIM: Enter a DTIM value (1-255).
- STATION IDLE TIMEOUT: Enter a station idle timeout value. The value range is 30-3600 and it must be the multiple of 15.
- VOIP FAILURE DETECT: Configures call failure detection.

5.1.3 Managing Root Service

To provide a wireless LAN service where cable installation is difficult, a WIRELESS ENTERPRISE AP can be configured as a repeater mode to relay wireless LAN traffics. To configure this kind of network, the Repeater AP and Root AP are required. The Repeater AP is working as a wireless terminal and the Root AP connects a Repeater AP to a wireless terminal for connection to the WEC8500.
The Root AP must configure WLAN 99 for Repeater AP connection.

Configuration using CLI

[WLAN 99 Configuration]
The basic configuration values of WLAN 99 created in the Root AP are as follows.

Category	Item	Default
WLAN	Radio	1 (5 GHz)
	SSID	!we@jt#kl$wh%kj^sh&md*gc(h)
	Suppress-ssid	Enable
	Tunnel-mode	LocalBridging
Security	Wpa2	Enable
	Ccmp	Enable
	Psk Type	Ascii
	Psk Value	!qazsxdr%^tfc&*uyhn_)(io;.,m

Additional configuration is required for if-group. Execute the command as follows:

1) Go to configure → wlan 99 configuration mode of CLI.

```
WEC8500# configure terminal
WEC8500/configure# wlan 99
WEC8500/configure/wlan 99#
```

2) Stop the operation of WALN 99.

```
WEC8500/configure/wlan 99# no enable
```

3) Specify a WLAN interface group.
   - if-group [INTERFACE_GROUP_NAME]

4) Restart WALN 99.

```
WEC8500/configure/wlan 99# enable
```

[Changing to Root AP]
The procedure of changing a WIRELESS ENTERPRISE AP to a Root AP is as follows:

1) Go to configure mode of CLI.

```
WEC8500# configure terminal
```

2) Check the registered AP list.

```
WEC8500/configure# show ap summary
```

3) Go to AP configuration mode to change to a Root AP.

```
WEC8500/configure# ap ap_1
```

4) Configure it to a Root AP.

```
WEC8500/ configure/ap ap_1# profile ap-mode rootAp
```

5) Restart the configured AP.

[Changing to Repeater AP]
The procedure of changing a WIRELESS ENTERPRISE AP to a Repeater AP is as follows:

1) Go to configure mode of CLI..

```
WEC8500# configure terminal
```

2) Check the registered AP list.

```
WEC8500/configure# show ap summary
```

3) Go to AP configuration mode of an AP that will be changed to a Repeater AP.

```
WEC8500/configure# ap ap_2
```

4) Configure it to a Repeat AP.

```
WEC8500/configure/ap ap_2# profile ap-mode repeaterAp
```

5) Restart the configured AP.

Configuration using Web UI

In the menu bar of **<WEC Main window>**, select **<Configuration>** and then select the **<Controller> → <General>** menu in the sub-menus. To enable repeater service, configure the INTERFACE GROUP in the Repeater Service of the window, select Enable in the SERVICE, and click the **<Apply>** button.

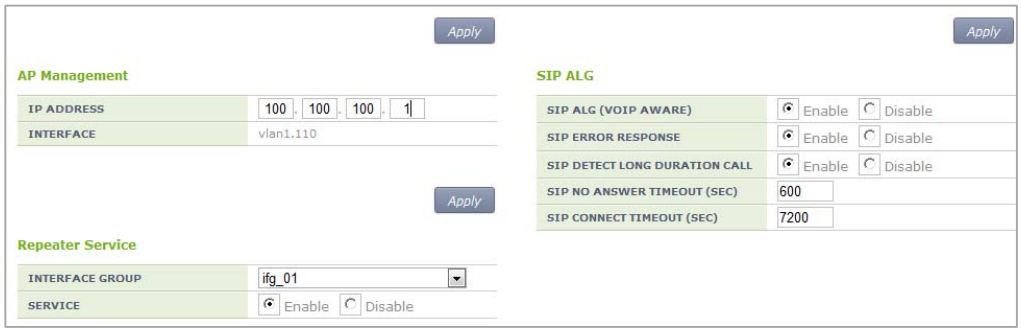


Figure 68. Root service management (1)

In the menu bar of **<WEC Main window>**, select **<Configuration>** and then select the **<Access Points> → AP selection → <General>** menu in the sub-menus.
After selecting AP MODE item, click the **<Apply>** button and restart the AP.

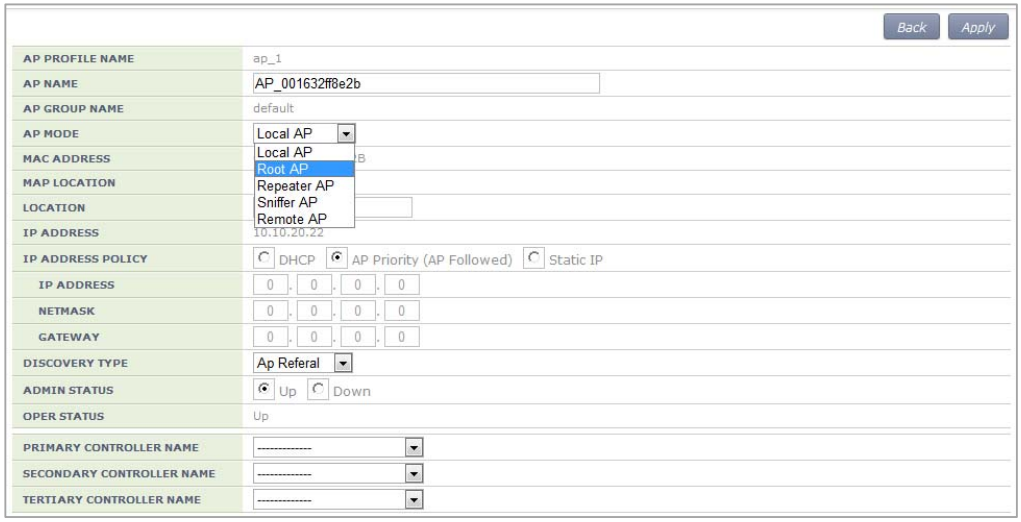


Figure 69. Root service management (2)

5.2 Local Switching

The WEC8500 provides the local switching function to support a service to an individual network such as a branch office. The local switching function must be provided by connecting an AP to WAN in an individual network where the WEC8500 is not installed. The control packet of an AP and a wireless terminal is processed in the centralized WEC8500 and a general data packet is switched in an individual network.

To configure the local switching function, the MAC type, tunnel mode, and Local-VLAN must be configured. Local switching is possible when the MAC type is set to 'LocalMac' and the tunnel mode is set to 'LocalBridging'. If an individual network is configured as VLAN, Local-VLAN can be used to configure a VLAN ID to WLAN that will be allocated to the AP.
If Local-VLAN is not specified, use a default interface specified in the AP.

Configuration using CLI

The procedure of local switching configuration is as follows:

1) Go to configure → wlan configuration mode of CLI. In the below example, the local switching function of wlan 1 is configured.

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

2) Configure the MAC type to local-mac.
   - mac-type local-mac

3) Configure the tunnel mode to local-bridging.
   - tunnel-mode local-bridging

4) Configure Local-VLAN to configure a VLAN ID to WLAN that will be allocated to the AP.
   - local-vlan [VLAN_ID]

Parameter	Description
VLAN_ID	VLAN ID (range: 1~4096)

5) To check configuration information, use the 'show wlan detail' 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 **<General>** tab.

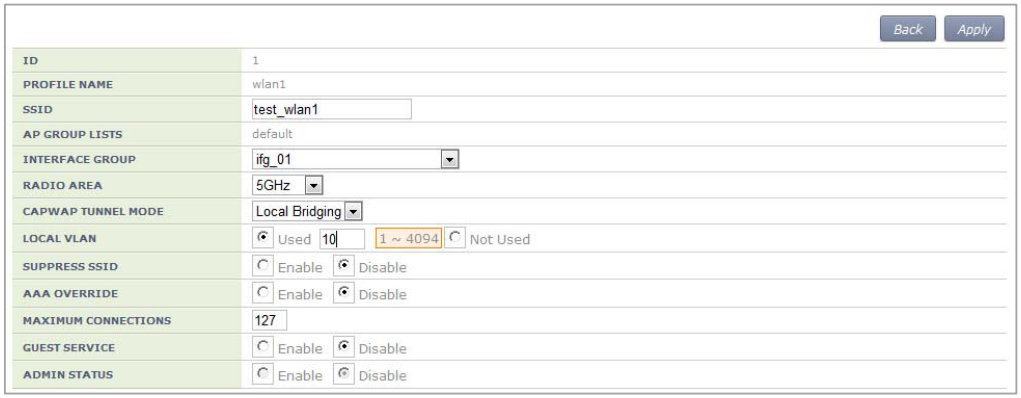


Figure 70. local switching configuration

After changing the CAPWAP TUNNELING MODE and LOCAL VLAN mode, click the **<Apply>** button.

5.3 Security and Authentication

The Samsung WIRELESS ENTERPRISE AP/APC supports the security and authentication function defined in the IEEE 802.11-based wireless LAN security standard and its main mechanism is as follows:

- WEP (Wired Equivalent Privacy)
- WPA1 (Wi-Fi Protected Access Version 1), WPA2 (Wi-Fi Protected Access Version 2)
- Authentication type: PSK, 802.1X
- Encryption type: TKIP, AES-CCMP

When a new WLAN is added, the initial WLAN security configuration becomes all disabled. Therefore, an operator must configure the security function.

5.3.1 Initialization of WLAN Security Function

This is a procedure to disable WLAN, where the security function is configured, to the initial status.

Configuration using CLI

An example of initializing the security function of wlan 1 is show below.

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

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

2) After entering into the security configuration mode, use the ‘setDefault’ command to initialize the security configuration.

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

3) After applying the changed configuration, exit the security configuration mode.

```
WEC8500/configure/wlan 1/security# apply
WEC8500/configure/wlan 1/security# exit
```

4) To check configuration information, use the ‘show wlan security summary’ 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 <**Security**> → <**L2**> tab.

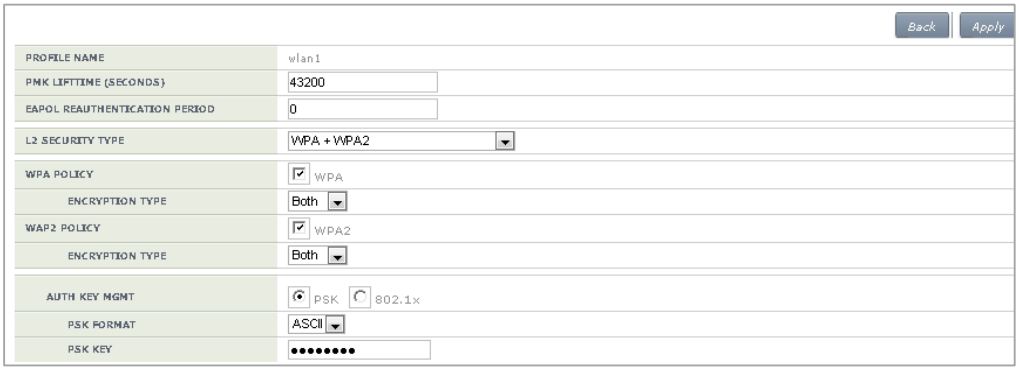


Figure 71. Initialization of WLAN security function

The configuration items available in the window are as follows.

Item		Description
PROFILE NAME		A WLAN configuration name is displayed.
PMK LIFETIME		PMK effective time (unit: s, range: 0-1000000, default: 43200)
EAPOL REAUTHENTICATION PERIOD		EAP re-authentication interval (unit: s, range: 0-100000, default: 3600)
L2 SECURITY TYPE		Layer2 security function type - None: Security function disabled (Select this to initialize the WLAN security function.) - Static WEP: Static WEP security function - WPA + WPA2: WPA/WPA2 PSK/802.1x security function
WPA POLICY	WPA	WPA Version 1 function is enabled when selected
	ENCRYPTION TYPE	Encryption type - TKIP: TKIP type - CCMP: AES-CCMP type - Both: TKIP, AES-CCMP type
WPA2 POLICY	WPA	WPA Version 2 function is enabled when selected
	ENCRYPTION TYPE	Encryption type - TKIP: TKIP type - CCMP: AES-CCMP type - Both: TKIP, AES-CCMP type
AUTH KEY MGMT	PSK/802.1x	Authentication key management type - PSK: PSK (shared key) authentication type - 802.1x: 802.1x authentication type through a RADIUS server

Item		Description
	PSK FORMAT	PSK key input type - ASCII: ASCII character string - HEX: Hexadecimal value
	PSK KEY	PSK key - 8-63 ASCII character string - 64-characters of hexadecimal value
STATIC WEP	WEP KEY FORMAT	key input format - ASCII: ASCII character string - HEX: Hexadecimal value
	WEP KEY SIZE	Key length - 40: 40-bit (5-byte) - 104: 104-bit (13-byte)
	WEP KEY INDEX	Key index (1-4)
	WEP KEY	key value

After selecting the L2 Security Type as None, click the <**Apply**> button.

5.3.2 WPA/WPA2 PSK Configuration

The WPA/WPA2 PSK, one of wireless LAN authentication types, can be used in a small size network where an authentication server is not installed.

The procedure of WPA/ WPA2 PSK configuration is as follows.

Configuration using CLI

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

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

2) Go to security configuration mode and initialize the configuration.

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

3) Configure the WPA type.

```
WEC8500/configure/wlan 1/security# [WPA_TYPE]
```

Parameter	Description
WPA_TYPE	WPA type (wpa/wpa2) - wpa: WPA Version 1 - wpa2: WPA Version 2

4) Configure the PSK key.

```
WEC8500/configure/wlan 1/security# psk [KEY_TYPE] [KEY_STRING]
```

Parameter	Description
KEY_TYPE	PSK key input format (ascii/hex) - ASCII: ASCII character string - HEX: Hexadecimal value
KEY_STRING	PSK key

5) Configure the encryption type.

```
WEC8500/configure/wlan 1/security# [WPA_TYPE] [ENC_TYPE]
```

Parameter	Description
WPA_TYPE	WPA type (wpa/wpa2): Use the same value as the WPA type configured before. - wpa: WPA Version 1 - wpa2: WPA Version 2
ENC_TYPE	Encryption type (tkip/ ccmp) - tkip: TKIP type - ccmp: AES-CCMP type

6) Configure the key management algorithm to PSK.

```
WEC8500/configure/wlan 1/security# keymgmt psk
```

7) Disable the 802.1x key management algorithm.

```
WEC8500/configure/wlan 1/security# no keymgmt ieee8021x
```

8) Disable the 802.1x authentication.

```
WEC8500/configure/wlan 1/security# no ieee8021x
```

9) After applying the changed configuration, exit the security configuration mode.

```
WEC8500/configure/wlan 1/security# apply
WEC8500/configure/wlan 1/security# exit
```

10) To check the configuration information, use the following command.

```
WEC8500/configure# show wlan security summary
```

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 **<Security>** → **<L2>** tab.

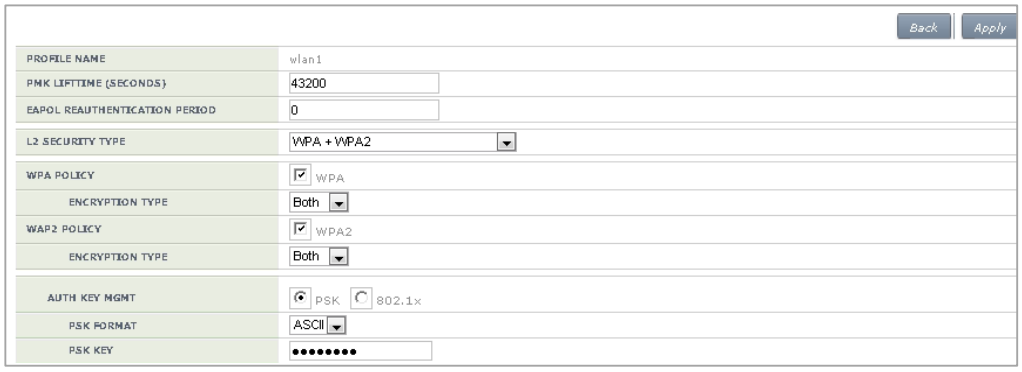


Figure 72. WPA/WPA2 PSK configuration

After selecting the L2 Security Type as WPA + WPA2 and AUTH KEY MGMT as PSK, click the **<Apply>** button.

For more information about detail configuration item, see ‘5.3.1 Initialization of WLAN Security Function’.

5.3.3 WPA/WPA2 802.1x Configuration

The WPA/WPA2 802.1x, one of wireless LAN authentication types, does authentication through an authentication server such as a Remote Authentication Dial-In User Service (RADIUS) server.
To configure WPA/WPA2 802.1x to WLAN, execute the command as follows:


NOTE

As the 802.1x authentication needs interoperation with a RADIUS server, the RADIUS server required for the WLAN security configuration must be configured first. For more information about RADIUS server configuration, see '8.1 RADIUS Server Configuration'.

Configuration using CLI

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

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

2) Go to security configuration mode and initialize the configuration.

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

3) Configure the WPA type.

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

Parameter	Description
wpa_type	WPA type (wpa/ wpa2) - wpa: WPA Version 1 - wpa2: WPA Version 2

4) Configure the encryption type.

```
WEC8500/configure/wlan 1/security# [WPA_TYPE] [ENC_TYPE]
```

Parameter	Description
WPA_TYPE	WPA type (wpa/wpa2): Use the same value as the WPA type configured before. - wpa: WPA Version 1 - wpa2: WPA Version 2

Parameter	Description
ENC_TYPE	Encryption type (tkip/ ccmp) - tkip: TKIP type - ccmp: AES-CCMP type

5) Disable the PSK key management algorithm.

```
WEC8500/configure/wlan 1/security# no keymgmt psk
```

6) Configure the key management algorithm to 802.1x.

```
WEC8500/configure/wlan 1/security# keymgmt ieee8021x
```

7) Enable the 802.1x authentication.

```
WEC8500/configure/wlan 1/security# ieee8021x
```

8) After enabling the RADIUS server function for authentication, specify the index of authentication RADIUS server. The RADIUS server information must be configured in advance.

```
WEC8500/configure/wlan 1/security# radius-server auth-servers
[RADIUS_SERVER_ID_LIST]
```

Parameter	Description
RADIUS_SERVER_ID_LIST	RADIUS server ID list (Up to 3 IDs can be configured.)

9) After enabling the RADIUS server function for accounting, specify the index of account RADIUS server. The RADIUS server information must be configured in advance.

```
WEC8500/configure/wlan 1/security# radius-server acct-servers
[RADIUS_SERVER_ID_LIST]
```

Parameter	Description
RADIUS_SERVER_ID_LIST	RADIUS server ID list (Up to 3 IDs can be configured.)

10) After applying the changed configuration, exit the security configuration mode.

```
WEC8500/configure/wlan 1/security# apply
WEC8500/configure/wlan 1/security# exit
```

11) To check the configuration information, use the following command.

```
WEC8500/configure# show wlan security summary
```

12) Enable the WLAN again.

```
WEC8500/configure/wlan 1# enable
```

13) To check configuration information, use the 'show wlan security summary' 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.

1) Select a WLAN ID to change in the WLANs screen and go to the **<Security>** → **<Radius>** tab.

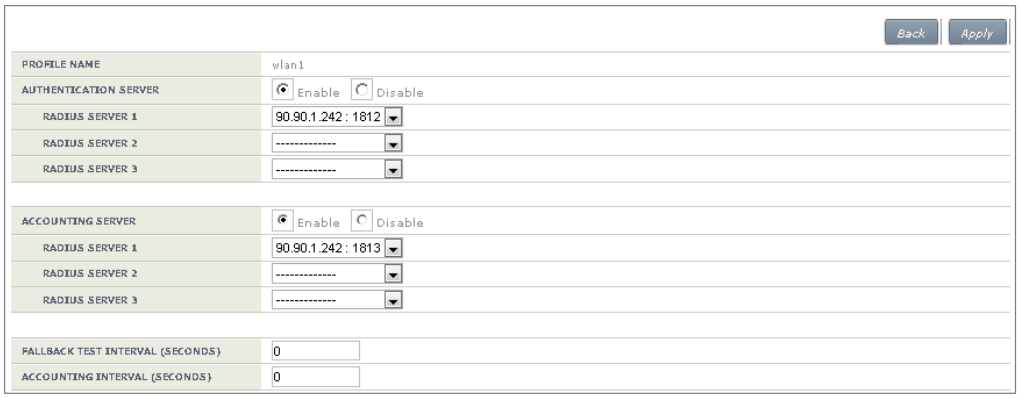


Figure 73. WPA/WPA2 802.1x Configuration (1)

Item		Description
PROFILE NAME		A WLAN configuration name is displayed.
AUTHENTICATION SERVER	Enable/ Disable	Whether the authentication function is enabled. - Enable: The authentication function is enabled. - Disable: The authentication function is disabled.
	RADIUS	Authentication server that will be used as the first priority

Item		Description
	SERVER 1	(Can select one out of pre-configured RADIUS servers.)
	RADIUS SERVER 2	Authentication server that will be used as the second priority (Can select one out of pre-configured RADIUS servers.)
	RADIUS SERVER 3	Authentication server that will be used as the third priority (Can select one out of pre-configured RADIUS servers.)
ACCOUNTING SERVER	Enable/ Disable	Whether the accounting function is enabled. - Enable: The accounting function is enabled. - Disable: The accounting function is disabled.
	RADIUS SERVER 1	Accounting server that will be used as the first priority (Can select one out of pre-configured RADIUS servers.)
	RADIUS SERVER 2	Accounting server that will be used as the second priority (Can select one out of pre-configured RADIUS servers.)
	RADIUS SERVER 3	Accounting server that will be used as the third priority (Can select one out of pre-configured RADIUS servers.)
FALLBACK TEST INTERVAL		RADIUS server Fallback attempt interval (unit: s, range: 0-500, default: 0), When set to 0, the fallback function is disabled.
ACCOUNTING INTERVAL		Accounting information transmission interval (unit: s, range: 0-10000, default: 600), When set to 0, the periodic accounting information transmission function is disabled.

Select AUTHENTICATION SERVER and ACCOUNTING SERVER as Enable and configure the rest items.

2) Click the <**L2**> tab.

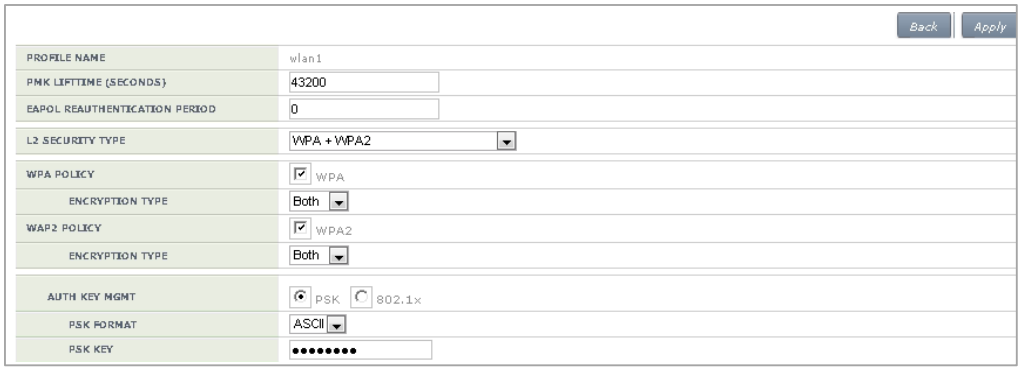


Figure 74. WPA/WPA2 802.1x Configuration (2)

Select the L2 Security Type as WPA + WPA2 and AUTH KEY MGMT as 802.1x. After configuring the rest values as required, click the <**Apply**> button.
For more information about detail configuration item of L2 tab, see ‘5.3.1 Initialization of WLAN Security Function’.

5.3.4 Static WEP Configuration

The WEP is a security algorithm defined in the initial wireless LAN standard. It provides security by using a cryptographic key and Initial Vector (IV) to encrypt the wireless transmission data exchanged between an AP and a wireless terminal connected to a wireless LAN.

Configuration using CLI

For static WEP configuration, execute the following commands.

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

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

2) Go to security configuration mode and initialize the configuration.

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

3) Disable WPA1, WPA2, and 802.1x authentication.

```
WEC8500/configure/wlan 1/security# no wpa
WEC8500/configure/wlan 1/security# no wpa2
WEC8500/configure/wlan 1/security# no ieee8021x
```

4) Enable the WEP.

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

5) Configure the WEP Shared Key mode.

```
WEC8500/configure/wlan 1/security# wep shared
```

6) Use the following command to configure the cryptographic key of WEP.

```
WEC8500/configure/wlan 1/security# wep encryption [KEY_TYPE]
[KEY_STRING] [KEY_INDEX] [KEY_LENGTH]
```

Parameter	Description
KEY_TYPE	WEP key Input format of WEP cryptographic key (ascii/hex) - ASCII: ASCII character string - HEX: Hexadecimal value
KEY STRING	WEP cryptographic key
KEY_INDEX	Key index (range: 1-4)
KEY_LENGTH	Key length (Bit unit) - 40 - 104

7) After applying the changed configuration, exit the security configuration mode.

```
WEC8500/configure/wlan 1/security# apply
WEC8500/configure/wlan 1/security# exit
```

8) To check configuration information, use the 'show wlan security summary' 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 **<Security>** → **<L2>** tab.

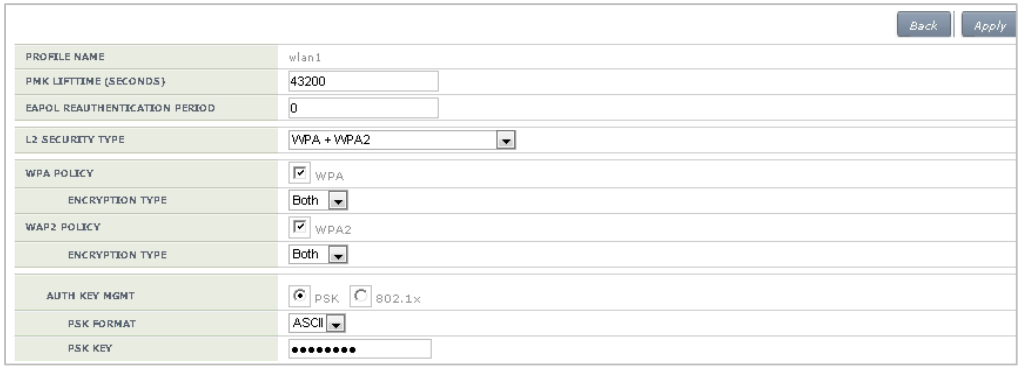


Figure 75. Static WEP configuration

Select the L2 Security Type as Static WEP. After configuring the rest values as required, click the **<Apply>** button.
For more information about detail configuration item of L2 tab, see '5.3.1 Initialization of WLAN Security Function'.

5.4 DHCP Configuration

The DHCP service of WEC8500 consists of DHCP server, DHCP relay, and DHCP proxy.

5.4.1 DHCP Server

5.4.1.1 DHCP Server Configuration

A DHCP server in the WEC8500 dynamically allocates an IP address to a client.

Configuration using CLI

1) Go to configure mode of CLI.

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

2) To enable or disable the DHCP server, enter the ‘ip dhcp’ command. Use ‘no’ in front of the command to disable the configuration.
   - ip dhcp enable
   - no ip dhcp enable

3) To check configuration information, use the ‘show ip dhcp’ command.

Configuration using Web UI

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

Figure 76. DHCP server configuration

Enable/Disable the DHCP SERVER SERVICE item in the Internal Server window to enable or disable a DHCP server.

5.4.1.2 DHCP Pool

The DHCP pool includes the range of IP address to be allocated to a client, DNS server that will be used by a DHCP client, NTP server, and default router IP address information, etc.

Configuration using CLI

[Pool Creation]

The procedure of creating a pool in an internal DHCP server and entering into the pool mode is as follows:

1) Go to configure mode of CLI.

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

2) Enter the ‘ip dhcp pool’ command. Use ‘no’ in front of the command to delete a DHCP pool.
   - ip dhcp pool [POOL_NAME]
   - no ip dhcp pool [POOL_NAME]

3) To check configuration information, use the ‘show ip dhcp’ command.
   To configure the DHCP Pool related function, execute the command as follows to go to the DHCP pool mode.

```
WEC8500# configure terminal
WEC8500/configure # ip dhcp pool test
WEC8500/configure/ip/dhcp/pool test#
```

[Configuring IP address]

Before configuring a DHCP pool, you should configure a network first. If the network is not configured, you cannot execute other commands.

Enter the command as follows to configure the network bandwidth of a DHCP pool to serve. Enter ‘no’ parameter to delete a configured network bandwidth. After entering a separator ‘/’ after an IP address, enter the length of a netmask address or enter a netmask address after the IP address.

- network [IP_ADDRESS] [NETMASK]
- network [IP_ADDRESS]/[LENGTH]
- no network

Parameter	Description
IP_ADDRESS	IP address
NETMASK	Netmask address
LENGTH	Netmask length

[Configuring Gateway]

Configures the gateway address of a DHCP client. Enter 'no' parameter to delete a configured address.

- default-router [IP_ADDRESS]
- no default-router

Parameter	Description
IP_ADDRESS	Gateway IP address

[Configuring DNS Server]

Up to 3 IP addresses can be configured for a DNS server. Enter 'no' parameter to delete a configured DNS server. The lower command 'all' is used to delete all the IP addresses of a configured DNS server.

- dns-server [IP_ADDRESS]
- no dns-server [IP_ADDRESS]
- no dns-server all

Parameter	Description
IP_ADDRESS	DNS Server's IP address

[Configuring Domain Name]

Configures or deletes a domain name.

- domain-name [DOMAIN]
- no domain-name [DOMAIN]

Parameter	Description
DOMAIN	Domain name to configure (e.g. samsungwec8500.co.kr)

[Configuring Fixed IP Address to MAC Address]

Configures a fixed IP address to a specific MAC address or deletes the configuration. The 'range' of IP address to configure cannot be overlapped with the IP range and maximum 255 IP addresses can be configured. In addition, use the 'no fix-address all' command to delete all the configured values.

- fix-address [aa:bb:cc:dd:ee:ff A.B.C.D]
- no fix-address [aa:bb:cc:dd:ee:ff A.B.C.D]
- fix-address all

As shown in the below example, 100.100.100.10 can be always allocated to the IP address of a wireless terminal whose MAC address is 11:22:33:44:55:66.

```
WEC8500/configure/ip/dhcp/pool test# fix-address 11:22:33:44:55:66
100.100.100.10
```

[Configuring IP Address Lease Time]

Configure the time when a wireless terminal receives an IP address. The 'lease infinite' command configures the time infinitely. If 'no' parameter is entered in front of the command, it is configured to 24 hours (default).

- lease [TIME]
- lease infinite
- no lease

Parameter	Description
TIME	Lease time (range: 120-8640000, Unit: s)

[Configuring NTP Server]

Up to 3 IP addresses of a NTP server can be configured or deleted. In addition, use the 'no ntp-server all' command to delete all the configured addresses of a NTP server.

- ntp-server [IP_ADDRESS]
- no ntp-server [IP_ADDRESS]
- no ntp-server all

Parameter	Description
IP_ADDRESS	The IP address of the NTP server

[Ping check]

When a DHCP server allocates an IP address to a client, ping check can be used to check if an IP address to allocate is being used in the current network.

- ping-check [enable/disable]

Parameter	Description
enable/disable	Configures whether to use ping check (default: disable)

[Configuring IP Address Range]

A DHCP server configures the range of IP address to allocate to a client. the range of IP address to add is up to 16 and the IP address specified in the range cannot be duplicated with the IP address of fix-address. Enter 'no' to delete the range of configured IP address and enter 'no range all' to delete all the ranges.

- range [IP_ADDRESS]
- range [IP_ADDRESS1] [IP_ADDRESS2]
- no range [IP_ADDRESS]
- no range [IP_ADDRESS1] [IP_ADDRESS2]
- no range all

Parameter	Description
IP_ADDRESS	IP address. Use to configure one IP address.
IP_ADDRESS1	Start address of IP address range
IP_ADDRESS2	Last address of IP address range

[Configuring Option Data]

Use the 'user-option' command to configure or delete the DHCP option. Use 'no' to delete each option and use 'no user-option all' to delete all the options.

- Option: Up to 254 can be entered (1-254).
- Data type: string (character string), octet (hex string), int (32bit integer), uint (32-bit unsigned integer), int16 (16-bit integer), uint16 (16-bit unsigned integer), ipaddress (IP address)
- Mode: Can be configured to the active/passive mode.
  - active: Although a client does not request data transmission, the DHCP server transmits user-option data (Default).
  - passive: The DHCP server transmits data upon a client's request.

Command	Description
- user-option [1-254] string [string] [active/passive] - user-option [1-254] octet aa:bb:cc [active/passive] - user-option [1-254] int [integer] [active/passive]	Configures an option.

Command	Description
- user-option [1-254] uint [unsigned integer] [active/passive] - user-option [1-254] int16 [16 bit integer] [active/passive] - user-option [1-254] uint16 [16 bit unsigned integer] [active/passive] - user-option [1-254] ipaddress A.B.C.D [active/passive]	
- no user-option [1-254] string [string] [active/passive] - no user-option [1-254] octet aa:bb:cc [active/passive] - no user-option [1-254] int [integer] [active/passive] - no user-option [1-254] uint [unsigned integer] [active/passive] - no user-option [1-254] int16 [16 bit integer] [active/passive] - no user-option [1-254] uint16 [16 bit unsigned integer] [active/passive] - no user-option [1-254] ipaddress A.B.C.D [active/passive]	Deletes a configured option.
no user-option all	Deletes all the configured options.

A usage example is given below.

```
WEC8500/configure/ip/dhcp/pool test# user-option 3 string “hi, there”
active
WEC8500/configure/ip/dhcp/pool test# user-option 200 octet
33:4A:5C:6F:DD passive
WEC8500/configure/ip/dhcp/pool test# user-option 201 int -3000
WEC8500/configure/ip/dhcp/pool test# user-option 202 uint16 300
WEC8500/configure/ip/dhcp/pool test# user-option 203 ipaddress
111.22.22.33
```

[Retrieving Pool Information]

To check the entire information of a DHCP pool, execute the ‘show ip dhcp pool’ command. If you enter a pool name as a parameter as shown in ‘show ip dhcp pool [POOL NAME]’, you can check the information of a specific pool.

[Retrieving DHCP Lease Information]

To check the DHCP lease information, execute the ‘show ip dhcp lease’ command.

Configuration using Web UI

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

Click the **<Add>** or **<Delete>** button to add or delete a DHCP pool.

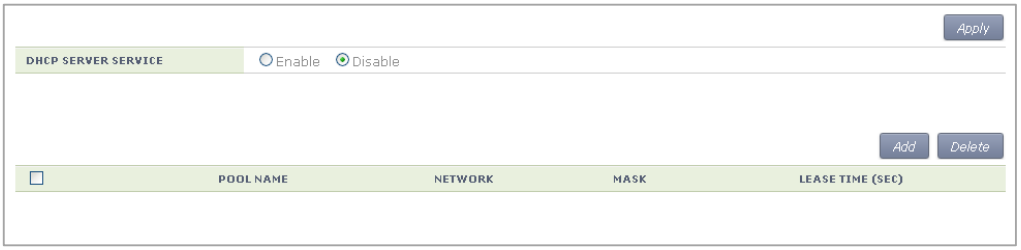


Figure 77. DHCP Pool (1)

The window where a DHCP pool can be added is shown below.

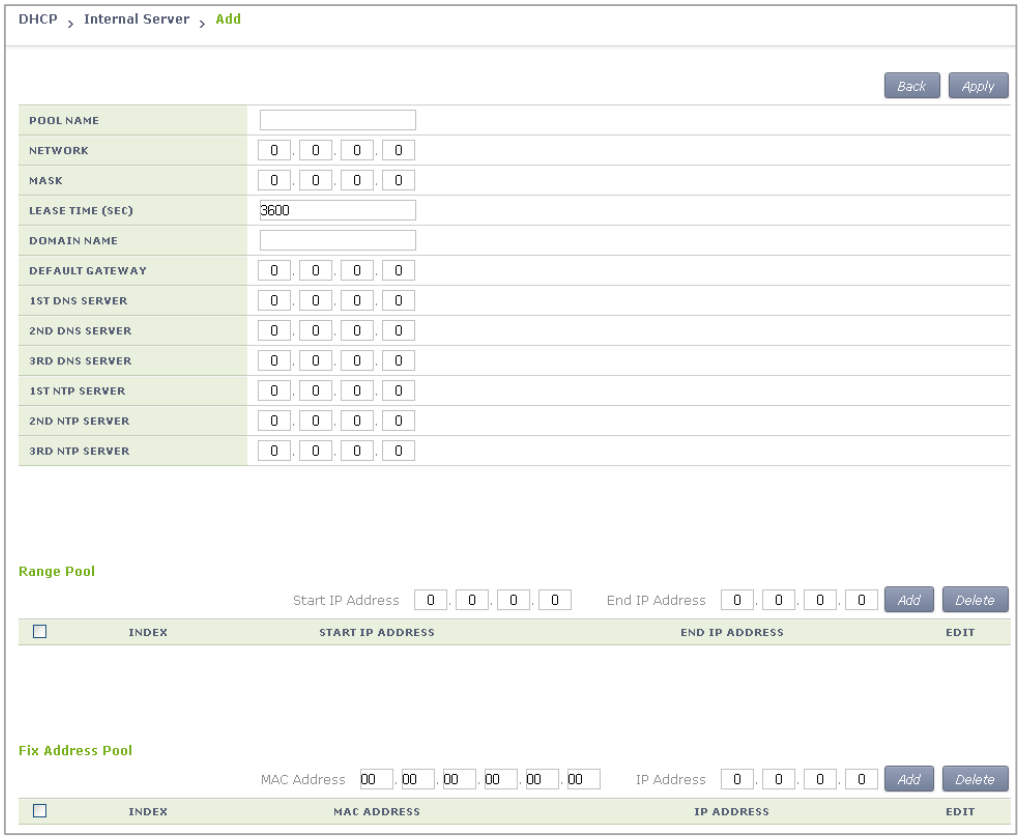


Figure 78. DHCP Pool (2)

- POOL NAME: DHCP pool name (mandatory input item)
- NETWORK: Network bandwidth IP that a DHCP server will serve (mandatory input item)
- MASK: Netmask length IP of an IP that is entered into the NETWORK item (mandatory input item)
- LEASE TIME: DHCP IP address lease time (Unit: s, default: 3600 s, Maximum value: 8640000 s)
- DOMAIN NAME: Configures a domain name that will be used by a DHCP client in a DNS.
- DEFAULT GATEWAY: Gateway IP that will be configured by a DHCP client
- 1ST/2ND/3RD DNS SERVER: Configures a DNS server that will be used by a DHCP client.
- 1ST/2ND/3RD NTP SERVER: Configures a NTP server that will be used by a DHCP client.
- Range Pool: Configures the range of IP address that will be leased to a DHCP client. Enter an IP address into the Start IP Address IP box and End Ip Address IP box each and then click the **<Add>** button to create a list. In addition, select one in the created list and click the **<Delete>** button to delete it. The IP address range cannot be overlapped with the IP address in a network bandwidth and also the IP address fixed to a MAC address.
- Fixed Address Pool: Configures a fixed IP address to the MAC address of a specific DHCP client.
  Enter a MAC address and an IP address and click the **<Add>** button to create the list. In addition, select one in the created list and click the **<Delete>** button to delete it. The IP address fixed to a MAC address cannot be overlapped with the IP address in a network bandwidth and also the IP address range.

5.4.1.3 Retrieving Number of DHCP Packets

To check the number of DHCP packets that the DHCP server receives, execute the ‘show ip dhcp statistics’ command.

5.4.2 DHCP Relay

The DHCP relay forwards a DHCP packet received from a client through broadcast to the DHCP server. Because it switches with the DHCP proxy, the DHCP relay is enabled when the DHCP proxy is disabled.
The DHCP relay is working in the unit of interface. It is disabled in the ‘mgmt0’ and ‘lo’ interface. The DHCP relay is not working even when no IP address is configured in the interface.

Configuration using CLI

The procedure of changing to the DHCP relay is as follows:

1) Go to configure mode of CLI.

```
WEC8500# configure terminal
```

2) Switch to the DHCP relay.

```
WEC8500/configure #ip dhcp-proxy disable
```

3) To check the configured DHCP information, use the ‘show ip dhcp-proxy’ command.

Configuration using Web UI

In the menu bar of **<WEC Main window>**, select **<Configuration>** and then select the **<DHCP>** → **<Proxy>** menu in the sub-menus.
You can configure the Proxy mode of DHCP to relay/proxy. Change the radio box for configuration in the DHCP PROXY MODE of Global Parameter item.

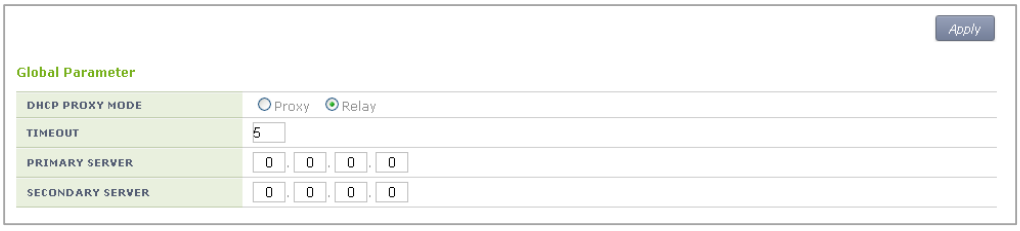


Figure 79. DHCP Relay

5.4.3 DHCP Proxy

The procedure of changing to the DHCP proxy is as follows.

Configuration using CLI

The CLI configuring a DHCP proxy is located as a command under 'ip dhcp-proxy' in the configure mode.

1) Go to configure mode of CLI.

```
WEC8500# configure terminal
```

2) Switch to the DHCP proxy.

```
WEC8500/configure#ip dhcp-proxy enable
```

3) To check the configured information, use the 'show ip dhcp-proxy' command.

4) Use the below command to check an IP address that is leased through the DHCP proxy.

```
WEC8500t#show ip dhcp proxy-lease
IP address   |   Server IP   |   MAC address   | Lease Expiration time
10.10.10.100       1.1.1.1   00:1c:bf:c1:50:28   2012/08/31 12:00:24
```

Configuration using Web UI

In the menu bar of **<WEC Main window>**, select **<Configuration>** and then select the **<DHCP>** → **<Proxy>** menu in the sub-menus.
You can configure the Proxy mode of DHCP to relay/proxy. Change the radio box for configuration in the DHCP PROXY MODE of Global Parameter item.

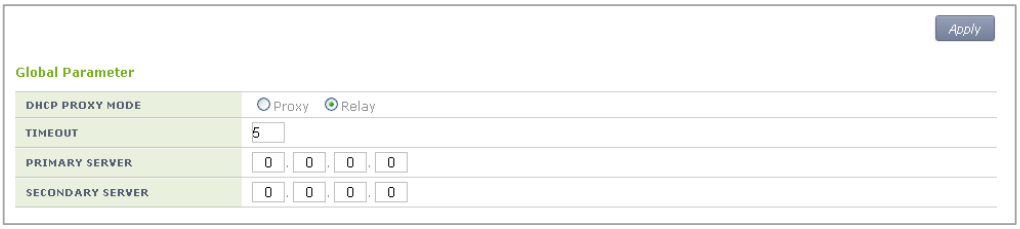


Figure 80. DHCP Proxy

5.4.4 Option 82 Configuration

The WEC8500 uses the DHCP Option 82 to provide various services during IP allocation by forwarding the information such as access control, QoS, or security policy, etc. when a wireless terminal connected to an AP receives an IP address.
The Option 82 has two fields, i.e. remote ID and circuit ID. Enter the name of an interface for which the WEC8500 constantly does relay/proxy in the circuit ID and enter a part of AP information in the remote ID accordingly. One of the following three data can be used as the remote id of Option 82.

- ap-mac: 802.11 MAC data of the AP. The length is 12-byte (Default).
- ap-mac-ssid: The character string of SSID is added to the data of AP-MAC. The length is variable.
- ap-mac-ssid: Ethernet MAC data of the AP. The length is 12-byte.

To configure Option 82 related functions, go to the interface mode by executing the following command.

```
WEC8500# configure terminal
WEC8500/configure#interface vlan10
WEC8500/configure/interface vlan10#
```

Configuration using CLI

[Configuring Option 82]
Enables or disables the Option 82 function. Can be configured for each interface.

- dhcp option-82 [MODE]

Parameter	Description
MODE	Configures whether to use the Option 82 function (enable/disable).

[Configuring Remote ID]
The command is shown below.

- dhcp option-82 remote-id [MODE]

Parameter	Description
MODE	Specifies one out of the following three data to the Option 82 remote-id. - ap-mac: MAC address of an AP - ap-mac-ssid: MAC address and SSID of an AP - ap- ethermac: Ethernet MAC address of an AP

Configuration using Web UI

In the menu bar of **<WEC Main window>**, select **<Configuration>** and then select the **<Controller>** → **<Interfaces>** menu in the sub-menus. In the interface, you can see the page where you can change the Option 82.

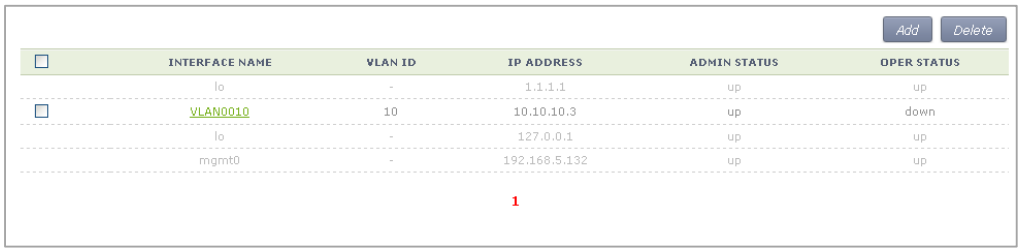


Figure 81. Option 82 configuration (1)

Select an item in the list and perform detail configuration.

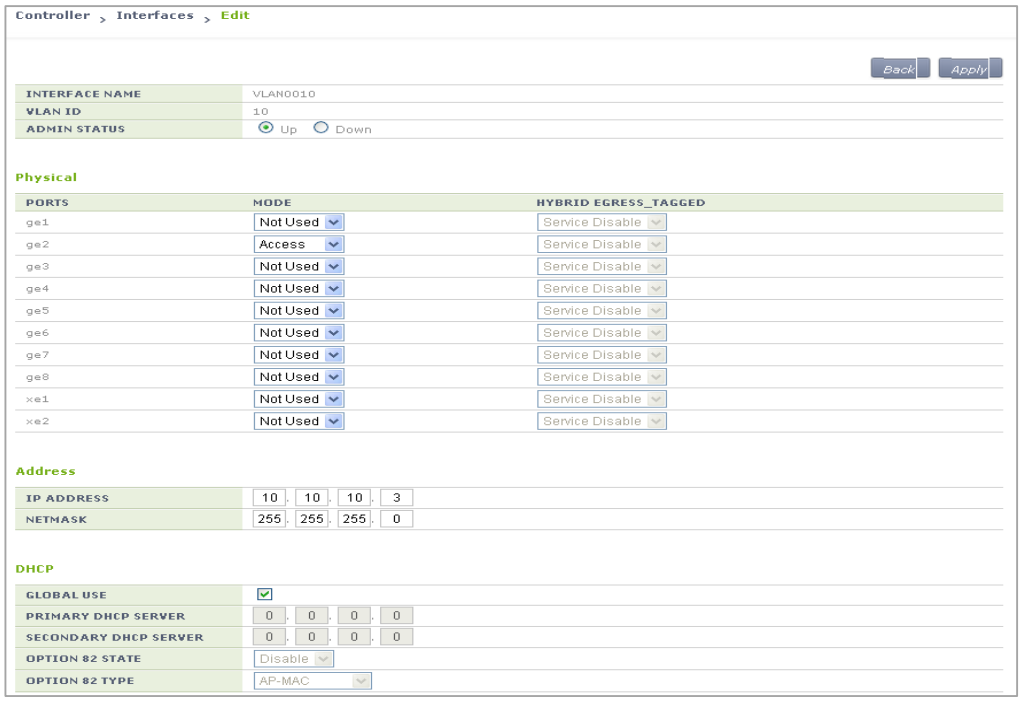


Figure 82. Option 82 configuration (2)

After unchecking the GLOBAL USE check box in the DHCP part, configure OPTION 82 STATE and OPTION 82 TYPE and then click the **<Apply>** button.
In the OPTION 82 STATE, configure Enable/Disable for Option 82 and configure ap-mac, ap-mac-ssid, or ap-ethermac for OPTION 82 TYPE.

5.4.5 Primary/Secondary Server Configuration

The DHCP relay/proxy can transmit a DHCP packet received from a client through broadcast to two DHCP servers. Here, the two servers are called a primary server and a secondary server. If there is no response from the primary server during timeout after transmitting a DHCP packet, it transmits the DHCP packet to the secondary server. If there is no response from the secondary server during timeout, it transmits the packet to the primary server.

The configuration of primary/secondary servers can be done in the interface mode, but it is also possible in the global mode. If the configuration exists both in the interface mode and global mode, the configuration in the interface mode has a higher priority.

Configuration using CLI

[Configuration at Interface]

1) Go to configure → interface mode of CLI.

```
WEC8500# configure terminal
WEC8500/configure#interface [INTERFACE_NAME]
```

2) Enter the ‘dhcp server’ command.
   To configure only a primary server, do not enter the information of a secondary server.
   - dhcp server primary A.B.C.D secondary A.B.C.D: Configures both primary/secondary servers.
   - dhcp server primary A.B.C.D: Configures only a primary server.
   - no dhcp server primary A.B.C.D secondary A.B.C.D: Deletes both primary/secondary servers.
   - no dhcp server primary A.B.C.D: Deletes a primary server.

[Configuration at Global]

1) Go to configure mode of CLI.

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

2) Enter the ‘ip dhcp-proxy default-dhcp-server’ command.
   To configure only a primary server, do not enter the information of a secondary server.
   - ip dhcp-proxy default-dhcp-server primary A.B.C.D secondary A.B.C.D: Configures both global primary/secondary servers.
   - ip dhcp-proxy default-dhcp-server primary A.B.C.D: Configures only a global primary server.
   - no ip dhcp-proxy default-dhcp-server primary A.B.C.D secondary A.B.C.D: Deletes both global primary/secondary servers.
   - no ip dhcp-proxy default-dhcp-server primary A.B.C.D: Deletes a global primary server.

Configuration using Web UI

[Configuration at Interface]

In the menu bar of <**WEC Main window**>, select <**Configuration**> and then select the <**Controller**> → <**Interfaces**> menu in the sub-menus. In the interface, you can see the page where you can change the Option 82.

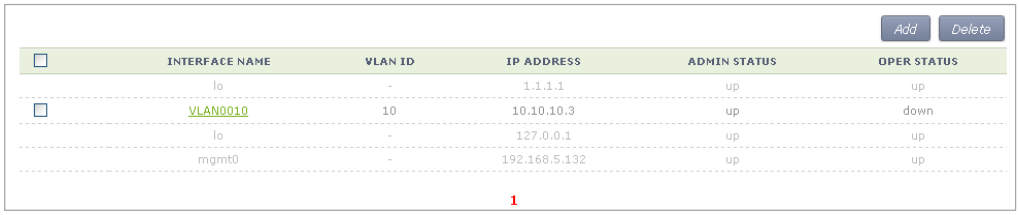


Figure 83. Primary/Secondary server configuration (1)

Select an item in the list and perform detail configuration.

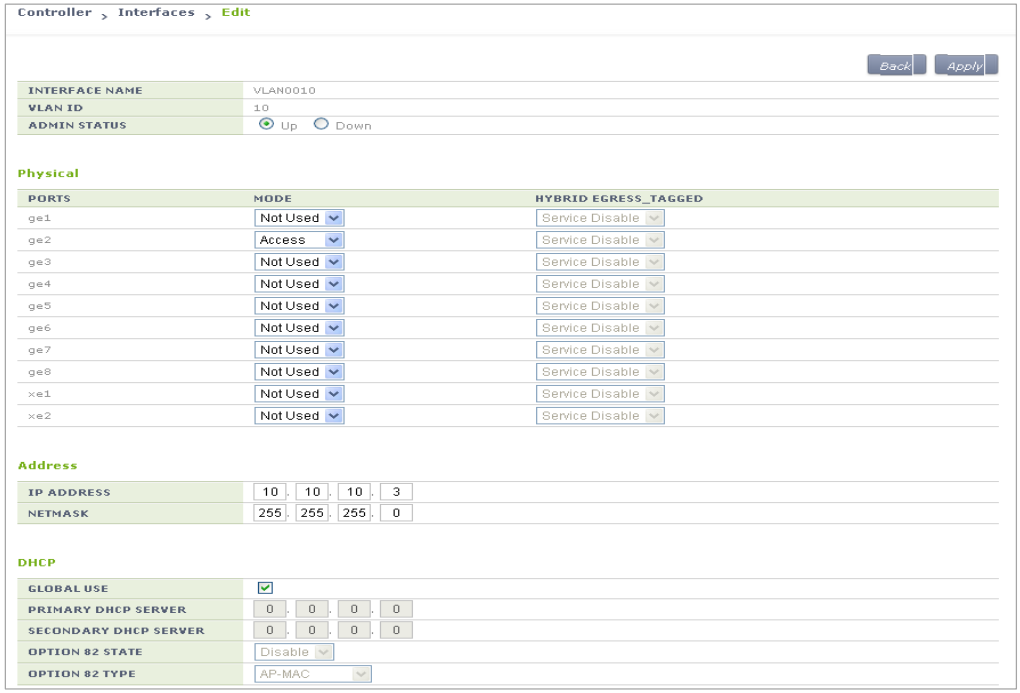


Figure 84. Primary/Secondary server configuration (2)

After unchecking the GLOBAL USE checkbox in the DHCP part, configure PRIMARY DHCP SERVER and 'SECONDARY DHCP SERVER' and then click the <**Apply**> button.

[Configuration at Global]

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

Configure the PRIMARY SERVER and SECONDARY SERVER of the Global Parameter. If you does Global configuration, the configuration is applied to all the interfaces whose 'GLOBAL USE' checkbox is checked in the DHCP configuration of APC interface.

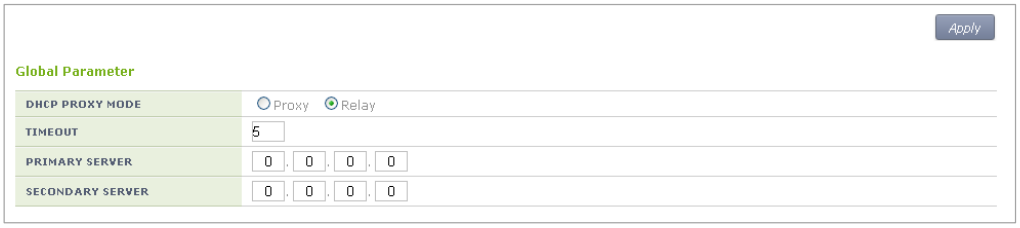


Figure 85. Primary/Secondary server configuration (3)

5.5 Radio Service Configuration

The WEC8500 supports WLAN-based radio configuration. You can enable or disable WMM based on WLAN and change DTIM and station idle timeout.

Configuration using CLI

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

```
WEC8500# configure terminal
WEC8500/configure# wlan-radio-service
WEC8500/configure/wlan-radio-service#
```

2) Configure whether to enable or disable WMM.
   - wmm-mode [WLAN_ID] [MODE]

Parameter	Description
WLAN_ID	WLAN ID (range: 1-16)
MODE	WMM configuration mode (disable/enable)

3) Configure DTIM.
   - dtim [WLAN_ID] [DTIM]

Parameter	Description
WLAN_ID	WLAN ID (range: 1-16)
DTIM	Beacon DTIM: 1~255(default: 1)

4) Configure station idle timeout.
   - sta-idle-timeout [WLAN_ID] [TIMEOUT]

Parameter	Description
WLAN_ID	WLAN ID (range: 1-16)
TIMEOUT	Station idle timeout (range: 30-3600, unit: 15 s, default: 300)

5) To check the configured information, use the ‘show wlan-radio-service’ 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.

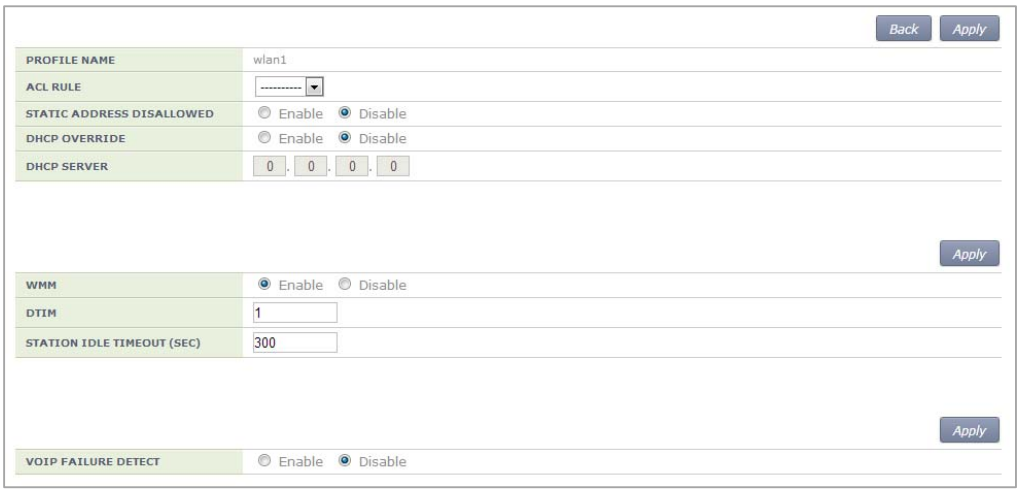


Figure 86. Radio service configuration

After configuring the below items, click the **<Apply>** button.

- WMM: Configures the WMM mode.
- DTIM: Enter a DTIM value (1-255).
- STATION IDLE TIMEOUT: Enter a station idle timeout value. The value range is 30-3600 and it must be the multiple of 15.

CHAPTER 6. Wi-Fi Configuration

This chapter describes how to manage the 802.11a, 80211.bg, or 802.11n device of WIRELESS ENTERPRISE AP.
An 802.11n device supports 2.4 GHz and 5 GHz wireless bandwidth and high data processing speed.

6.1 802.11a/b/g/n Radio Property

6.1.1 802.11a/b/g Configuration

The configuration of radio property for 802.11a/b/g is as follows:

Configuration using CLI

1) Go to configure → radio mode to configure of CLI. The radio mode can be either '80211a' or '80211bg'.
   An example of entering into 80211a is shown below.

```
WEC8500# configure terminal
WEC8500/configure# 80211a
WEC8500/configure/80211a#
```

2) Configure the channel of an AP.
   - channel [CHANNEL] ap [AP_ID]: Configures the channel of an AP.
   - channel [CHANNEL] ap [AP_ID] fixed: A channel is designed to be fixed and it is not affected by the automatic adjustment function such as RRM. (When executing the 'show 80211a summary' or 'show 80211bg summary', the channel value is displayed in '*'.)

Parameter	Description
CHANNEL	Channel Configuration - Range for 80211a: 36-165 - Range for 80211bg: 1-14
AP_ID	AP ID (range: 1-500)

3) Configure the TX power of an AP.
   - txPower [POWER] [AP_ID]: Configures a TX power.
   - txPower [POWER] [AP_ID]fixed: The TX power is configured as fixed and it is not affected by the automatic adjustment function such as RRM. (When executing the 'show 80211a summary' or 'show 80211bg summary', the channel value is displayed in '*'.)

Parameter	Description
POWER	TX power value (range: 3-23)
AP_ID	AP ID (range: 1-500)

4) To check the configured channel and TX power information, use the following command.
   In the below example, the AP_f4d9fb23bfb9 whose Tx Power is displayed as 10* has a fixed TX power.

```
WEC8500# show 80211a[|80211bg] summary
AP Name          MAC Address       Operation State  Channel   TxPower
---------------- ----------------- --------------- ---------- -------
-
AP_f4d9fb23bfb9   F4:D9:FB:23:BF:B9  1              161      10 *
AP_f4d9fb23c2b9   F4:D9:FB:23:C2:B9  1              157       5
AP_f4d9fb23c079   F4:D9:FB:23:C0:79  1              153       5
AP_f4d9fb23baf9   F4:D9:FB:23:BA:F9  1              149       5
AP_f4d9fb23beb9   F4:D9:FB:23:BE:B9  1               64       5
```

5) Configure the beacon period of an AP.
   - beacon period [PERIOD] global

Parameter	Description
PERIOD	Beacon period (range: 40-3500)

6) Configure the fragmentation threshold of an AP.
   - threshold fragmentation [THRESHOLD] global

Parameter	Description
THRESHOLD	Fragmentation threshold (range: 256-8000)

7) Configure the data rate of an AP.
   - rate [MODE] [RATE] global

Parameter	Description
MODE	Mode (basic/supported) - basic: Basic rate at which a terminal connects to an AP. - supported: A connected terminal that supports the supported rate can communicate with an AP at the supported rate.
RATE	Data rate - Range for 80211a: 6, 9, 12, 18, 24, 36, 48, or 54 Mbps - Range for 80211bg: 1, 2, 5.5, 6, 9, 11, 12, 18, 24, 36, 48, or 54 Mbps

8) To check the configured beacon period, fragmentation threshold, and data rate information, uses the 'show 80211a radio-config global' command.

Configuration using Web UI

In the menu bar of <**WEC Main window**>, select <**Configuration**> and then select the <**Access Points**> → <**802.11a/n**> or <**802.11b/g/n**> → <**General**> menu in the sub-menus. An example of selecting 802.11a/n is shown below.

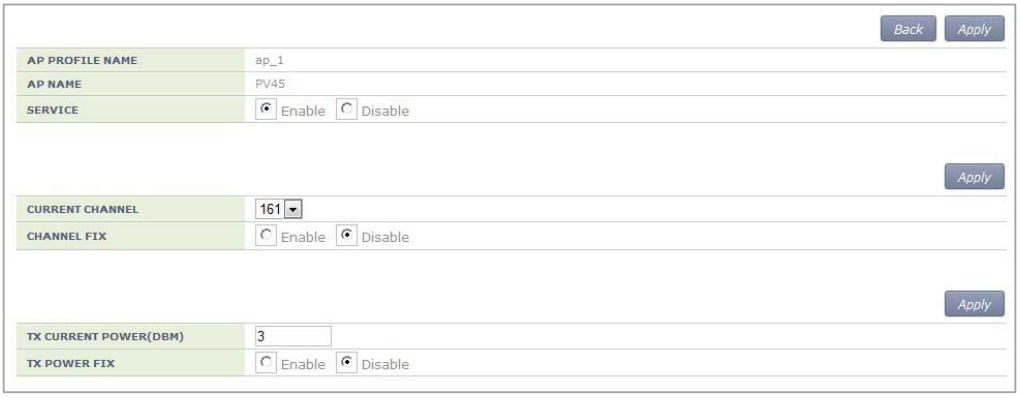


Figure 87. 802.11a/b/g/n radio (1)

The configuration items are as follows:

[AP Basic Configuration]
SERVICE: Enable or disable

[Channel Configuration]

- CURRENT CHANNEL: Configures a channel.
  - Range for 80211a: 36-165
  - Range for 80211bg: 1-14
- CHANNEL FIX: The configured channel is configured as fixed and it is not affected by the automatic adjustment function such as RRM. When selecting the <**Monitor**> → <**Access Points**> → <**Radio**> → <**802.11a/n**> or <**802.11b/g/n**> menu, the channel value is displayed as *. (Optional)

[TX power Configuration]

- TX CURRENT POWER: TX Power (range: 3-23)
- TX POWER FIX: The configured TX power is configured as fixed and it is not affected by the automatic adjustment function such as RRM. When selecting the **<Monitor>** → **<Access Points>** → **<Radio>** → **<802.11a/n>** or **<802.11b/g/n>** menu, the Tx power value is displayed as *. (Optional)

NOTE

To check the configured channel and TX power information, go to **<Monitor>** → **<Access Points>** → **<Radio>** → **<802.11a/n>** or **<802.11b/g/n>**.

In the menu bar of **<WEC Main window>**, select **<Configuration>** and then select the **<Radio>** → **<802.11a/n>** or **<802.11b/g/n>** → **<802.11h>** menu in the sub-menus.
An example of selecting 802.11a/n is shown below.

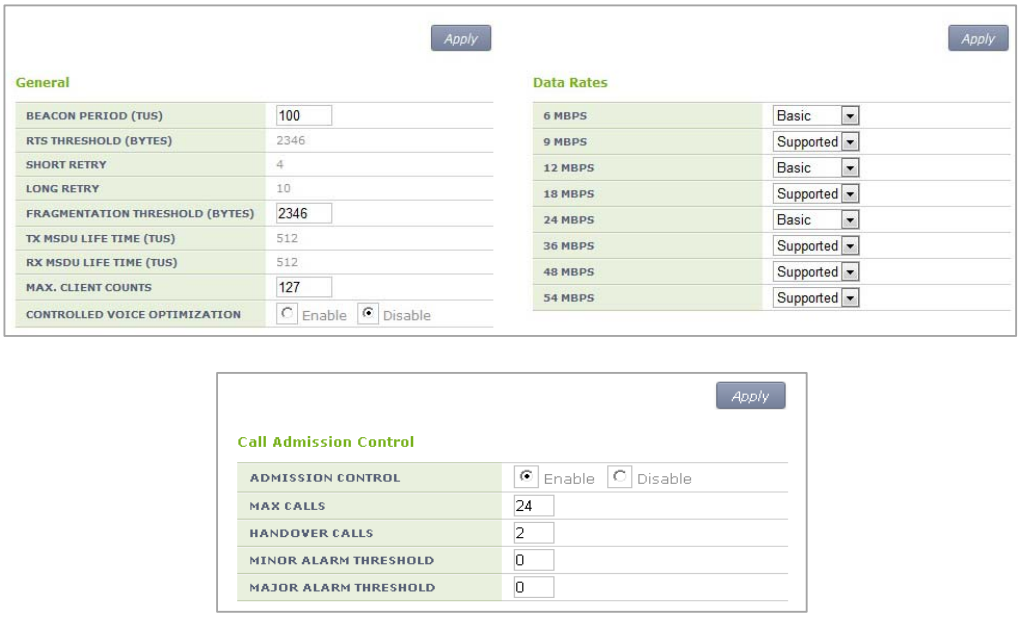


Figure 88. 802.11a/b/g/n radio (2)

[General]

- BEACON PERIOD: Beacon period (range: 40-3500)
- FRAGMENTATION THRESHOLD: AP fragmentation threshold (range: 256-8000)
- MAX. CLIENT COUNTS: Limits the number of connected clients per radio
- CONTROLLED VOICE OPTIMIZATION: Configures voice optimization.

[Data Rates]

The data rate selection options are as follows:

- Basic: Basic rate supported for a terminal to connect to an AP.
- Supported: A connected terminal that supports the supported rate can communicate with an AP at the supported rate.
- Data Rates: data rate
  - Range for 80211a: 6, 9, 12, 18, 24, 36, 48, or 54 Mbps
  - Range for 80211bg: 1, 2, 5.5, 6, 9, 11, 12, 18, 24, 36, 48, or 54 Mbps

[Call Admission Control]

- ADMISSION CONTROL: Configures the CAC function.
- MAX CALLS: Maximum number of allowed calls (range: 2-30)
- HANDOVER CALLS: Number of marginal calls considering handover (range: 0-10)
  The number of allowed calls is MAX CALLS –HANDOVER CALLS.
- MINOR ALARM THRESHOLD: Configures a threshold that generates a Minor alarm (range: 0-15)
  Enter ‘0’ to prevent the alarm.
- MAJOR ALARM THRESHOLD: Configures a threshold that generates a Major alarm (range: 0-30)
  Enter ‘0’ to prevent the alarm.

6.1.2 802.11n Configuration

The 802.11n configuration is as follows:

Configuration using CLI

1) Go to configure → radio mode (80211a or 80211bg) to configure of CLI.

```
WEC8500# configure terminal
WEC8500/configure# 80211a
```

2) Go to the 11n-support mode.

```
WEC8500/configure/80211a#11n-support
```

3) Configure an AP so that it can support 802.11n property.

```
WEC8500/configure/80211a/11n-support# enable [AP_ID]
```

Parameter	Description
AP_ID	AP ID (range: 1-500)

4) Configure the MCS rate.

```
WEC8500/configure/80211a/11n-support# mcs [RATE] ap [AP_ID]
```

Parameter	Description
RATE	MSC rate (range: 0-23)
AP_ID	AP ID (range: 1-500)

5) To check the configured 11n-support information, use the ‘show 80211a radio-config ap [AP_ID]’ command.

Configuration using Web UI

In the menu bar of **<WEC Main window>**, select **<Configuration>** and then select the **<Access Points>** → **<802.11a/n>** or **<802.11b/g/n>** → **<General>** menu in the sub-menus. Perform the configuration by referring to ‘6.1.1 802.11a/b/g Configuration’.

6.2 Wi-Fi QoS Configuration

The WEC8500 provides various QoS in the wire/wireless section for every packet type (voice, video, best-effort, or background). The QoS can be configured for each wireless section (2.4 GHz, 5 GHz).

6.2.1 QoS Configuration of Wireless Terminal

The system provides probable QoS by changing the EDCA parameter in a wireless section.

Configuration using CLI

To configure an EDCA profile in the upward wireless section of a wireless terminal, execute the command as follows:

1) Go to configure → radio mode to configure of CLI.

```
WEC8500# configure terminal
WEC8500/configure# [80211a/80211bg]
```

2) Apply the EDCA profile.
   - edca-parameters [PROFILE] station

Parameter	Description
PROFILE	Configures each EDCA profile (wmm_default_sta/wmm_default_ap/edca_user1/edca_user2).

3) To check the application status of a configured EDCA profile, use the ‘show 80211a[|80211bg] qos edca-parameters wmm_default_sta’ command.

Configuration using Web UI

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

In the EDCA parameter menu, there are Station and Access Point tab. To change the Station EDCA parameter, select the Station tab. If you want to change the AP EDCA parameter to configure the QoS of an AP wireless section, select the Access Point tab.

[Station tab]

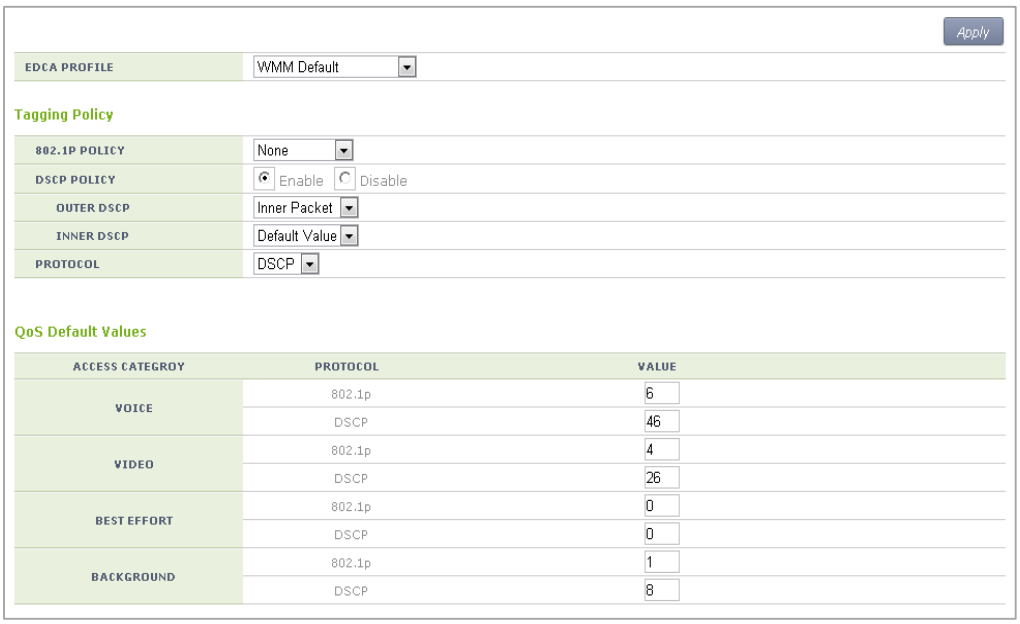


Figure 89. QoS configuration of a wireless terminal (1)

[Access Point tab]

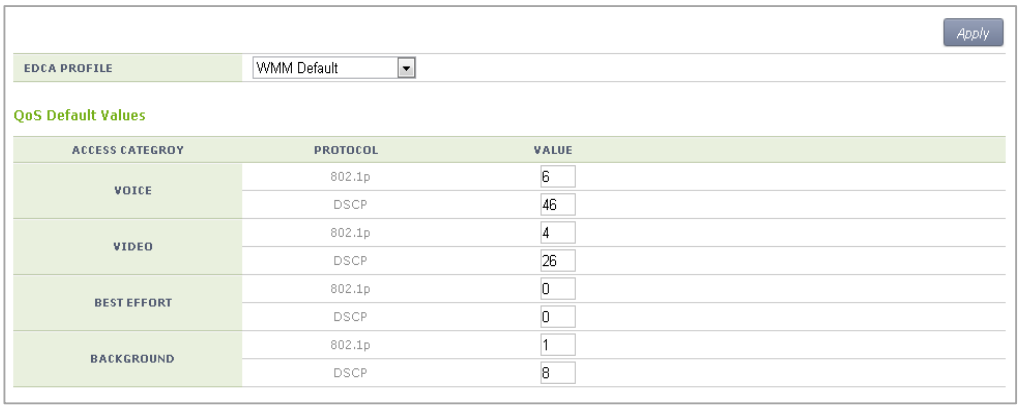


Figure 90. QoS configuration of a wireless terminal (2)

6.2.2 QoS Configuration of AP

6.2.2.1 Wire Section

The WEC8500 provides QoS in a wire section using 802.1p and DSCP marking and it can adjust packet traffics because it can adjust queue length depending on packet type.

Configuration using CLI

To configure the Station QoS parameter that will be applied to the wire section between WEC8500 and AP, execute the command as follows:

1) Go to configure → QoS mode of a wireless section of CLI.

```
WEC8500# configure terminal
WEC8500/configure# [80211a/80211bg] qos
WEC8500/configure/80211a/qos#
```

2) Configures a QoS policy to a wire section packet.
   - 802.1P Policy: enable policy [802_1P]
   - DSCP Policy: enable policy [DSCP_OUTER] [DSCP_INNER]

Parameter	Description
enable	Enables 802.1p or DSCP marking.
802_1P	802.1p configuration (user_priority/default) - user_priority: Marks the 802.1p or User Priority value of an incoming packet into the 802.1p field. - default: Marks pre-configured basic value to the 802.1p field.
DSCP_OUTER	DSCP Outer configuration (inner_packet/default) - inner_packet: Marks the DSCP value of an incoming packet into the Outer DSCP field. - default: Marks pre-configured basic value to the Outer DSCP field.
DSCP_INNER	DSCP Inner configuration (no_mark/default) - no_mark: Marks no value into the Inner DSCP field. - default: Marks pre-configured basic value to the Inner DSCP field.

3) Configure a default 802.1p value per packet.
   - dot1p-tag [PACKET_TYPE] [802.1P_TAG]

Parameter	Description
PACKET_TYPE	Packet type configuration (voice/video/best_effort/background)
802.1P_TAG	Default 802.1p value

4) Configure a default DSCP value per packet.
   - dscp-tag [PACKET_TYPE] [DSCP TAG]

Parameter	Description
PACKET_TYPE	Packet type configuration (voice/video/best_effort/background)
DSCP_TAG	Default DSCP value

5) Configure a protocol to distinguish packet types.
   - protocol [PROTOCOL]

Parameter	Description
PROTOCOL	Protocol configuration (none/dot1p/dscp) - none: Determine the type of every incoming packet with best effort. - dot1p: Judge the packet type by checking the 802.1p field of an incoming packet. - dscp: Judge the packet type by checking the DSCP field of an incoming packet.

The packet judgment criteria are as follows: For example, if the packet type is voice, the 802.1p input value is 6 or 7 and the input range of DSCP value is 46-63. Also, if the packet type is video, the 802.1p input value is 4 or 5 and the input range of DSCP value is 24-45.

802.1p	DSCP	Packet type
6, 7	46~63	voice
4, 5	24~45	video
0, 3	0~7, 16~23	best effort
1, 2	8~15	background

6) To check the configured policy and QoS parameter information per packet, use the ‘show 80211a[|80211bg] qos policy’ command.

Configuration using Web UI

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

1) Select one out of None/Default/User Priority in the 802.1P POLICY drop-down list of Tagging Policy.
2) To disable a DSCP policy in the DSCP POLICY, select Disable.
3) To enable a DSCP policy in the DSCP POLICY, select Enable.
   A) Select one out of Inner Packet/Default Value in the OUTER DSCP drop-down list.
   B) Select one out of No Mark/Default Value in the INNER DSCP drop-down list.
4) Select one out of None/802.1p/DSCP in the PROTOCOL drop-down list.
5) Enter 802.1p or a DSCP value into the QoS Default Values.
6) Click the <**Apply**> button to apply.

6.2.2.2 Wireless Section

The system can provide QoS service in a wireless section for each AP downward packet type (voice, video, best effort, background). You can configure 802.1p and DSCP tag which are the criteria used to select access category.

Configuration using CLI

1) Go to configure → QoS mode of a wireless section of CLI.

```
WEC8500# configure terminal
WEC8500/configure# [80211a/80211bg] qos
WEC8500/configure/80211a/qos#
```

2) Configure 802.1p or DSCP tag value to use for a packet type.
   • ap-tags [PACKET_TYPE] [802.1P TAG] [DSCP TAG]

Parameter	Description
PACKET_TYPE	Packet type configuration (voice/video/best_effort/background)
802.1P_TAG	802.1p configuration
DSCP_TAG	DSCP tag configuration

3) To check the QoS parameter information of a configured AP, use the ‘show 80211a[|80211bg] qos ac-profile [PACKET_TYPE]’ command.

Configuration using Web UI

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

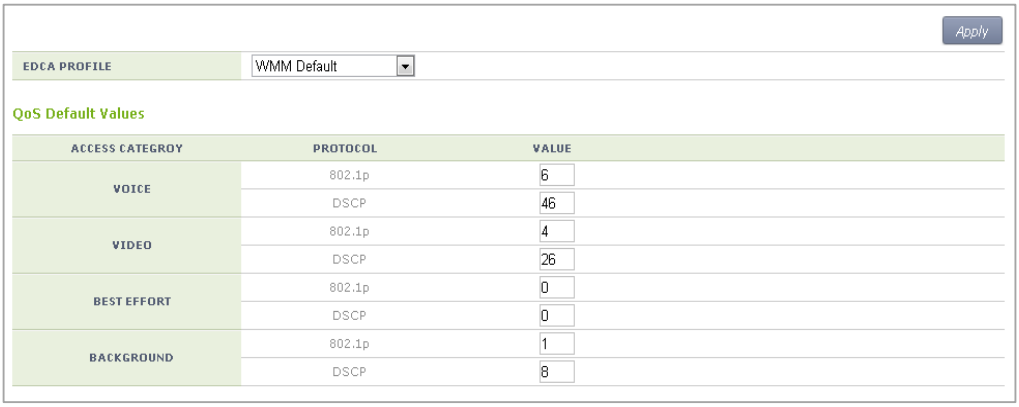


Figure 91. QoS configuration of AP (wireless section)

In the Access Point tab, enter 802.1p or a DSCP value into the QoS Default Values. Click the <**Apply**> button to apply.

6.2.3 Configuring QoS Profile of a Specific Terminal

You can configure a QoS profile that is applied to a specific wireless terminal. This QoS profile is applied from the RADIUS server of a wireless terminal during authentication.

Configuration using CLI

1) Go to configure → QoS profile configuration mode of CLI.

```
WEC8500# configure terminal
WEC8500/configure# qos <profile name>
WEC8500/configure/qos Samsung #
```

2) Configure 802.1p and a DSCP value that will be used for each access category.
   - ac [AC] [802.1P_TAG] [DSCP_TAG]

Parameter	Description
AC	Access Category(AC_VO/AC_VI/AC_BE/AC_BK)
802.1P_TAG	802.1p configuration (range: 0-7)
DSCP_TAG	DSCP tag configuration (range: 0-63)

3) Configure the brief information of a profile.
   - description [DESCRIPTION]

Parameter	Description
DESCRIPTION	Profile description

4) Configure maximum allowed 802.1p priority value used in the Traffic Identifier (TID) field of AP QoS packet.
   - max-dot1p <802.1p tag>

Parameter	Description
802.1P_TAG	Maximum allowed 802.1p configuration (range: 0-7)

5) To check the configured QoS 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.

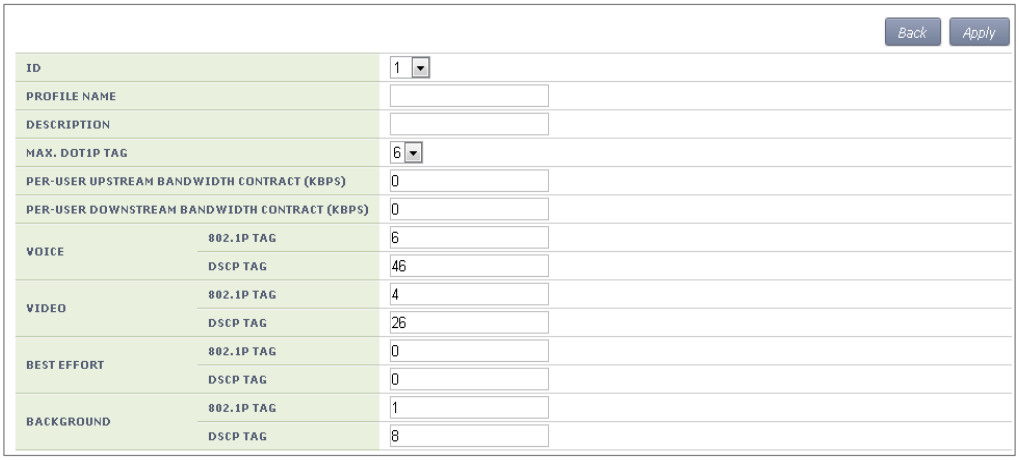


Figure 92. Configuring QoS profile of a specific terminal

- 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.

6.2.4 Voice Optimization Configuration

The WEC8500 configures an EDCA parameter value that is optimized for voice service to an AP in real-time.

Configuration using CLI

1) Go to configure → radio cvo mode to configure of CLI.

```
WEC8500# configure terminal
WEC8500/configure# [80211a|80211bg] cvo
WEC8500/configure/80211a/cvo#
```

2) Enable or disable the function.
   - [no] enable

3) To check the configured information, use the 'show 80211a cvo config' 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 93. Configuring voice optimization

To enable CVO, select Enable in the CONTROLLED VOICE OPTIMIZATION. To disable it, select Disable.

6.3 802.11h Configuration

The WEC8500 supports the configuration and transmission power limitation for the DFS function in an AP. When the AP detects radar, an event is sent to the WEM and a detouring channel can be configured in the AP.

Configuration using CLI

For channel switching announcement related configuration and power constraint value configuration in an AP, execute the command as follows:

1) Go to configure → 80211h configuration mode of CLI.

```
WEC8500# configure terminal
WEC8500/configure# 80211h
WEC8500/configure/80211h#
```

2) Configure the 802.11h information.
   - channel-switch [MODE] [RESTRICTION] [TBTT]

Parameter	Description
MODE	Whether the switching announcement function is enabled/disabled
RESTRICTION	Channel packet transmission restriction (0/1) - 0: Off - 1: On
TBTT	Waiting time until channel switching announcement

3) Configure the transmission power of a wireless terminal.
   - power-constraint [VALUE]

Parameter	Description
VALUE	Transmission power

4) To check the configuration information, use the ‘show 80211h configuration’ 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>** → **<802.11h>** menu in the sub-menus.

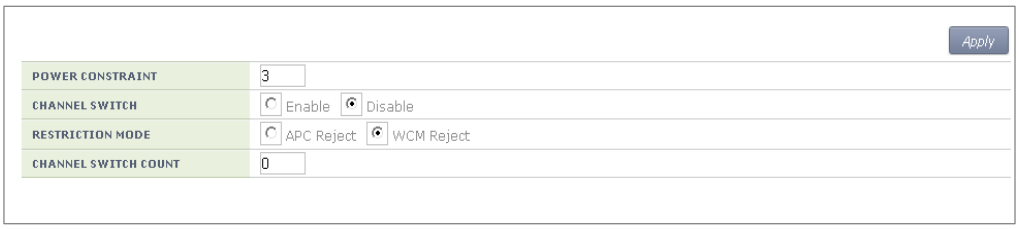


Figure 94. Configuring 802.11h

- POWER CONSTRAINT: Power constraint value (0-100)
- CHANNEL SWITCH: Enables channel switch announcement.
- RESTRICTION MODE: Configures transmission restriction.
- CHANNEL SWTICH COUNT: Enter a waiting time until channel switching announcement. Target Beacon Transmission Times (TBTT)

6.4 Country Code

You can use a country code to restrict the number of channels that can be used in an AP and the maximum transmission power of each channel.

Configuration using CLI

To configure the country code function, go to country mode first by executing the following command.

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

[Global Country Code Configuration]

If you configure a global country code, the country code can be specified to all the connected APs at the same time. The command is shown below.

- set-global [COUNTRY_CODE] [VALUE]

Parameter	Description
COUNTRY_CODE	Country code to configure
VALUE	Environment configuration (both/outdoor/indoor/none)

To check the configuration information, use the ‘show country global-config’ command.

[AP Country Code Configuration]

To configure a country code, execute the command as follows:

- set-ap [AP_ID] [COUNTRY_CODE] [VALUE]

Parameter	Description
AP_ID	AP ID (range: 1-500)
COUNTRY_CODE	Country code to configure
VALUE	Environment configuration (both/outdoor/indoor/none)

To check the configuration information, use the ‘show country ap-config [AP_ID]’ command.

[Editing Country Code]

You can add or delete an operation channel per country and change maximum transmission power per channel.

The command used to add or delete a channel per country is shown below.

- add-channel [COUNTRY_CODE] [CHANNEL_NUMBER] [MAX_TX_POWER]: Adds a channel.
- del-channel [COUNTRY_CODE] [CHANNEL_NUMBER]: Deletes a channel.

Parameter	Description
COUNTRY_CODE	Country code to configure
CHANNEL_NUMBER	Channel to configure.
MAX _TX_POWER	Maximum transmission power per channel.

The command used to change maximum transmission power value of a channel for a specific country code is shown below.

- max-tx-power [COUNTRY_CODE] [CHANNEL_NUMBER] [MAX_TX_POWER]

Parameter	Description
COUNTRY_CODE	Country code to configure
CHANNEL_NUMBER	Channel to configure.
MAX _TX_POWER	Maximum transmission power per channel.

To check the configuration information, use the ‘show country information [COUNTRY_CODE]’ command.

Parameter	Description
COUNTRY_CODE	Country code to configure

Configuration using Web UI

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

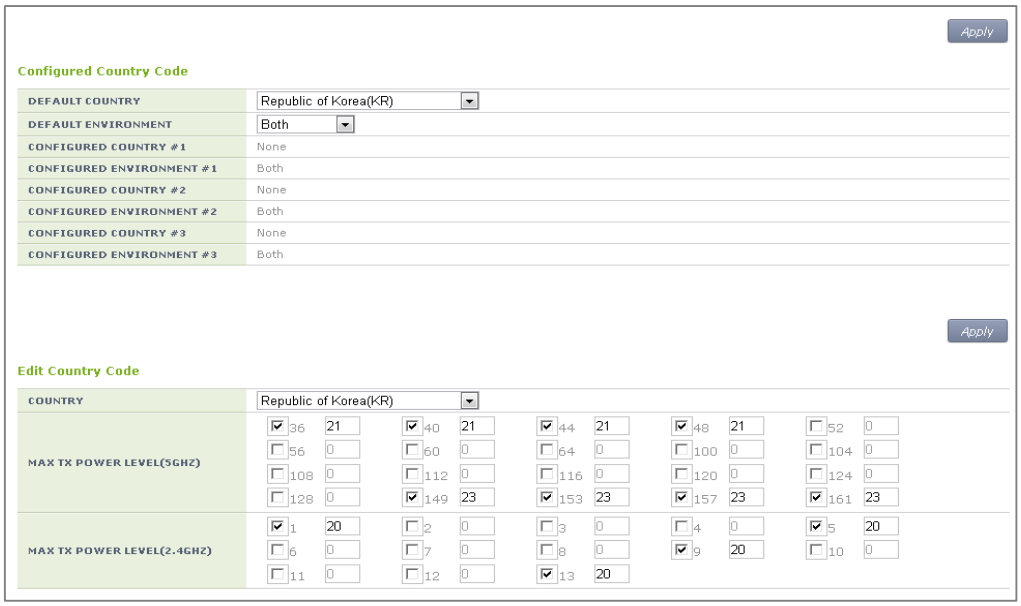


Figure 95. Country code window (1)

[Global Country Code Configuration]

1) Select a country in the DEFAULT COUNTRY drop-down list of Configured Country Code item. (Only an authenticated country code is supported.)
2) Select an environment in the DEFAULT ENVIRONMENT drop-down list.
   - Both: The terminal operation environment includes all the environments.
   - Outdoor: The terminal operation environment is outdoor.
   - Indoor: The terminal operation environment is indoor.
   - Non-country: A terminal is operating under non-country entity.
3) Click the **<Apply>** button to apply.

[Editing Country Code]

In the Edit Country Code item, you can add or delete an operation channel per country or change maximum transmission power per channel.

1) Select a country in the COUNTRY drop-down list of Edit Country Code item. (Only an authenticated country code is supported.)
2) Select a channel to add in the MAX TX POWER LEVEL (5 GHZ/2.4 GHZ) and enter maximum transmission power level (0-30).
3) In the MAX TX POWER LEVEL (5 GHZ/2.4 GHZ), unselect a channel to delete.
4) Click the **<Apply>** button to apply.

[AP Country Code Configuration]

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

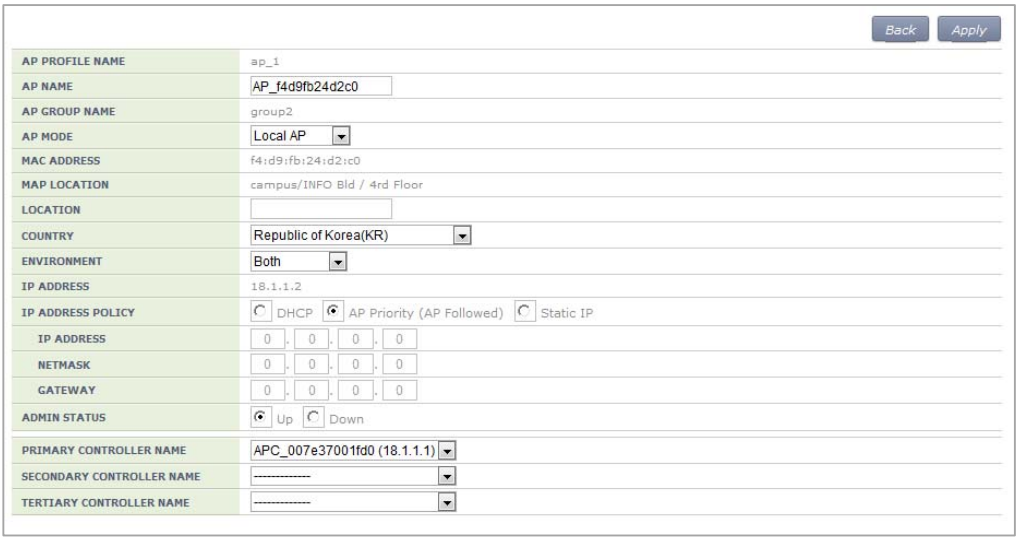


Figure 96. Country code window (2)

After selecting COUNTRY and ENVIRONMENT, click the **<Apply>** button.

CHAPTER 7. WLAN Additional Services

In this chapter, how to configure WLAN additional services such as wireless terminal management, spectrum analysis, Call Admission Control (CAC) and Radio Resource Management (RRM), etc. is described.

7.1 Managing Wireless Terminal

7.1.1 Information Retrieval Functions

Configuration using CLI

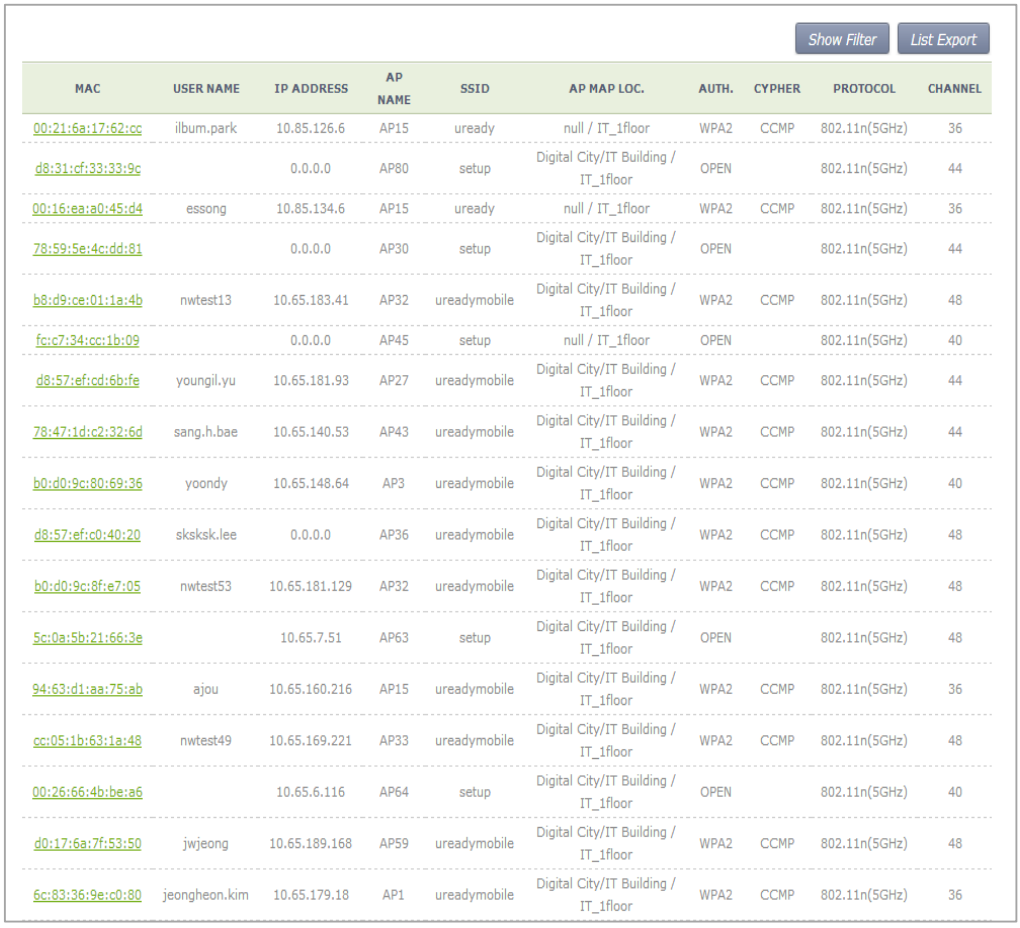
Using the following command, you can retrieve the information of a wireless terminal being serviced by the WEC8500.

- show station summary: When you enter this command, the summary information of all the wireless terminals connected to the WEC8500 is retrieved.
- show station summary ap [AP_ID]: The information of wireless terminals of each AP is retrieved.
- show station summary bssid [BSSID_ID]: The information of wireless terminals of each BSSID is retrieved.
- show station summary wlan [WLAN_ID]: The information of wireless terminals of each WLAN is retrieved.
- show station detail [MAC_ADDRESS]: The detail information of a wireless terminal that has a specific MAC address is retrieved.
- show station stats ap-80211-stats [MAC_ADDRESS]: The WI-FI statistics information of a wireless terminal is retrieved.
- show station association history [MAC_ADDRESS]: The connection history of a wireless terminal is retrieved.
- show station stats debug all: The debug statistics information of a wireless terminal is retrieved.
- show station stats management_frame all: The debug statistics information of a wireless terminal is retrieved.

Configuration using Web UI

In the menu bar of **<WEC Main window>,** select **<Monitor>** and then select the **<Stations>** menu in the sub-menus. The brief information of each station is displayed in the window.

To check the detail information of a specific station, click the MAC information of the specific station in the Stations window list.



MAC	USER NAME	IP ADDRESS	AP NAME	SSID	AP MAP LOC.	AUTH.	CYPHER	PROTOCOL	CHANNEL
00:21:6a:17:62:cc	ilbum.park	10.85.126.6	AP15	uready	null / IT_1floor	WPA2	CCMP	802.11n(5GHz)	36
d8:31:cf:33:33:9c		0.0.0.0	AP80	setup	Digital City/IT Building / IT_1floor	OPEN		802.11n(5GHz)	44
00:16:ea:a0:45:d4	essong	10.85.134.6	AP15	uready	null / IT_1floor	WPA2	CCMP	802.11n(5GHz)	36
78:59:5e:4c:dd:81		0.0.0.0	AP30	setup	Digital City/IT Building / IT_1floor	OPEN		802.11n(5GHz)	44
b8:d9:ce:01:1a:4b	nwtest13	10.65.183.41	AP32	ureadymobile	Digital City/IT Building / IT_1floor	WPA2	CCMP	802.11n(5GHz)	48
fc:c7:34:cc:1b:09		0.0.0.0	AP45	setup	null / IT_1floor	OPEN		802.11n(5GHz)	40
d8:57:ef:cd:6b:fe	youngil.yu	10.65.181.93	AP27	ureadymobile	Digital City/IT Building / IT_1floor	WPA2	CCMP	802.11n(5GHz)	44
78:47:1d:c2:32:6d	sang.h.bae	10.65.140.53	AP43	ureadymobile	Digital City/IT Building / IT_1floor	WPA2	CCMP	802.11n(5GHz)	44
b0:d0:9c:80:69:36	yoondy	10.65.148.64	AP3	ureadymobile	Digital City/IT Building / IT_1floor	WPA2	CCMP	802.11n(5GHz)	40
d8:57:ef:c0:40:20	sksksk.lee	0.0.0.0	AP36	ureadymobile	Digital City/IT Building / IT_1floor	WPA2	CCMP	802.11n(5GHz)	48
b0:d0:9c:8f:e7:05	nwtest53	10.65.181.129	AP32	ureadymobile	Digital City/IT Building / IT_1floor	WPA2	CCMP	802.11n(5GHz)	48
5c:0a:5b:21:66:3e		10.65.7.51	AP63	setup	Digital City/IT Building / IT_1floor	OPEN		802.11n(5GHz)	48
94:63:d1:aa:75:ab	ajou	10.65.160.216	AP15	ureadymobile	Digital City/IT Building / IT_1floor	WPA2	CCMP	802.11n(5GHz)	36
cc:05:1b:63:1a:48	nwtest49	10.65.169.221	AP33	ureadymobile	Digital City/IT Building / IT_1floor	WPA2	CCMP	802.11n(5GHz)	48
00:26:66:4b:be:a6		10.65.6.116	AP64	setup	Digital City/IT Building / IT_1floor	OPEN		802.11n(5GHz)	40
d0:17:6a:7f:53:50	jwjeong	10.65.189.168	AP59	ureadymobile	Digital City/IT Building / IT_1floor	WPA2	CCMP	802.11n(5GHz)	48
6c:83:36:9e:c0:80	jeongheon.kim	10.65.179.18	AP1	ureadymobile	Digital City/IT Building / IT_1floor	WPA2	CCMP	802.11n(5GHz)	36

Figure 97. Information viewing window

7.1.2 Connection History related Configuration

You can configure maximum value for the connection history of a wireless terminal that will be managed in the WEC8500.

- station number-of-assoc-tracking [COUNT]

Parameter	Description
COUNT	Maximum number of association tracking

7.2 Handover Management

The handover releases a connection with an existing AP and connects to a new AP. It provides seamless wireless LAN connection to a wireless terminal. The WEC8500 provides both 802.11 standard handover and Samsung's unique AirMove (Network Controlled Handover) handover.

7.2.1 Connection History Information

Use the 'show station association history [MAC_ADDRESS]' command to check the handover history information of a specific wireless terminal connected to the WEC8500.

7.2.2 AirMove Configuration

Unlike the 802.11 standard handover where a wireless terminal performs the handover function by itself, the AirMove handover is performed by the collaboration between wireless terminals compatible with the WEC8500. Therefore, the packet loss or handover time is optimized. Some Samsung smartphones such as Galaxy S2 or S3, etc. provide the AirMove function.

Configuration using CLI

To configure the AirMove related function, execute the following command to go to the handover configuration mode.

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

[Handover Option Configuration]

- handover [OPTION] [OPTION_DETAIL]

AirMove Configuration Item	Description
operation mode	Operation mode configuration - OPTION: opmode - OPTION_DETAIL: Each mode (VoIP/STA)
buffered-forwarding mode	Configures whether to use the buffered forwarding function. - OPTION: fwd-buffering - OPTION_DETAIL: Enable/Disable
decision delta	Configures the threshold of RSSI difference between a serving AP and a target AP. - OPTION: decision-delta - OPTION_DETAIL: Threshold (dBm)
scan time on channel	Configures scanning time of a wireless terminal per channel. - option: scan-time-channel - OPTION_DETAIL: Time (ms)

AirMove Configuration Item	Description
scan interleaving time	Configures the scanning interval of a wireless terminal. - OPTION: scan-time-interleave - OPTION_DETAIL: Time (ms)
Service time in scanning period	Configures a period when an wireless terminal transmits/receives an actual data traffic after scanning. - OPTION: scan-time-service - OPTION_DETAIL: Time (ms)
scan report level	Configures the threshold of a scan report that will be transmitted from an AP to the WEC8500. - OPTION: scan-report-level - OPTION_DETAIL: scan report level (dBm)
Numbers of handover scan attempts per channel	Configures the scanning times of a wireless terminal per channel. - OPTION: number-of-proreq - OPTION_DETAIL: Number of times
Number of channels for which scan is attempted	Configures the number of channels a wireless terminal will scan at a time. - OPTION: number-of-channel - OPTION_DETAIL: Number of channels
scan trigger level	RSSI intensity at which a wireless terminal starts channel scanning - OPTION -trigger-level - OPTION_DETAIL: RSSI (dBm)
station decision delta	Configures the threshold of RSSI difference, measured in a wireless terminal, between a serving AP and a target AP. If the threshold is exceeded, a wireless terminal performs its handover. - OPTION: station-decision-delta - OPTION_DETAIL: Threshold (dBm)

An example of using the command for each configuration item is as follows:

```
WEC8500/configure# handover opmode APP
WEC8500/configure# handover buffered-forwarding enable
WEC8500/configure# handover decision-delta 10
WEC8500/configure# handover scan-time-channel 10
WEC8500/configure# handover scan-time-interleave 1000
WEC8500/configure# handover scan-time-service 200
WEC8500/configure# handover scan-report-level -90
WEC8500/configure# handover number-of-proreq 3
WEC8500/configure# handover number-of-channel 4
WEC8500/configure# handover scan-trigger-level -65
WEC8500/configure# handover station-decision-delta 10
```

To check the configuration information, use the ‘show handover configuration’ command.

[AirMove Enable/Disable Configuration]

The AirMove is enabled by default, so use the following command to disable it.

- no handover mode NCHO

To check the configuration information, use the 'show handover configuration' command.

Configuration using Web UI

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

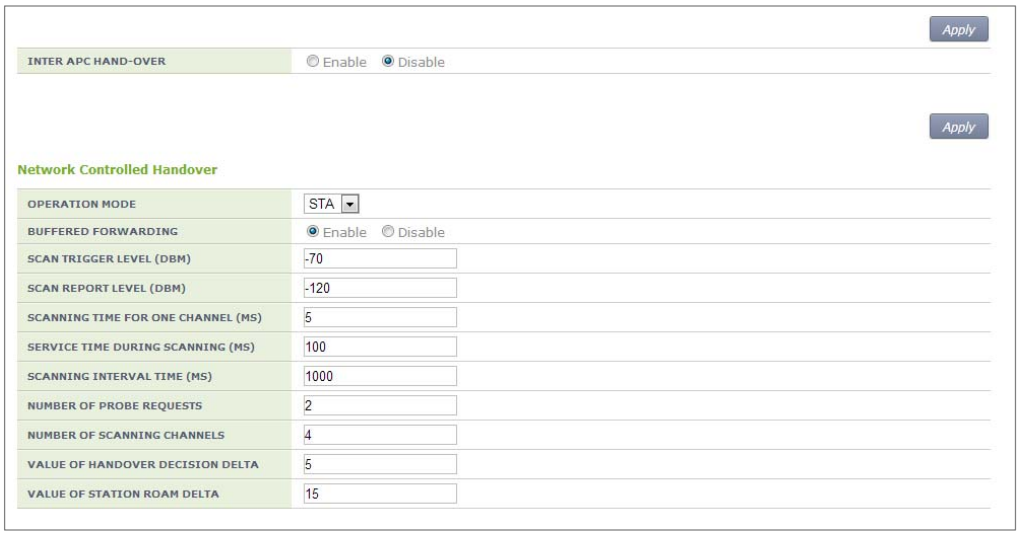


Figure 98. Handover window

You can enable or disable the intra handover function by selecting Enable/Disable in the INTER APC HAND-OVER item. After configuring a value, click the **<Apply>** button to apply.

7.2.3 Inter APC Handover Configuration

The Inter APC handover is a technology that supports handover among several WEC8500 systems. Depending on network configuration, the Inter APC L3 handover and Inter APC L2 handover services are provided.

By using the clustering service, you can configure several WEC8500 systems into a single group.

Configures whether to use the Inter APC handover.

The default value of Inter APC handover is not configured.

- handover inter-apc enable

To check the configuration information, use the 'show handover configuration' command.

7.3 Voice CAC Configuration

The CAC function is provided to protect existing calls from the voice calls incoming to a wireless LAN. The WEC8500 does not allow an additional call when maximum allowed number of voice calls per radio is reached.

7.3.1 SIP ALG Configuration

To make Call Admission Control (CAC) working, the SIP ALG function must be enabled. The SIP ALG analyzes a SIP packet and forwards VoIP communication status to the CAC.

Configuration using CLI

The SIP ALG related commands are as follows:

- sipalg enable: Configures whether to enable the SIP ALG function.
- sipalg sip-error-resp-enable(SIP ERROR RESPONSE): Configures how to reject a received call when maximum allowed number of calls is exceeded.
  - Disable (default): No response for a received call connection request message. The received message is not forwarded to the called side.
  - Enable: Rejects by transmitting 503 Service Unavailable SIP response for a received call connection request message. The received message is not forwarded to a called side.
- sipalg sip-detect-long-call-enable (SIP DETECT LONG DURATION CALL): Configures whether to delete an internal resource by detecting abnormal remaining calls. The values configured in the below two timers are used to judge an abnormal remaining call.
  - SIP No Answer Timeout (SIP Long Call Setuptimer): Maximum allowed time of the status before call connection (range: 300-3600, default: 600)
  - SIP Connect Timeout (SIP Long Call EstblshTimer): Maximum allowed time for a connected call (range: 3600-86400, default: 7200)
- sipalg sip-long-call-timeout (SIP NO ANSWER TIMEOUT, SIP CONNECT TIMEOUT): Configures a time required to judge an abnormal remaining call and enter SIP No Answer Timeout and SIP Connect Timeout in order.

To enable SIP ALG, execute the command as follows:

1) Go to configure mode of CLI.

```
WEC8500# configure terminal
```

2) Enable the SIP ALG.

```
WEC8500/configure# sipalg enable
```

3) To check the configuration information, use the ‘show sipalg configuration’ command.

Configuration using Web UI

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

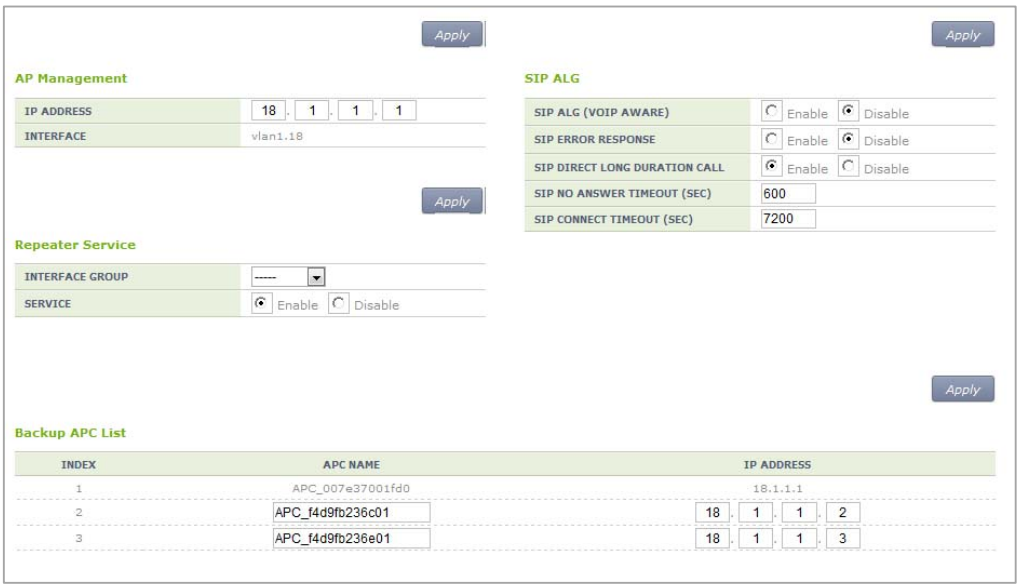


Figure 99. SIP ALG configuration window

After configuring SIP ALG that is a voice CAC related configuration in the SIP ALG, click the **<Apply>** button.

7.3.2 CAC Configuration

To protect existing calls, the CAC function configures maximum allowed number of calls and rejects any call request when the maximum number is exceeded. You can configure the number of marginal calls for handover.

Configuration using CLI

For voice CAC configuration, execute the command as follows:

1) Go to configure → CAC mode of a wireless section of CLI.

```
WEC8500# configure terminal
WEC8500/configure# [80211a/80211bg] cac
WEC8500/configure/80211a/cac#
```

2) Enable or disable the voice CAC function.
   - acm [MODE]

Parameter	Description
MODE	Enables or disables the CAC function - enable: Enable - disable: Disable

3) Configures maximum allowed number of calls.
   - max-calls [VALUE]

Parameter	Description
VALUE	Maximum allowed number of calls.

4) Configure the number of marginal calls considering the handover.
   - reserved-ho-calls [VALUE]

Parameter	Description
VALUE	Number of marginal calls considering the handover

5) To check the configured voice CAC information, use the ‘show 80211a cac configuration’ 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.

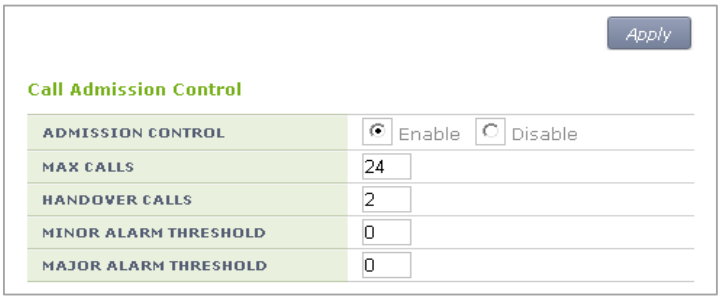


Figure 100. General configuration of 802.11a/n

After configuring the below item in the Call Admission Control, click the **<Apply>** button.

- ADMISSION CONTROL: Configures the CAC function.
- MAX CALLS: Maximum number of allowed calls (range: 2-30)
- HANDOVER CALLS: Number of marginal calls considering handover (range: 0-10)
  The number of allowed calls is MAX CALLS-HANDOVER CALLS.
- MINOR ALARM THRESHOLD: Configures a threshold that generates a Minor alarm (range: 0-15)
  Enter '0' to prevent the alarm.
- MAJOR ALARM THRESHOLD: Configures a threshold that generates a Major alarm (range: 0-30)
  Enter '0' to prevent the alarm.

7.4 Radio Resource Management (RRM)

RRM performs automatic setup function for AP's channel and Tx Power. RRM is functionally divided into Dynamic Channel Selection (DCS), Dynamic Power control (DPC), and Coverage Hole Detection and Control (CHDC). The DCS automatically sets the channels of the APs. The DPC DCS automatically sets the Tx Power of the AP. The CHDC adjusts the Tx Power when Coverage Hole occurs.

7.4.1 RRM Configuration

Describes the settings for using the RRM function and the cluster configuration.

Configuration using CLI

To configure each function, execute the command as follows:

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

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

2) Configure RRM. The 'no' parameter is used to clear the configuration. DCS, DPC and CHDC, which are functions of RRM, can run only is the RRM is enabled.

```
WEC8500/configure/rrm# enable
```

3) In the cluster environment, set the same RF Group Name to all the connected APCs. A name must consist of up to 15 characters.

```
WEC8500/configure/rrm# rf-group-name [Name]
```

4) To check the configured information, use the 'show rrm config-summary' 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>** → **<RRM>** menu in the sub-menus. Enable or disable the RRM service at the top of the menu. The RRM can be set in either 802.11a/n screen or 802.11b/g/n screens.

Figure 101. RRM configuration window

7.4.2 DPC Configuration

Describes the setting options of the DPC function which automatically sets the Tx Power of the AP.

Configuration using CLI

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

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

2) Go to the wireless section where you want to change the settings.

```
WEC8500/configure/rrm# 80211a
```

3) Set the DPC function. Enter the dpc setting mode and set it to ‘enable’. Use the ‘no’ parameter to disable the mode. The function operates only when the RRM is set to Enable.

```
WEC8500/configure/rrm/80211a# dpc
WEC8500/configure/rrm/80211a/dpc# enable
```

4) Execute the following command to change the RSSI threshold. The default value is -70 (dBm).

```
WEC8500/configure/rrm/80211a/dpc# rssi-threshold [value]
```

5) Execute the following command to change the execution interval. The default value is 600 (seconds).

```
WEC8500/configure/rrm/80211a/dpc# periodic-interval [value]
```

6) Execute the following command to change the Tx Power range which is automatically set by DPC. The default setting is minimum 5 and maximum 20.

```
WEC8500/configure/rrm/80211a/dpc# txPower min [value] max [value]
```

7) Check the settings using the ‘show rrm config-summary’ 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>** → **<RRM>** menu in the sub-menus.

Enable or disable the DPC in the SERVICE field in Dynamic TX Power Control.

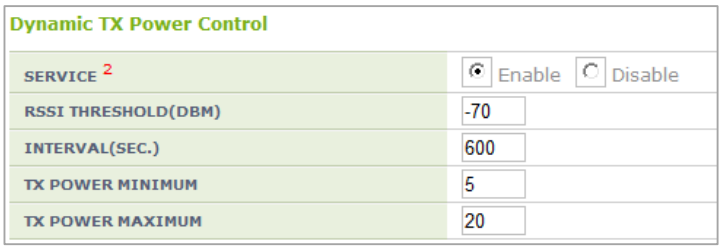


Figure 102. DPC settings

7.4.3 DCS Configuration

Describes the setting options of the DCS function which automatically sets the channel of the AP.

Configuration using CLI

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

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

2) Go to the wireless section where you want to change the settings.

```
WEC8500/configure/rrm# 80211a
```

3) Set the DCS function. Enter the dcs setting mode and set it to ‘enable’. Use the ‘no’ parameter to disable the mode. The function operates only when the RRM is set to Enable.

```
WEC8500/configure/rrm/80211a# dcs
WEC8500/configure/rrm/80211a/dcs# enable
```

4) Execute the following command to change the execution interval. The default value is 120 (seconds).

```
WEC8500/configure/rrm/80211a/dcs# periodic-interval [value]
```

5) Execute the following command to change the Channel Utilization threshold. The default value is 80 (%).

```
WEC8500/configure/rrm/80211a/dcs# channel-utilization-threshold
[value]
```

6) Execute the following command to set the anchor time. The default value is start time 0, end time 0. If both start time and end time are set to the same time, Anchor Run function is disabled.

```
WEC8500/configure/rrm/80211a/dcs# anchor-time start [value] end
[value]
```

7) Execute the following command to change the channels that is automatically set by the DCS. Use the 'no' parameter to disable the mode.

```
WEC8500/configure/rrm/80211a/dcs# channel [value]
```

8) Check the settings using the 'show rrm config-summary' 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>** → **<RRM>** menu in the sub-menus.
Enable or disable the DCS in the SERVICE field in Dynamic Channel Selection.

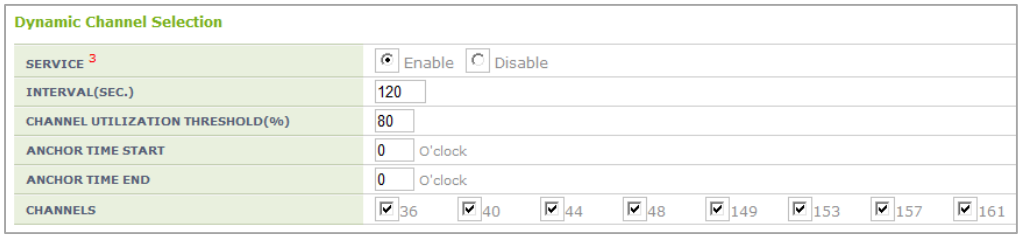


Figure 103. DCS settings

7.4.4 CHDC Configuration

Describes the setting options of the CHDC function which adjusts the Tx Power when Coverage Hole occurs.

Configuration using CLI

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

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

2) Go to the wireless section where you want to change the settings.

```
WEC8500/configure/rrm# 80211a
```

3) Set the CHDC function. Enter the chdc setting mode and set it to 'enable'. Use the 'no' parameter to disable the mode. The function operates only when the RRM is set to Enable.

```
WEC8500/configure/rrm/80211a# chdc
WEC8500/configure/rrm/80211a/chdc# enable
```

4) Check the settings using the 'show rrm config-summary' 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>** → **<RRM>** menu in the sub-menus.

Enable or disable the CHDC in the SERVICE field in Coverage Hole Detection Control.

Figure 104. CHDC settings

7.5 Location Tracking

The WEC8500 tracks the location information of several terminals in a wireless LAN network based on the wireless data collected from WIRELESS ENTERPRISE wireless LAN APs.

To configure the location tracking function, execute the command as follows:

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

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

2) Configure the location tracking function.

```
WEC8500/configure/locationtrack # enable
```

3) Configure the MAC address of a wireless terminal for which the tracking function will be executed.
   - station [MAC_ADDRESS]

4) To check the configured information, use the ‘show locationtrack current-config’ command.

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 WEC8500 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

```
WEC8500# 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

```
WEC8500# 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

```
WEC8500# 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   2012-06-2908:52:47802.11bgn  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.

Figure 105. 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:

```
WEC8500# configure terminal
WEC8500/configure# spectrum-analysis ap 1
WEC8500/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 - enable: Enable (default) - 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) - sample: FFT report (default: disabled) - duty-cycle: Duty cycle report (default: disabled) - interference: Interference report (default: enable)
MODE	Enables or disables each report function. - enable: Enable - 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 WIRELESS ENTERPRISE 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.

```
WEC8500# configure terminal
WEC8500/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 VQM

The WEC8500 provides the Voice Quality Monitoring (VQM) function as an additional service. As a function that monitors a voice packet in real-time, the VQM checks and manages the voice quality of a voice call being service by using the current wireless LAN section and also provides the status information by monitoring the quality of a voice traffic.

To use the VQM function, you must receive and install a license.
For more information about how to install the license, see 'Chapter 10. System Management'.

7.7.1 Starting VQM Monitoring

To start monitoring, enter the command as follows:

1) Go to configure mode of CLI.

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

2) Start VQM.
   - vqm enable

7.7.2 VQM Configuration

To use the VQM function, you must configure a filtering rule to classify voice packets. You can configure the filtering rule using an IP address and port range. To configure the filtering rule, go to vqm configuration mode first by executing the command as follows:

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

[Configuring IP Address Range]

To configure an IP address range, use the following command.

- filter prefix [IPV4_ADDRESS] [SUBNET_MASK]

Parameter	Description
IPV4_ADDRESS	IPv4 address
SUBNET_MASK	Subnet mask address

[Configuring RTP Port Range]

You can configure the port range that is used by a RTP packet. The command is shown below.

- rtp-port-range [MIN_PORT_VALUE] [MAX_PORT_VALUE]

Parameter	Description
MIN_PORT_VALUE	Minimum value of port range
MAX_PORT_VALUE	Maximum value of port range

[Configuring Maximum Number of Monitoring Voice Calls]

You can configure maximum number of voice calls to monitor. The command is shown below.

- connection-limit [COUNT]

Parameter	Description
COUNT	Maximum number of connections (range: 1-2500)

[Retrieving VQM Information]

To check the VQM configuration information, use the ‘show vqm current-config’ command.

7.8 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.

```
WEC8500# configure terminal
```

2) Create a QoS profile.

```
WEC8500/configure# qos [PROFILE_NAME]
WEC8500/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.

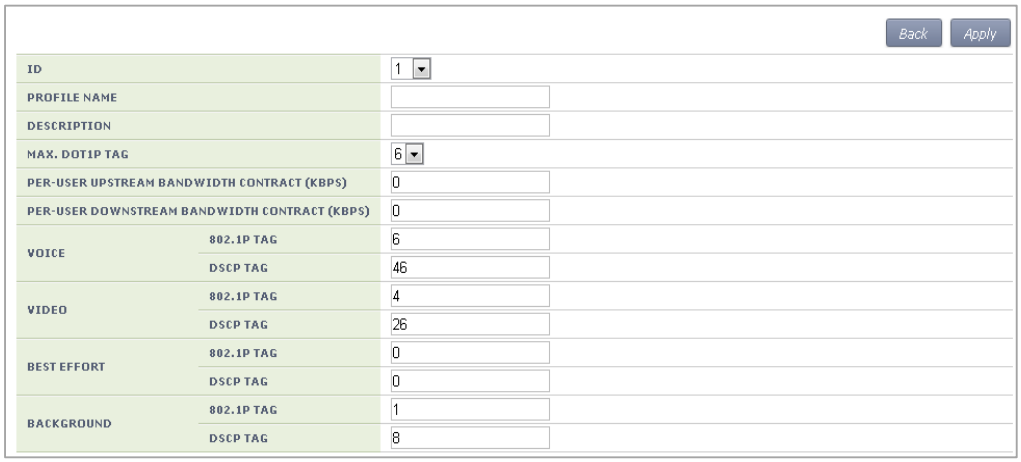


Figure 106. Controlling Usage per User

- 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.

7.9 Remote Packet Capture

WEC8500 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:

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

Configuring the MAC address of a wireless terminal

Configures the MAC address of a wireless terminal whose packets will be captured. (Maximum 10 packets)

```
WEC8500/configure/pcap# filter mac [MAC_ADDRESS]
WEC8500/configure/pcap# filter enable-mac [INDEX]
```

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

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.

```
WEC8500/configure/pcap# start-service
```

Retrieving Configuration Information

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

7.10 Clustering

The clustering function comprehensively manages several WEC8500 systems in a single wireless LAN when several WEC8500 systems are used to manage a wireless LAN that cannot be managed by a single WEC8500. 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 WEC8500 systems.

Configuration using CLI

[Cluster Setting]

To use the clustering function, you must configure each WEC8500 according to the following procedure. Maximum 12 WEC8500 systems can be grouped in a single 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 (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 (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 a WEC8500 from a cluster, you must delete the WEC8500 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 a WEC8500 from the cluster. To delete all the WEC8500 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.

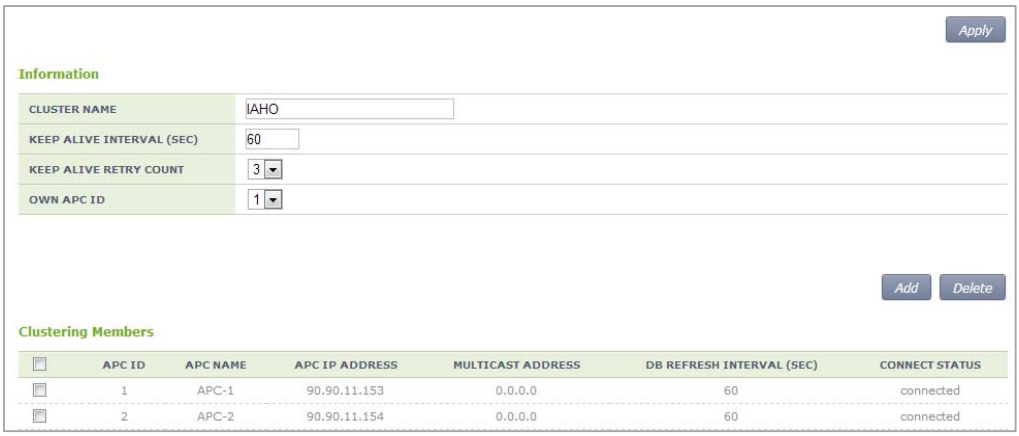


Figure 107. Clustering window

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.

Figure 108. Clustering addition window

7.11 Limiting the Number of Connected Users

The WIRELESS ENTERPRISE 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.

7.11.1 Limiting Connections per Radio

Configuration using CLI

1) Go to configure mode of CLI.

```
WEC8500# configure terminal
WEC8500/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 [80211bg/80211a] - 80211bg: 2.4 GHz area - 80211a: 5 GHz area
MAX-STATION	Maximum number of wireless terminals that can be connected (default: 127)
TARGET	Configuration range -AP: Index of an AP to configure -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 109. Configuring connection limitation per radio

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

7.11.2 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.

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

2) Disable the WLAN.

```
WEC8500/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.

```
WEC8500/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.

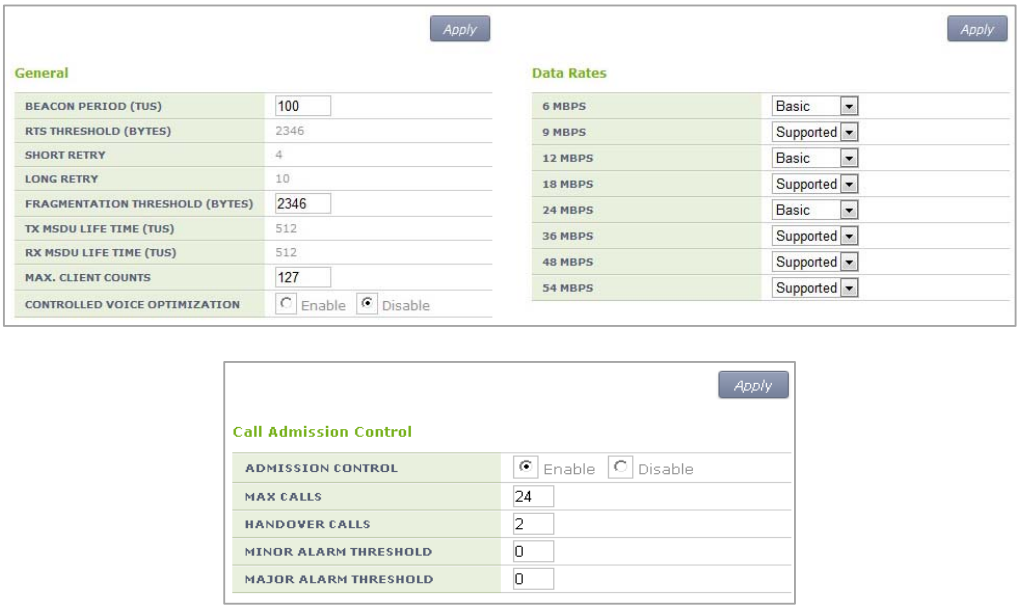


Figure 110. Configuring connection limitation per WLAN

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

7.12 Voice Statistics and Communication Failure Detection

Because WEC8500 provides voice statistics and the WLAN-based communication failure detection function, you can easily know communication failure reason.

7.12.1 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.

```
WEC8500# show 80211bg voip-stats 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.

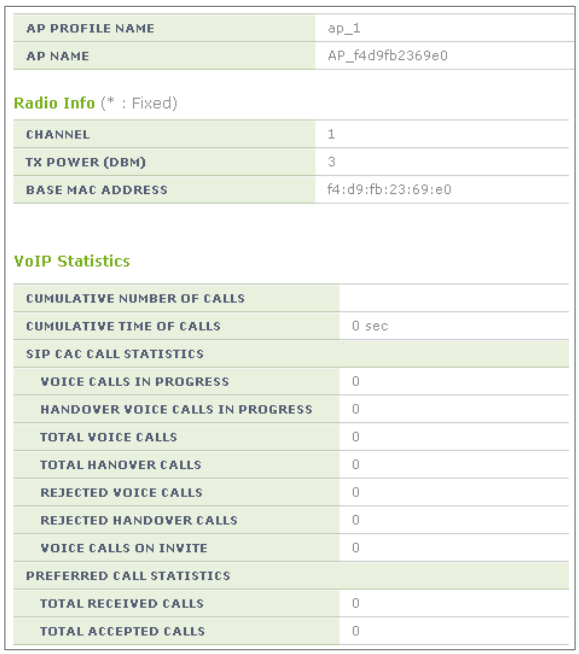


Figure 111. Voice statistics

7.12.2 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.

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

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

Parameter	Description
WLAN_ID	WLAN ID (range: 1-16)

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.

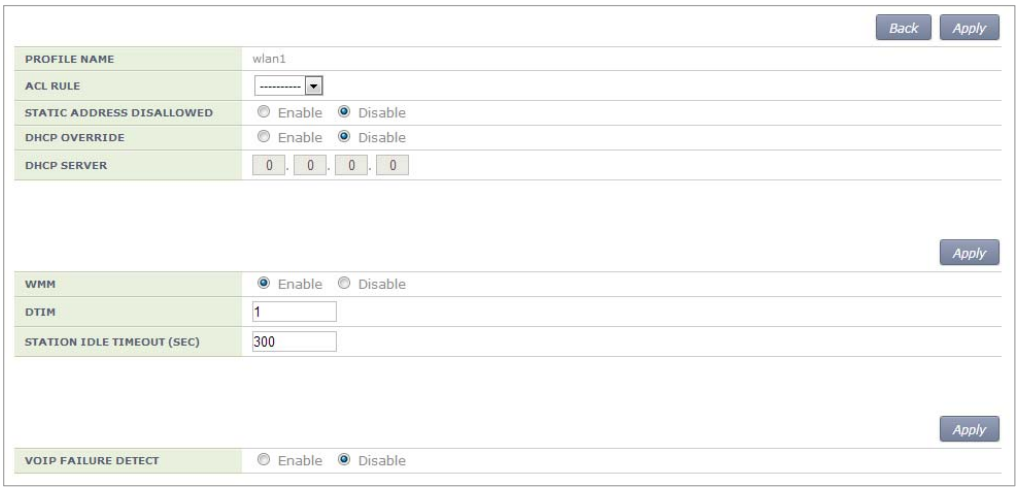


Figure 112. Detecting WLAN-based communication failure

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

CHAPTER 8. Security

The WIRELESS ENTERPRISE 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 WIRELESS ENTERPRISE 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.

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 - ASCII: ASCII character string - 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 (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 (range: 1-65535, default: 1812)

6) Exit RADIUS server configuration and security configuration mode.

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

7) 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 (Stations)> → <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.

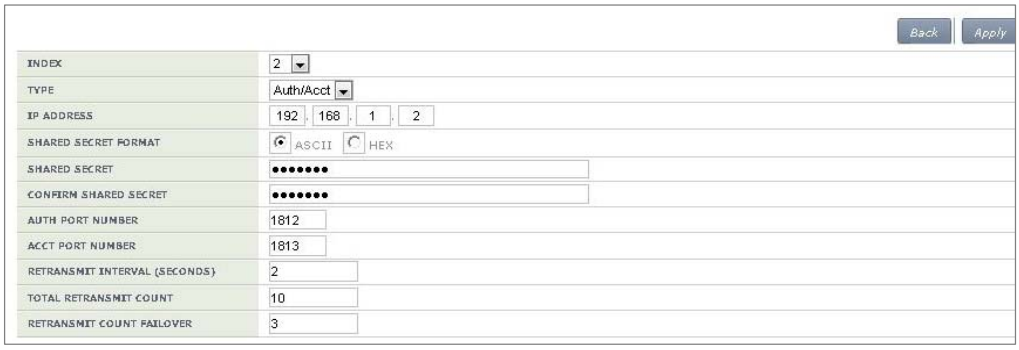


Figure 113. RADIUS server configuration

- INDEX: ID that distinguishes RADIUS server configuration
- TYPE: Selects a RADIUS server type
  - Auth: Executes the authentication function
  - Acct: Executes the accounting function
  - Auth/Acct: Executes the authentication and accounting functions.
- IP ADDRESS: IP address of a RADIUS server
- SHARED SECRET FORMAT: Input format of a RADIUS server communication key
  - ASCII: ASCII character string
  - HEX: Hexadecimal value
- SHARED SECRET: RADIUS server communication key
- CONFIRM SHARED SECRET: Re-enter to check a RADIUS server communication key.
- AUTH PORT NUMBER: Communication port number to authenticate a RADIUS server (range: 1-65535, default: 1812)
- ACCT PORT NUMBER: Communication port number to authenticate a RADIUS server (range: 1-65535, default: 1813)
- RETRANSMIT INTERVAL: Interval of RADIUS message re-transmission (range: 1-60, default: 2, unit: s)
- TOTAL RETRANSMIT: Maximum number of RADIUS message re-transmission (range: 1-20, default: 10)
- RETRANSMIT COUNT FAILOVER: Maximum number of re-transmission until the RADIUS server failover is attempted (range: 1-10, default: 3, Must be less than the TOTAL RETRANSMIT value)

8.2 Unauthorized AP/Terminal Detection and Blocking

As the security function, the WIRELESS ENTERPRISE wireless LAN device provides the detection and blocking service for an unauthorized (rogue) AP using the WIDS/WIPS function.
This function detects and blocks 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.


NOTE

- If you want to use a WEC8500 AP without blocking when a WIPS module other than the WEC8500 is working, turn off the power or function of the other WIPS or register the wireless MAC address of WIRELESS ENTERPRISE AP connected to the WEC8500 to the WIPS.
- To use an AP/APC system other than the WEC8500 without blocking at the same time, you must register the AP wireless MAC address of the other device to the WIDS friendly list of WEC8500.

8.2.1 Enabling Detection and Blocking Function

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

1) Go to configure mode of CLI.

```
WEC8500# configure terminal
```

2) Enable the detection function.

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

3) Enable the blocking function.

```
WEC8500/configure# wips enable
```

To check the configured information, use the following command.

- show wids current-config
- show wips current-config

8.2.2 Detection

The WIRELESS ENTERPRISE 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
Friendly AP	AP that is allowed to be used by an administrator among the detected unauthorized APs - Configures the friendly AP classification policy. - An administrator can classify a specific AP as a friendly AP among the manually detected unauthorized APs.
Malicious AP	AP that is not allowed to be used by an administrator among the detected unauthorized APs and AP that can be used maliciously - Configures the malicious AP classification policy. - An administrator can classify a specific AP as a malicious AP among the manually detected unauthorized APs.
Unclassified AP	AP that is not classified as a friendly AP or a malicious AP among the detected unauthorized APs

Configuring the friendly AP classification policy

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

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

```
WEC8500# configure terminal
WEC8500/configure# wids
WEC8500/configure/wids# rogue
WEC8500/configure/wids/rogue#
```

2) Configure the friendly type unauthorized AP policy.
   - add-classification-rule-friendly [RULE_NAME] enable [PRIORITY] [SSID_TYPE] [SSID]

Parameter	Description
RULE_NAME	Classification policy name
PRIORITY	Priority number
SSID_TYPE	SSID type - managed-ssid: SSID that is used in an authorized AP that is connected to the

Parameter	Description
	APC. - user-configured-ssid [SSID]: Entered SSID (An AP that has SSID as SSID is classified as a friendly type unauthorized AP.)
SSID	SSID that is used when the SSID_TYPE is entered as user-configured-ssid

3) To check the configured information, use the 'show wids rogue rule friendly' command.

Configuring the malicious AP classification policy

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

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

```
WEC8500# configure terminal
WEC8500/configure# wids
WEC8500/configure/wids# rogue
WEC8500/configure/wids/rogue#
```

2) Configure the malicious type unauthorized AP policy.
   - add-classification-rule-malicious [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. - match-all: Classifies as a malicious unauthorized AP when the detection criteria entered thereafter are all satisfied. - match-any: Classifies as a malicious 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 malicious unauthorized AP.
MIN_DURATION	Minimum lasting time (unit: s). When the signal lasting time is higher than this value, it is classified as a malicious 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 malicious unauthorized AP.
ENCRYPTION	Whether to use encryption - 0: Does not use encryption. If encryption is not used, it is classified as a malicious unauthorized AP.

Parameter	Description
	- 1: Uses encryption. If encryption is used, it is classified as a malicious unauthorized AP.
SSID TYPE	SSID type - managed-ssid: SSID that is used in an authorized AP that is connected to the APC. - user-configured-ssid [SSID]: Entered SSID (An AP that has SSID as SSID is classified as a friendly type unauthorized AP.)
SSID	SSID that is used when the SSID_TYPE is entered as user-configured-ssid

3) To check the configured information, use the 'show wids rogue rule malicious' command.

Manual configuration (Move)

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

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

```
WEC8500# configure terminal
WEC8500/configure# wids
WEC8500/configure/wids# rogue
WEC8500/configure/wids/rogue#
```

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 wids rogue ap list unclassified
   - show wids rogue ap list friendly
   - show wids rogue ap list malicious

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.

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

```
WEC8500# configure terminal
WEC8500/configure# wids
WEC8500/configure/wids# rogue
WEC8500/configure/wids/rogue#
```

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

2) To check the changed configuration, use the following command.
   - show wids rogue ap list removed

Unauthorized AP detection option

Go to configure → wids → rogue → ap configuration mode.

```
WEC8500# configure terminal
WEC8500/configure# wids
WEC8500/configure/wids# rogue
WEC8500/configure/wids/rogue# ap
WEC8500/configure/wids/rogue/ap#
```

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 - Alarm: Notify the state with alarm - Log: 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-detection	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-detection	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-detection	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-detection	Allocates Rogue ID = 106 if an AP uses a channel that is not in the channel validation list among detected APs.
managedap/ invalid-ssid-detection	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-det	Allocates Rogue ID = 108 by checking the association status between an unauthorized AP and a managed client.
unknownap/wired-netwrok-detection	Allocates Rogue ID = 109 by checking if an unauthorized AP is connected in wire.

To check the changed configuration, use the following command.

- show wids rogue ap current-config

Unauthorized client detection option

Go to configure → wids → rogue → client configuration mode.

```
WEC8500# configure terminal
WEC8500/configure# wids
WEC8500/configure/wids# rogue
WEC8500/configure/wids/rogue# client
WEC8500/configure/wids/rogue/client#
```

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 - Alarm: Notify the state with alarm - Log: 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.

To check the changed configuration, use the following command.

- show wids rogue client current-config

8.2.3 Blocking

WEC8500 attempts to block unauthorized devices according to the configured unauthorized AP policy. An unauthorized AP is blocked when a de-authentication packet is transmitted to a target AP.

Automatic blocking

To configure automatic blocking, execute the command as follows:

1) Go to configure → wids→autocontainment configuration mode.

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

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

Parameter	Description
OPTION	- adhoc-connection: Blocks an AP when the Ad-hoc connection type is detected. - rogueap-with-managed-ssid: Blocks an AP if it is detected than a rogue AP is using an entered SSID. - malicious-rogue-ap: Blocks an AP when an AP classified as malicious is detected. - rogue-ap-on-wired-network: Blocks an AP when wire connection is detected among rogue APs. - rogue-ap-with-auth-client: Blocks an AP if a client in the client-whitelist is associated with a rogue AP. - managed-client-associated-with-friendly-external: Blocks a client if it is detected that a managed client is connected to a friendly extern AP.

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

4) To check a blocked unauthorized device, use the following command.
   - show wids rogue ap list containment-pending
   - show wids rogue ap list contained
   - show wids rogue client list containment-pending
   - show wids rogue client list contained

Manual blocking

To manually block a specific AP among the detected unauthorized APs, execute the command as follows: But, a friendly type unauthorized AP cannot be blocked.

To configure the unauthorized AP blocking policy, execute the command as follows:

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

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

2) Block it manually by specifying the MAC address of a specific unauthorized AP.
   - manualcontainment [DEV_TYPE][MAC]

Parameter	Description
DEV_TYPE	Enter either ap or client
MAC	MAC address of a device to block

3) To check a blocked unauthorized device, use the following command.
   - show wids rogue ap list containment-pending
   - show wids rogue ap list contained
   - show wids rogue client list containment-pending
   - show wids rogue client list contained

8.2.4 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:

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

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

2) Enable the unauthorized channel validation function.

```
WEC8500/configure/wids/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 configuration information, use the ‘show wids current-config’ command.

8.3 Guest Access

The WIRELESS ENTERPRISE wireless LAN system provides the Guest Access function. A guest user can receive a limited service after connected to a specific WLAN (SSID) and going through authentication.

8.3.1 WLAN Security Configuration

To configure WLAN security for guest connection control, execute the command as follows:

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

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

2) Disable the WLAN.

```
WEC8500/configure/wlan 1# no enable
```

3) Configure the WEB policy (default: disabled).

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

4) Enable the WEB authentication (default: disabled)

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

5) Configure a guest flag (default: disabled).

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

6) Enable the WLAN.

```
WEC8500/configure/wlan 1# enable
```

7) To check the configured environment, use the ‘show wlan security summary’ command.

8.3.2 Guest Connection Configuration

By using the 'security guest-access' command, you can configure various Guest Access related options.
First of all, go to the configuration mode to execute the command.

```
WEC8500# configure terminal
```

[Access Configuration]
Enables or disables guest access.

- security guest-access enable: Configures whether to allow access.

[Adding User]
The below command is used to add a guest user.

- security guestaccess add-user [ID] [PASSWD] [TIME_SCHEDULE] [SCHEDULE_TIME] [ACCESS_LIMITED] [LIFE_TIME]

Parameter	Description
ID	login ID of a user
PASSWD	password
TIME_SCHEDULE	access time schedule
SCHEDULE_TIME	schedule time (YYYY:MM:DD:HH:MM format)
ACCESS_LIMITED	access limited
LIFE_TIME	lifetime time (YYYY:MM:DD:HH:MM format)

[Deleting User]
The below command is used to delete a guest user.

- security guest-access del-user [ID]

Parameter	Description
ID	Login ID of a user

[DB Access Flag Configuration]
To select a location where the information for access control of a guest service, execute the command as follows:

- security guest-access db-access-flag [FLAG]

Parameter	Description
FLAG	Information storage location - local: Uses internal authentication. - internal: Uses internal radius server authentication. - external: Uses external radius server authentication.

[External Primary RADIUS Server Configuration]

Can configure the profile id of a primary server during external RADIUS configuration.

- security guest-access ext-primary-radius-server [PROFILE_ID]

Parameter	Description
PROFILE_ID	Profile ID

[Idle Session Timeout Configuration]

Can configure idle session timeout for a guest user.

- security guest-access idle-session-timeout [TIME_OUT]

Parameter	Description
TIME_OUT	Timeout time (range: 300-3600 s)

[Security Authentication]

The command used to enable or disable security authentication is shown below:

- security guest-access secure-auth-enable
- no security guest-access secure-auth-enable

[Web Server Configuration]

Can configure the redirect URL of a web server. The access control of a guest service is used as authentication web for a guest user.

- security guest-access web-server [URL] [IP_ADDRESS] [PORT_NUMBER]

Parameter	Description
URL	Web server redirect URL
IP_ADDRESS	IPv4 address of a web server
PORT_NUMBER	UDP port number of a web server

[Retrieving Guest Access Configuration]

To check the configured environment, use the following command.

- show security guest-access config-user-detail
- show security guest-access current-config

8.4 WEB Pass-through

The WEC8500 provides the WEB Pass through function that transmits a user packet to the redirect URL configured by an operator.

8.4.1 WLAN Security Configuration

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

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

2) Disable the WLAN.

```
WEC8500/configure/wlan 1# no enable
```

3) Configure the WEB policy (default: disabled).

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

4) Configure the Pass through function (default: disabled).

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

5) Enable the WLAN.

```
WEC8500/configure/wlan 1# enable
```

6) To check the configured environment, use the ‘show wlan security summary’ command.

8.4.2 Redirect URL Configuration

1) Go to configure mode of CLI.

```
WEC8500# configure terminal
```

2) Configure guest access.

```
WEC8500/configure# security guest-access enable
```

3) Configure a redirect URL.

```
WEC8500/configure# security guest-access web-server [URL] [IP_ADDRESS]
[PORT_NUMBER]
```

Parameter	Description
URL	Web server redirect URL
IP_ADDRESS	IPv4 address of a web server
PORT_NUMBER	UDP port number of a web server

4) To check the configuration information, use the ‘show security guest-access current-config’ command.

8.5 NAT and Firewall Configuration

The WEC8500 provides the NAT and firewall function to provide stable network to a WLAN user.

8.5.1 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.

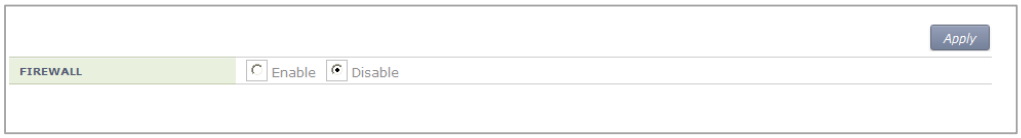


Figure 114. Firewall configuration (1)

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 115. Firewall configuration (2)

8.5.2 Access List Configuration

Configuration using CLI

1) Go to configure mode of CLI.

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

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

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

Configuration using Web UI

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

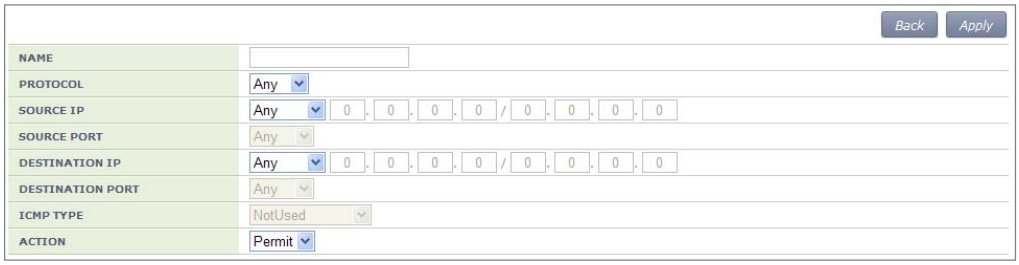


Figure 116. Access-list configuration

8.5.3 NAT Configuration

Configuration using CLI

[SNAT Configuration using Access List]

To add 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 DNAT using an access-list, execute the command as follows:

1) Go to configure mode of CLI.

```
WEC8500# configure terminal
```

2) Create a NAT pool.

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

3) Configure a NAT to the interface.

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

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

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

[DNAT Configuration using Static IP]

To add DNAT using a static IP, execute the command as follows:

1) Go to configure mode of CLI.

```
WEC8500# configure terminal
```

2) Configure a NAT to the interface.

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

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

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

[Checking NAT Configuration]

To check the created NAT, use the following command.

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

Configuration using Web UI

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

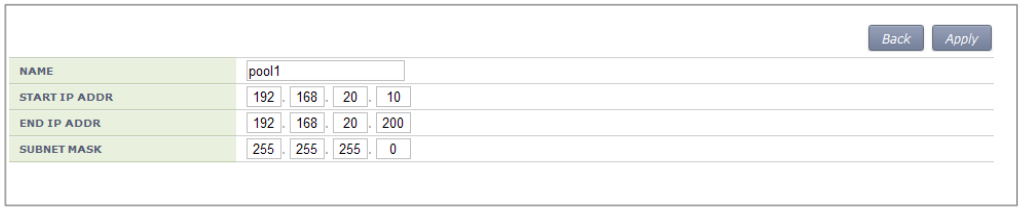


Figure 117. NAT configuration (1)

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

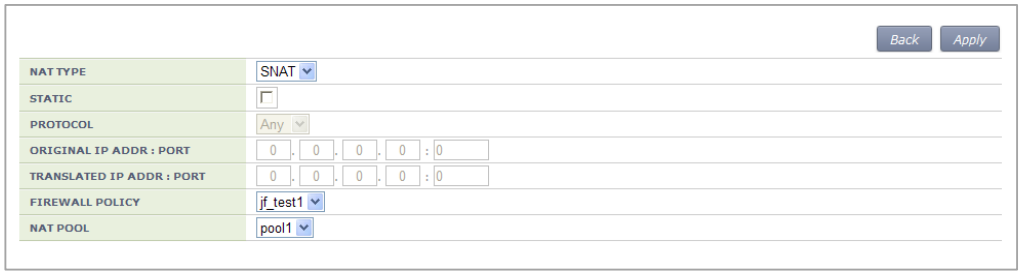


Figure 118. NAT configuration (2)


NOTE

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

8.6 MAC Filter

The WIRELESS ENTERPRISE 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: 1-16)

3) Configure the filtering policy.

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

Parameter	Description
POLICY	Table policy of MAC filtering list (default: deny)

4) Configure a MAC entry.

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

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

5) Apply the MAC filter to the WLAN by entering the created WLAN ID.

```
WEC8500/configure/security/mac-filter 1# wlan_id <WLAN_ID>
```

Parameter	Description
WLAN_ID	WLAN ID (range: 1-16)

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 (AP)>** menu in the sub-menus.

You can configure a MAC list for station connection control.

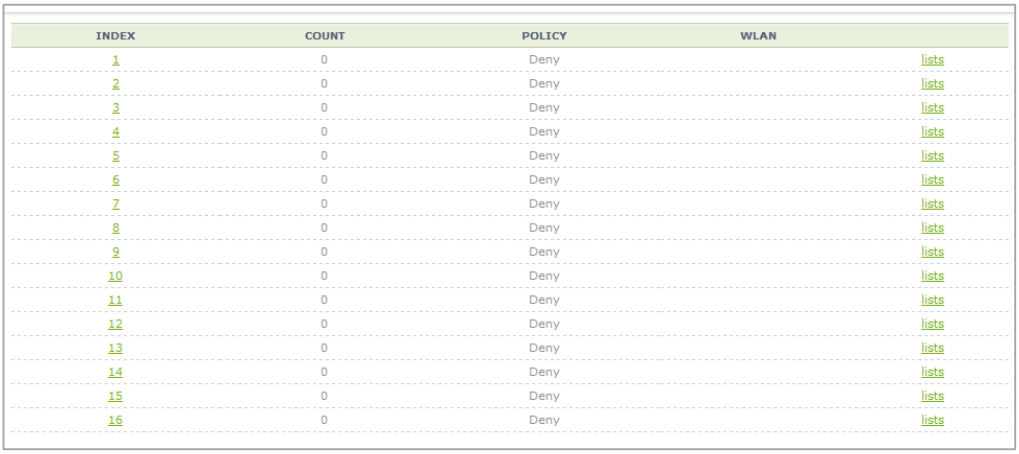


Figure 119. MAC configuration

The procedure for MAC entry configuration is given below.

1) In the MAC Filter initial window, select an INDEX item to switch to the List screen and then click the ADD button to configure a MAC entry.

Figure 120. MAC entry configuration window(1)

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

Figure 121. MAC entry configuration(2)

3) Select a policy and WLAN for which the MAC filter will be applied. When you check a WLAN ID to apply in the List configuration screen, you can do multiple selections. To apply the configuration, click the <**Apply**> button.

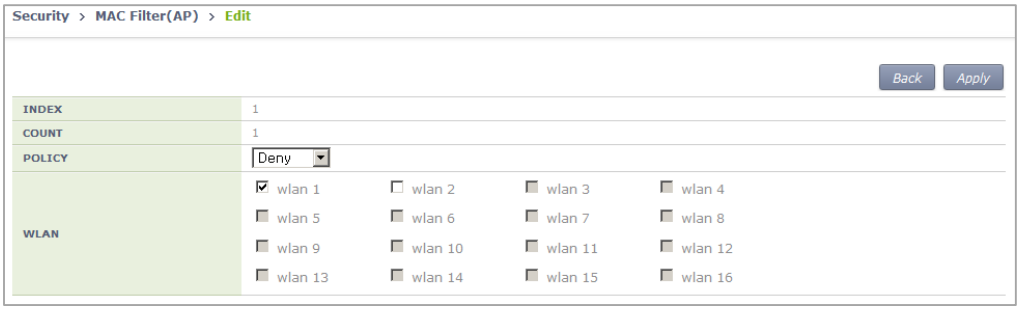


Figure 122. MAC entry configuration(3)

CHAPTER 9. IP Application

In this chapter, the IP application functions available in the WEC8500 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 WEC8500 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 WEC8500 configures the WEC8500 as a DNS server, it can receive the DNS service.
If a DNS server is connected to the WEC8500 and a DNS proxy is configured, a station connected to the WEC8500 can receive the DNS service by configuring the WEC8500 as a DNS server.

9.1.1 DNS Client Configuration

Configuration using CLI

1) Go to configure mode of CLI.

```
WEC8500# configure terminal
```

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

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

Configuration using Web UI

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

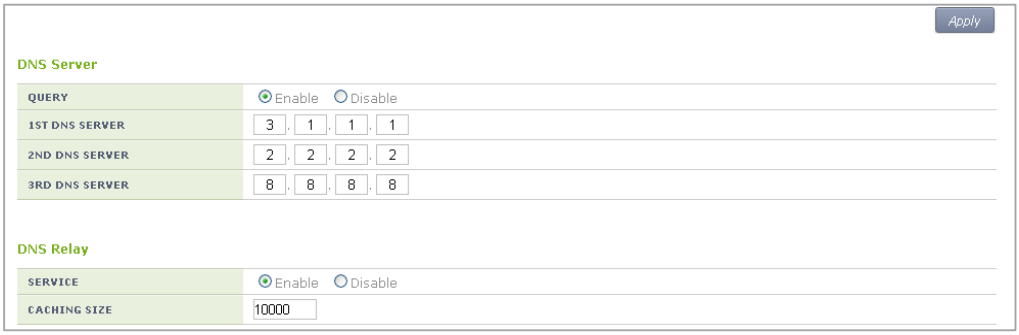


Figure 123. DNS client

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 WEC8500 saves the DNS information obtained from a DNS server.
You can configure maximum number of entries as 10000-100000. The DNS relay is related to the DNS client configuration. If you disable the DNS client function or delete all the name servers, the DNS relay function is not working.

Configuration using CLI

1) Go to configure mode of CLI.

```
WEC8500# configure terminal
```

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

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

Configuration using Web UI

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

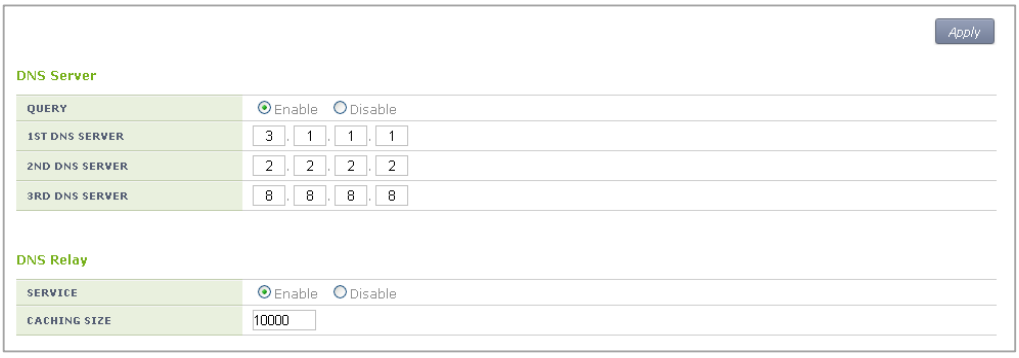


Figure 124. DNS proxy

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 WEC8500 can operate as a NTP server and a client. If you configure the WEC8500 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 WEC8500 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 WEC8500 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]
Enables or disables.

- 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.

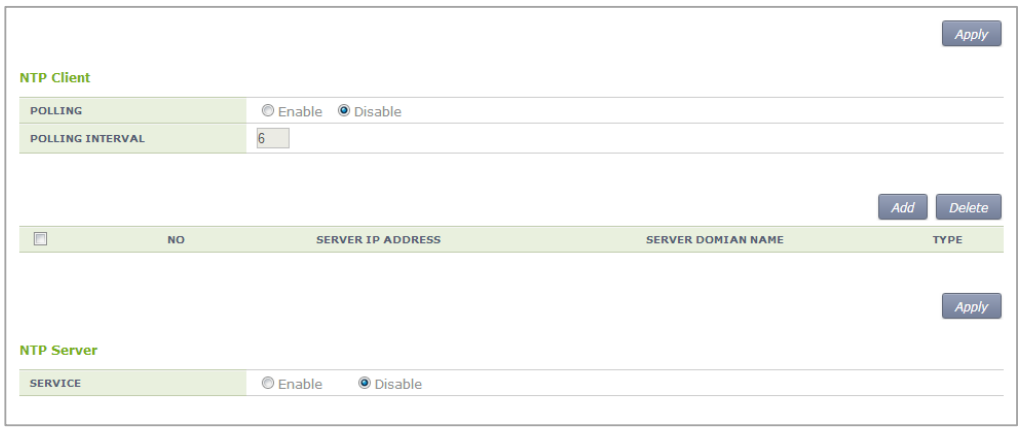


Figure 125. NTP client configuration

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 WEC8500 support the client and server function for FTP and sFTP (Secured 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 check the status of FTP server, enter the 'show ftp-server' command.

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

- file download
- file upload

A usage example is provided below.

- File download using a sFTP client

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

- File upload using a sFTP client

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

- File download using a FTP client

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

- File upload using a FTP client

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

Configuration using Web UI

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

Figure 126. 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’.
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 WEC8500 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 WEC8500 as a telnet or SSH client, you can connect to a server.
Enter as follows in CLI.

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

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

Configuration using Web UI

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

Figure 127. 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 WEC8500 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 3 SNMP communities.

Configuration using CLI

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

1) Go to configure mode of CLI.

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

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

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

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

Configuration using Web UI

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

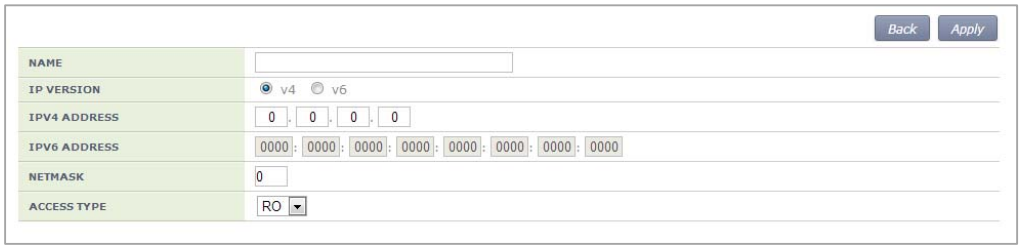


Figure 128. Adding SNMP community

10.1.2 SNMP Trap

All the alarms of the WEC8500 system are basically transmitted to outside through the SNMP trap. Therefore, to receive a system alarm from an external management server, the server address must be registered as a trap target. The trap supports v1/v2.

Configuration using CLI

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

1) Go to configure mode of CLI.

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

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

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

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

Configuration using Web UI

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

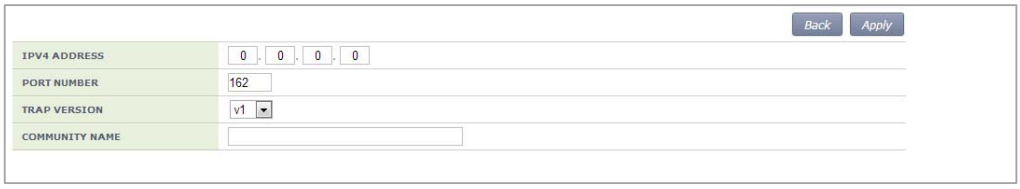


Figure 129. SNMP trap configuration

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 WEC8500 system such as version information, memory information, disk information, temperature sensor and fan status, etc.

The following shows the execution results of the command:

```
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 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]

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

[Power Supply Status]

Parameter	Description
Power Supply[0]~[1]	Whether a power module is equipped (Equipped, Not Equipped)
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 various information, status retrieving event and alarm retrieving function of the WEC8500 system.

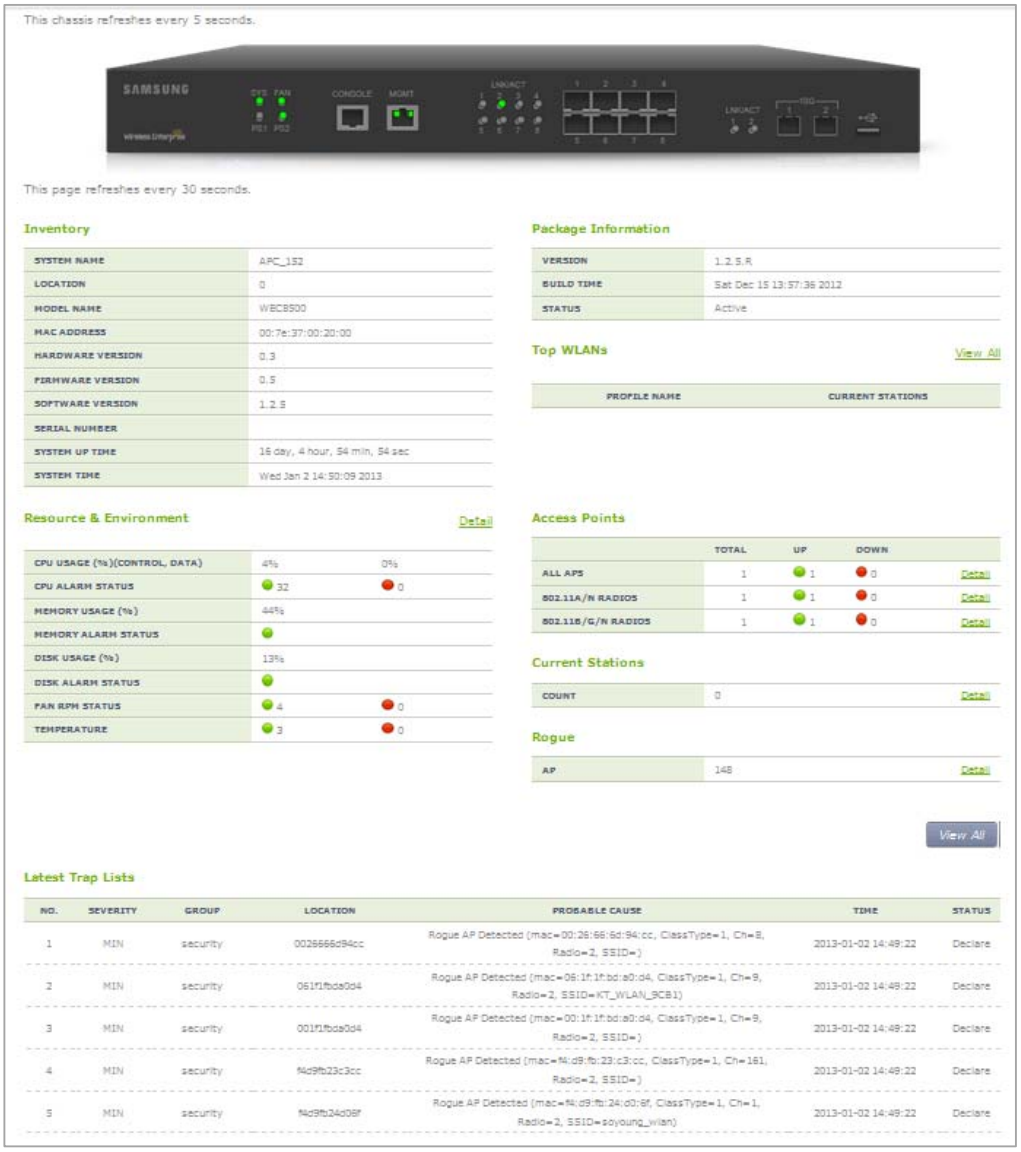


Figure 130. System information

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]

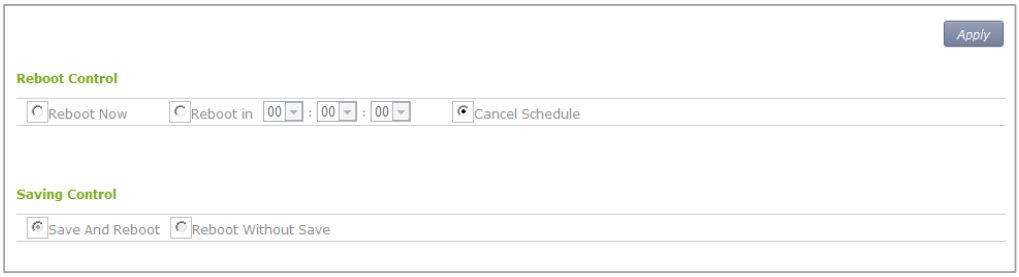


Figure 131. Reboot (APC)

[AP]

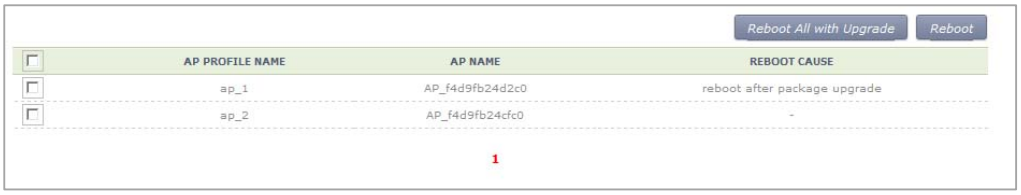


Figure 132. Reboot (AP)

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]

```
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]
```

[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]

```
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
```

[System Temperature (°C)]

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

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 WEC8500 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.

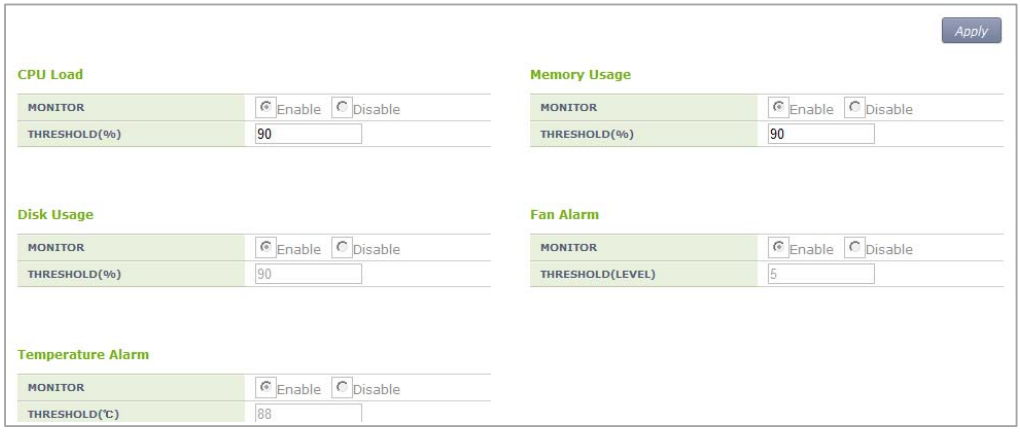


Figure 133. Configuring SNMP alarm threshold

10.4 Managing Alarm and Event

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

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

Alarm, event group

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

Alarm level

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

10.4.1 Retrieving Current Alarm

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

Retrieving with CLI

To retrieve current alarms, execute the command as follows:

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

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

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

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

Retrieving with Web UI

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

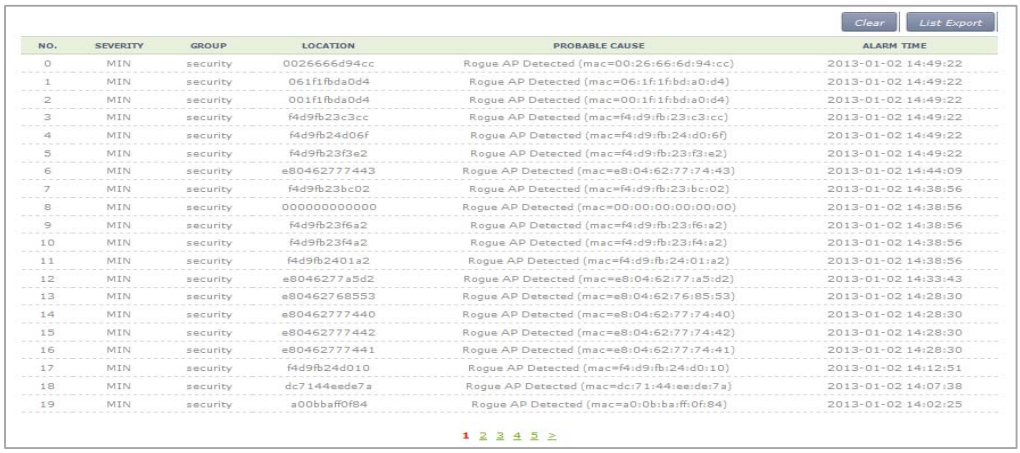


Figure 134. Current alarm

10.4.2 Retrieving History

Retrieving with CLI

The WEC8500 retrieves the history of alarm and event using the following command.

[Alarm History]

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

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

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

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

[Event History]

You can retrieve event information using the following command.

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

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

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

Configuration using Web UI

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

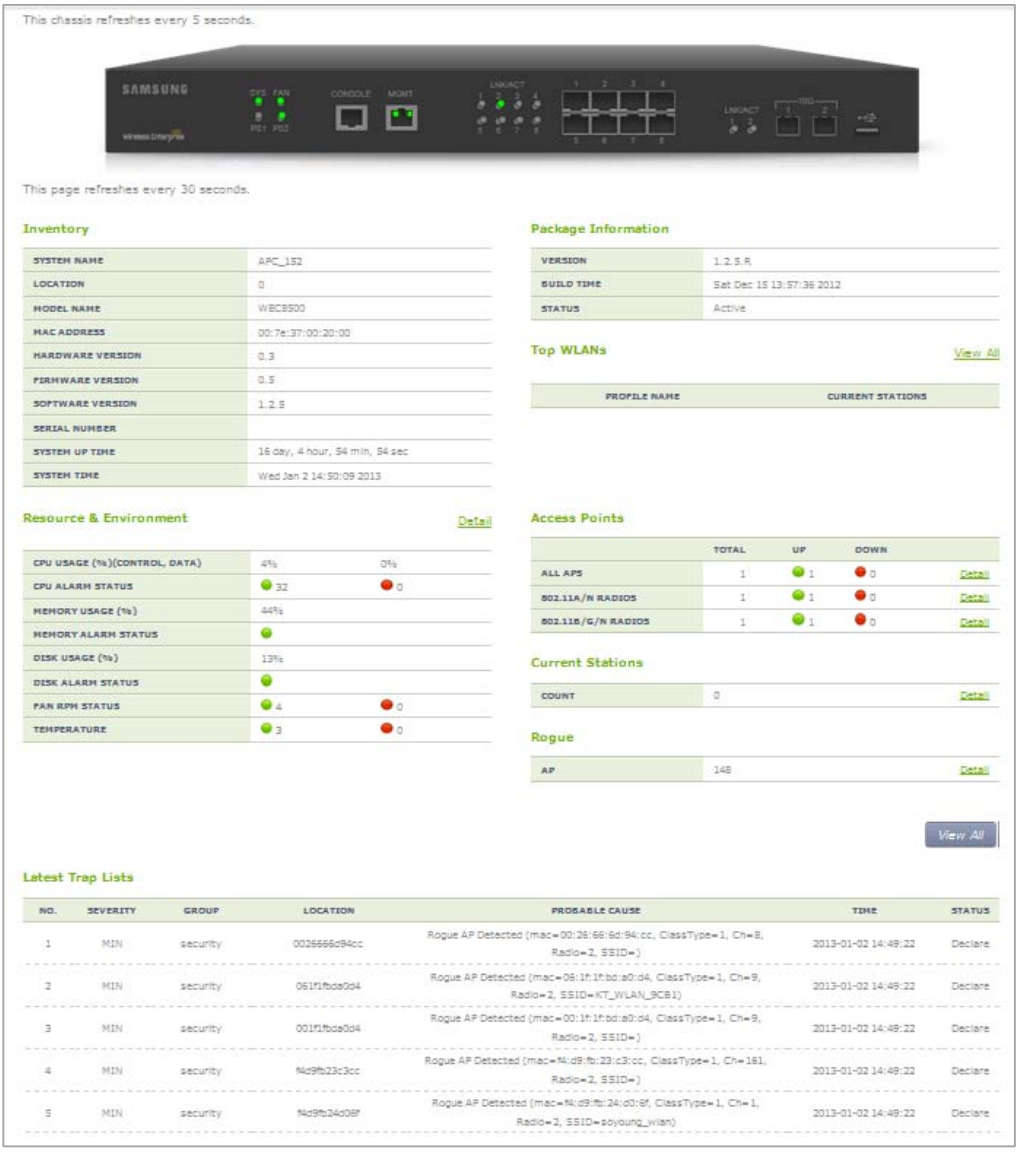


Figure 135. History

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.

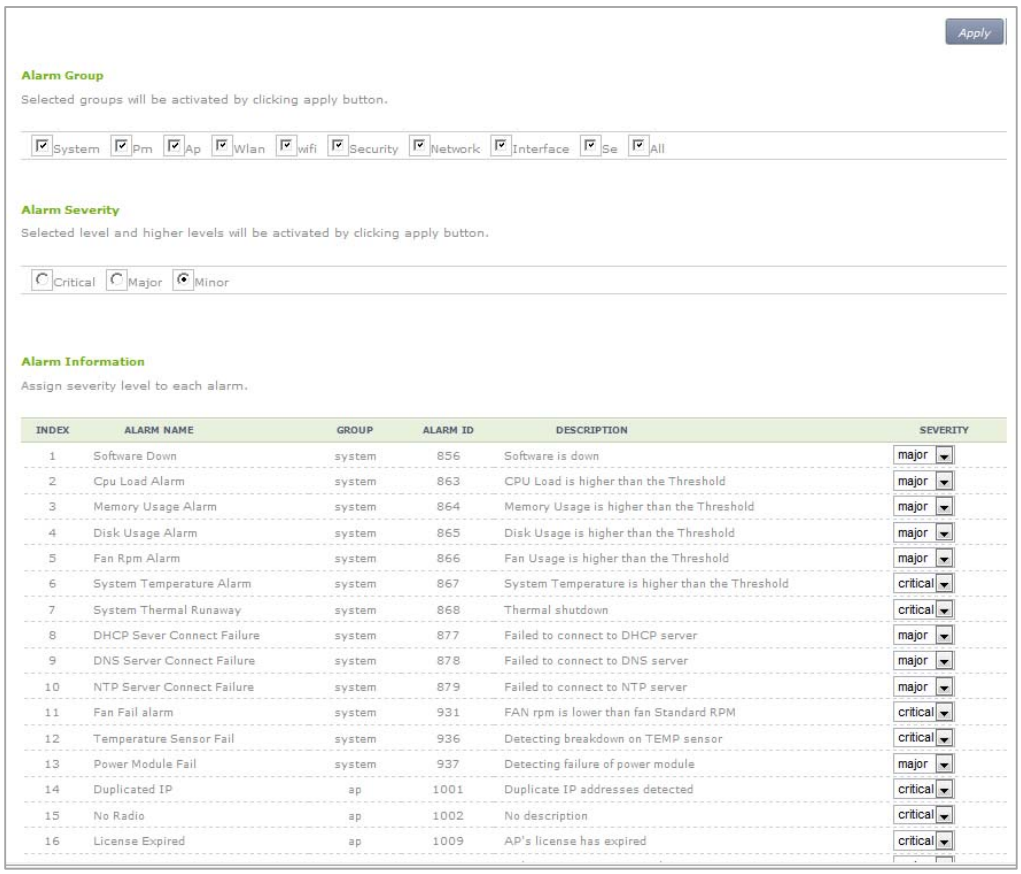
```
WEC8500/configure# alarm level major
```

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.



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 136. Configuring alarm filter and level

10.5 Managing Traffic Performance

You can manage the traffic performance statistics information and accumulated data for the WEC8500 system and the interface of each AP.

10.5.1 Managing History Information

When the traffic performance information management is enabled, the WEC8500 system creates history information at every 5 minute. But, if the FTP server information is not configured, the history information is not transmitted to outside although it is created.

Collecting information

1) Go to configure mode of CLI.

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

2) Configure the traffic performance information.

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

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

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

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

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

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

Stopping information collection

1) Go to configure mode of CLI.

```
WEC8500# configure terminal
```

2) 'Disable' the traffic performance information management.

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

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

10.5.2 Managing Real-time Information Collection

1) Go to configure mode of CLI.

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

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

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

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

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

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

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

10.6 Managing License Key

By using a license key, you can change the number of available APs, whether to support the VQM function or firewall function, and the period of additional functions for each system.
A license key is unique for each system and it consists of encrypted 53 characters.
A license key is distributed in a file or text format.

Installation

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

Use period

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

Apply

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

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.

- license-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.
- license-key [LICENSE_KEY]: Direct registration
- license-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 license-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..

```
Type 1 License Key Info.
   - Official Key
   > Key Value          :XXXXXXXX-XXXXXXXXX-XXXXXXXX-XXXXXXXX-XXXXXXXX-
                          XXXXXXXX
   > MAC address        :007E37001FF0
   > System Model       :Any
   > Lifetime           :Permanent
   - Licensed Features
   > Number of APs      :500
   > VQM                :Enabled
   > Firewall           :Disabled
   - Temporary Key
   > Key Value          :XXXXXXXX-XXXXXXXXX-XXXXXXXX-XXXXXXXX-XXXXXXXX-
                          XXXXXXXX
   > MAC address        :007E37001FF0
   > System Model       :Any
   > Lifetime           : 60 day(s)
   > Remaining Lifetime : 59 day(s) 06 hour(s)
   - Licensed Features
   > Number of APs      :500
   > VQM                :Enabled
   > Firewall           :Enabled
   - Current System Status
   > Number of APs      :500
   > VQM                :Enabled
   > Firewall           :Enabled
   > Installation Time  :01
```

[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.

In the License window, you can install, delete, or retrieve a license key.

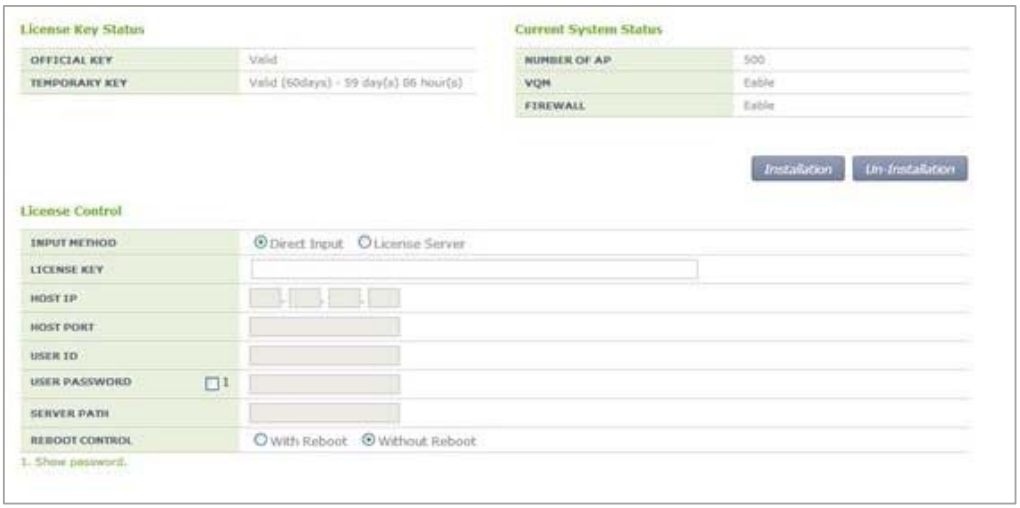


Figure 137. License window

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 a filtered log information is transmitted to the syslog server.

Configuration using CLI

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

1) Go to configure mode of CLI.

```
WEC8500# configure terminal
```

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

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

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

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

4) Configure a log level to filter.

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

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

Configuration using Web UI

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

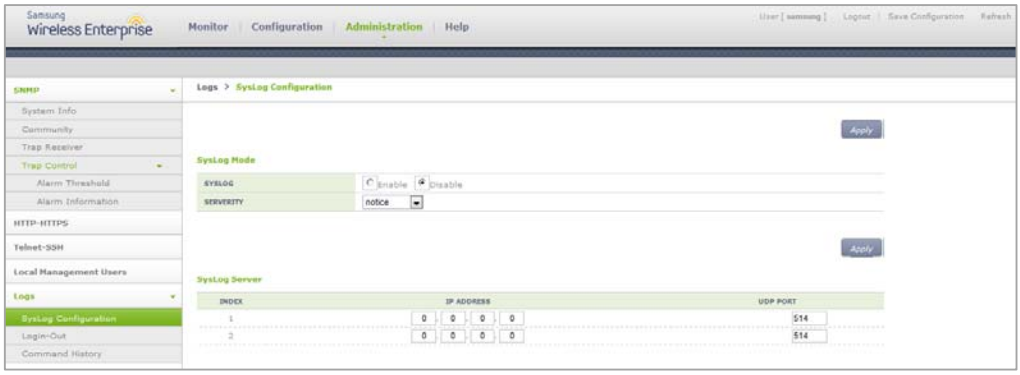


Figure 138. Syslog window

10.8 Upgrade

The WEC8500 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            : 0.6.1.R
  buildTime    : Thu Aug  9 11:11:12 2012
  builder      : apcbuild
  buildDir     : /home2/apcbuild/rel_build/master
Backup
  ver          : 0.6.1.R
  buildTime    : Thu Aug  9 11:11:12 2012
  builder      : apcbuild
  buildDir     : /home2/apcbuild/rel_build/master

Boot rom version information
  ver          : -
```

10.8.2 System Upgrade

The WEC8500 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 [PREFIX] [FILE_NAME]

Parameter	Description
PREFIX	Storage name + path information - Storage name ・'DISK:/': User disk space of a WEC8500 device ・'USBn:/': n-th partition of a USB storage device - path information: Use '/' as a separator whenever a lower path is included after storage name.
FILE_NAME	Package file to upgrade

A usage example is provided below. When the upgrade is completed, the system is rebooted to apply the package.

```
WEC8500/configure# package upgrade wec8500_1.0.0.bin
Notice: The system will reboot after upgrading with the file.

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

       Do you want to upgrade the system? (y/n): y
Package Validation check ... success
Package Upgrade ..................... done
Success
```

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

Possible Cause	Error Message	Troubleshooting
File does not exist	Error: no exist 'wec8500_1.3.11.R.bin' file	Download the package to be upgraded again as the package error has occurred during the package downloading.
Checksum error on the file	Error: Package validation check	
Upgrade terminated due to an internal error	Error: Internal error	1) Execute the 'show process status' command to check the process status. 2) Execute the 'show system cpu detail' command to check the CPU status. 3) Transmit the logs above to the Samsung Technical Support.
Upgrade terminated due to timeout	saving the configuration-failed (time-out)	1) Execute the 'show process status' command to check the process status. 2) Execute the 'show system cpu detail' command to check the CPU status. 3) Transmit the logs above to the Samsung Technical Support.

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

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

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

Boot rom version information
  ver           : unknown
```

Configuration using Web UI

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

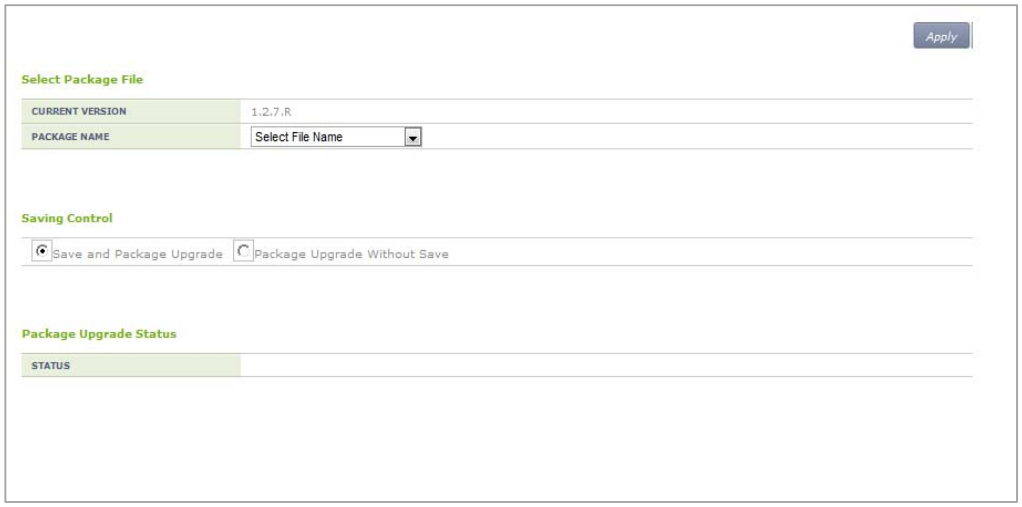


Figure 139. Package upgrade (APC)

10.9 Configuration Management

The WEC8500 supports the following functions for configuration management.

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

Configuration using CLI

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

```
WEC8500# save local
```

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

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

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

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

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

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

Configuration using Web UI

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

Figure 140. 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 WEC8500 can retrieve the status of an active process in the system and an error associated with each process.

Retrieving the Process Status

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

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

Checking process error log

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

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

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

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

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


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

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

10.10.2 Retrieving Crash Information

When a critical problem occurs in the system platform during operation, the WEC8500 saves important system information at that time to provide the crash information that can be used for post mortem analysis. The crash information includes the Crash Detect and Report (CDR) information that has the context about the crash status and the core dump information that has the memory dump about the crash status of a user process.

10.10.2.1 Managing CDR Information

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

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

[Retrieving Summarized CDR History Information]

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

- show debug reboot summary

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

[Retrieving Detail CDR History Information]

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

- show debug reboot info [DATA]

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

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

```
WEC8500# show debug reboot info

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

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

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

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

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

[Exporting CDR history information]

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

- show debug reboot export

[Deleting CDR history information]

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

- debug reboot erase [DATA]

Parameter	Description
DATA	If there is no reboot information selection (id/all) option, the most recent system reboot information is displayed. - id: A specific CDR ID value to view - all: View 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 WEC8500 provides the file management functions of copying, moving, or retrieving a file and also file download and upload. In addition, it checks the integrity of a package file and provides version retrieving method.

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

1) Go to the file mode of CLI.

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

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

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

10.11.1 Retrieving Configuration of Current Directory

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

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

```
WEC8500/file# pwd

 disk:/
```

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

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

 disk:/etc
```

Parameter	Description
TARGET_DIR	Name of a directory to change

10.11.2 Retrieving Directory List

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

A usage example is provided below.

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

```
WEC8500/file# ls disk:/etc
Current working directory: disk:/
 directory       4.0K   Jun  9  15:36:02  ap
 directory       4.0K   Jun  9  15:36:02  config
 directory       4.0K   Jun  9  15:36:02  db
 file          168      Jul  5  13:49:49 P KG_INFO_STANDBY
WEC8500/file#
```

10.11.3 Revising File

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

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

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

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

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

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

10.11.4 Retrieve File Content

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

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

10.11.5 File Download and Upload

A file is downloaded or uploaded through FTP protocol.

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

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

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

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

10.11.6 Package File

You can use a package file by downloading it from a network or copying it from a USB memory. The WEC8500 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 WEC8500 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 WEC8500 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. Both current directory-based relative path and absolute path are all supported during command execution and the path of each device is shown in the below table.

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

The check the information of a storage media connected to the WEC8500, 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

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

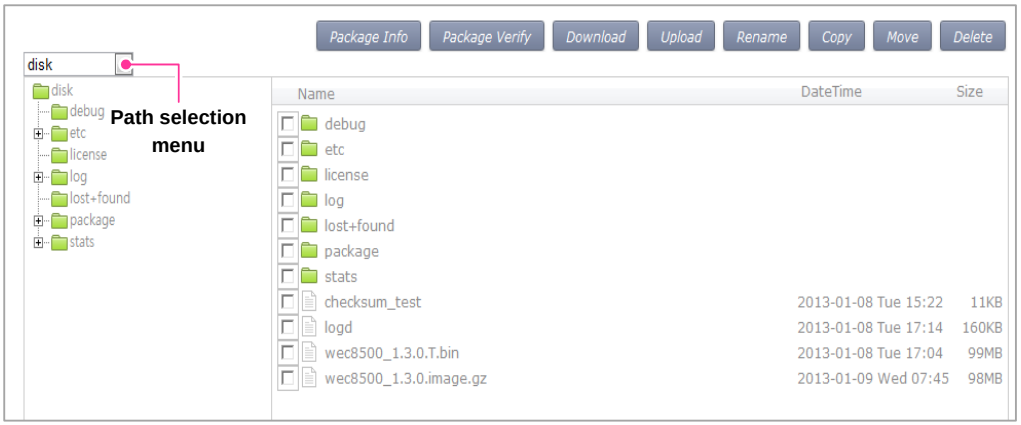


Figure 141. File management window

The File Management window provides the following functions:

Retrieving a file list

Selects a desired path in the path selection menu. Select the path selection menu 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.

ANNEX A. CLI Command Structure

The structure of CLI command is as follows.

A.1 configure

```
|-- configure
|       |-- spectrum-analysis
|       |       |-- apid
|       |       |       |-- 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
|       |-- hostname
|       |-- 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
|       |-- country
|       |       |-- set-global
|       |       |-- set-ap
|       |       |-- add-channel
|       |       |-- del-channel
|       |       |-- max-tx-power
|       |-- neighbor-ap
|       |       |-- add
|       |       |-- del
|       |-- handover
|       |       |-- time
|       |       |       |-- ho-decision
|       |       |       |-- command
|       |       |       |-- scan-suppress
|       |       |-- mode
|       |       |-- opmode
|       |       |-- scan-trigger-level
|       |       |-- scan-report-level
|       |       |-- scan-time-channel
|       |       |-- scan-time-service
|       |       |-- scan-time-interleave
|       |       |-- number-of-proreq
|       |       |-- number-of-channel
|       |       |-- buffered-forwarding
|       |       |-- handover-timer
|       |       |-- command
|       |       |-- scanmode-clear
```

```
|       |       |-- start-buffering
|       |       |-- fwd-buffering
|       |       |-- upload-data
|       |       |-- decision-delta
|       |       |-- station-decision-delta
|       |       |-- nchostats-req
|       |       |-- inter-apc
|       |       |-- inter-apc-database
|       |       |-- inter-apc-db-reqtime
|       |-- station
|       |       |-- delete
|       |       |-- number-of-assoc-tracking
|       |       |-- stats-req
|       |-- security
|       |       |-- radius
|       |       |       |-- auth
|       |       |       |-- acct
|       |       |       |-- serverIp
|       |       |       |-- secret
|       |       |       |-- fo-retransmit-count
|       |       |       |-- retransmit-count
|       |       |       |-- retransmit-interval
|       |       |-- advanced
|       |       |       |-- 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
|       |       |-- 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
|       |-- ap-group
|       |       |-- 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
|       |       |-- time-config
|       |-- if-group
|       |       |-- add-if
|       |-- wlan
|       |       |-- multicast-to-unicast
|       |       |       |-- enable
|       |       |       |-- discard
|       |       |       |-- radio_id
|       |       |       |-- max-entry
|       |       |-- enable
|       |       |-- guest-flag
|       |       |-- radio
|       |       |-- ssid
|       |       |-- security
|       |       |       |-- wpa
|       |       |       |-- psk
|       |       |       |-- wpa2
|       |       |       |-- ieee8021x
|       |       |       |-- keymgmt
|       |       |       |-- wep
|       |       |       |-- okc
|       |       |       |-- dynamicVlan
|       |       |       |-- setDefault
|       |       |       |-- grpRekeyTime
|       |       |       |-- pmkLifeTime
|       |       |       |-- radius-server
|       |       |       |       |-- auth-servers
|       |       |       |       |-- acct-servers
|       |       |       |-- eapReauthTime
|       |       |       |-- layer3
```

```
|       |       |       |       |-- web-policy
|       |       |       |-- radiusPrimaryRetryInterval
|       |       |       |-- acct_interim_interval
|       |       |-- if-group
|       |       |-- ap-group
|       |       |-- acl
|       |       |-- aaa-override
|       |       |-- mac-type
|       |       |-- tunnel-mode
|       |       |-- qos-class
|       |       |-- supress-ssid
|       |       |-- dls-allowed
|       |       |-- local-vlan
|       |       |-- max-associated-stations
|       |-- wlan-repeater
|       |       |-- add-mac
|       |-- ap
|       |       |-- profile
|       |       |       |-- mac
|       |       |       |-- location
|       |       |       |-- name
|       |       |       |-- echo-interval
|       |       |       |-- discovery-interval
|       |       |       |-- statistics-timer
|       |       |       |-- retransmit-interval
|       |       |       |-- max-retransmit
|       |       |       |-- echo-retransmit-interval
|       |       |       |-- max-echo-retransmit
|       |       |       |-- ap-mode
|       |       |       |-- ip-mode
|       |       |       |-- static-ip
|       |       |       |-- primary-apc
|       |       |       |-- secondary-apc
|       |       |       |-- tertiary-apc
|       |       |       |-- ap-stats-history-enable
|       |       |       |-- vlan-support
|       |       |       |-- native-vlanId
|       |       |-- reboot
|       |       |-- upgrade-request
|       |       |-- debug
|       |       |       |-- get-crash-file
|       |       |       |-- get-coredump
|       |       |       |-- get-log-file
|       |       |-- get-if-stats
```

```
|       |       |-- syslog-config
|       |-- apc
|       |       |-- dtls-policy
|       |       |-- security-auth-type
|       |       |-- R-MAC
|       |       |-- ap-mgmt-if
|       |       |-- capwap
|       |       |       |-- ctr-src-port
|       |       |       |-- ctr-dtls-mode
|       |       |       |-- 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
|       |       |       |-- fallback-enable
|       |       |       |-- ecn-support
|       |       |-- upgrade
|       |       |       |-- mode
|       |       |       |-- max-retry
|       |       |       |-- max-download
|       |       |       |-- file-save
|       |       |       |-- ap-upgrade-request-all
|       |       |-- debug
|       |       |       |-- mode
|       |       |       |-- max-retry
|       |       |-- ap-stats-history
|       |       |       |-- mode
|       |       |       |-- period
|       |       |       |-- max-retry
|       |       |       |-- enable
|       |       |-- ap-if-stats
|       |       |       |-- period
```

```
|       |       |-- BackupPrimaryController
|       |       |-- BackupSecondaryController
|       |       |-- ap-time-config
|       |       |-- reboot
|       |-- 80211a
|       |       |-- max-associated-stations
|       |       |-- edca-parameters
|       |       |-- qos
|       |       |       |-- protocol
|       |       |       |-- edca-profile
|       |       |       |       |-- cw-min
|       |       |       |       |-- cw-max
|       |       |       |       |-- aifsn
|       |       |       |       |-- txop-limit
|       |       |       |       |-- msdu-lifetime
|       |       |       |-- policy
|       |       |       |       |-- dot1p
|       |       |       |       |       |-- enable
|       |       |       |       |       |-- policy
|       |       |       |       |-- dscp
|       |       |       |       |       |-- enable
|       |       |       |       |       |-- policy
|       |       |       |-- dot1p-tag
|       |       |       |-- dscp-tag
|       |       |       |-- queue-depth
|       |       |       |-- bridge
|       |       |       |-- qap-missing-ack-retry-limit
|       |       |       |-- edca-avg-period
|       |       |       |-- reset-edca-profiles
|       |       |-- cac
|       |       |       |-- acm
|       |       |       |-- reserved-ho-calls
|       |       |       |-- max-calls
|       |       |       |-- alarming-count
|       |       |-- rate
|       |       |       |-- basic
|       |       |       |-- supported
|       |       |-- txPower
|       |       |-- channel
|       |       |-- 11n-support
|       |       |       |-- enable
|       |       |       |-- mcs
|       |       |       |-- forty-mhz
|       |       |       |-- guard-interval
```

```
|       |       |       |-- rifs
|       |       |       |-- forty-mhz-intolerant
|       |       |       |-- phy-format
|       |       |       |-- tx-stbc
|       |       |       |-- rx-stbc
|       |       |       |-- beamforming
|       |       |       |-- tx-mcs-set
|       |       |       |-- protection
|       |       |       |-- spatial-stream
|       |       |-- retry-limit
|       |       |       |-- short
|       |       |       |-- long
|       |       |-- threshold
|       |       |       |-- rts
|       |       |       |-- fragmentation
|       |       |-- msdu-lifetime
|       |       |       |-- tx
|       |       |       |-- rx
|       |       |-- beacon
|       |       |       |-- period
|       |       |       |-- dtim
|       |       |-- ofdm
|       |       |       |-- channel-width
|       |       |       |-- channel-starting-factor
|       |       |       |-- ti-threshold
|       |       |-- sds
|       |       |       |-- enable
|       |-- 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
|       |       |       |-- queue-depth
|       |       |       |-- bridge
|       |       |       |-- 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
```

```
|       |       |       |-- dtim
|       |       |-- cca
|       |       |       |-- mode
|       |       |       |-- threshold
|       |       |-- sds
|       |       |       |-- enable
|       |-- 80211h
|       |       |-- no-possess-time
|       |       |-- channel-switch
|       |       |-- power-constraint
|       |-- capwaptx
|       |-- alarm
|       |       |-- level
|       |       |-- group
|       |       |-- logsize
|       |       |-- logcount
|       |       |-- dump
|       |       |-- backupIP
|       |       |-- stdout
|       |       |-- current-terminal
|       |-- web-passthrough-port
|       |-- ip
|       |       |-- dhcp
|       |       |       |-- pool
|       |       |       |       |-- network
|       |       |       |       |-- range
|       |       |       |       |-- lease
|       |       |       |       |-- domain-name
|       |       |       |       |-- dns-server
|       |       |       |       |-- default-router
|       |       |       |       |-- fix-address
|       |       |       |       |-- ntp-server
|       |       |       |       |-- user_option
|       |       |       |       |-- ping-check
|       |       |       |-- enable
|       |       |-- 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
|       |-- arp
|       |-- firewall
|       |-- wlan-arp-mode
|       |-- package
|       |       |-- upgrade
|       |-- stats-report
|       |       |-- enable
|       |       |-- target
|       |       |-- last5min-ap
|       |       |-- last5min-apc
|       |-- telnet-server
|       |       |-- enable
|       |       |-- port
|       |-- ssh-server
|       |       |-- enable
```

```
|       |       |-- port
|       |-- sftp-server
|       |       |-- enable
|       |       |-- chguser
|       |-- ftp-server
|       |       |-- enable
|       |       |-- port
|       |       |-- chguser
|       |-- clock
|       |       |-- set
|       |       |-- timezone
|       |-- ntp
|       |       |-- server
|       |       |       |-- address
|       |       |       |       |-- ip
|       |       |       |       |-- hostname
|       |       |-- proxy
|       |       |       |-- enable
|       |       |-- client
|       |       |       |-- enable
|       |       |       |-- interval
|       |-- 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
|       |       |       |       |-- proxy-service
|       |       |       |       |-- 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
|       |       |       |       |       |-- mroute
|       |       |       |       |       |-- querier
|       |       |       |       |       |-- report-supression
|       |       |       |       |-- 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
|       |       |-- lacp
|       |       |       |-- port-priority
|       |       |       |-- timeout
|       |       |-- arp-ageing-timeout
|       |       |-- 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
|       |       |       |-- priority
|       |       |       |-- virtual-ip
|       |-- delete
|       |       |-- rip
|       |       |-- ospf
```

```
|       |       |-- vrrp
|       |-- fqm-mode
|       |       |-- access-list
|       |       |-- class-map
|       |       |       |-- match
|       |       |       |       |-- access-group
|       |       |       |       |-- class
|       |       |       |       |-- cos
|       |       |       |       |-- dst
|       |       |       |       |-- ip
|       |       |       |       |       |-- dscp
|       |       |       |       |       |-- precedence
|       |       |       |       |       |-- tos
|       |       |       |       |-- protocol
|       |       |       |       |-- src
|       |       |       |-- match-type
|       |       |-- no
|       |       |-- policy-map
|       |       |       |-- class
|       |       |       |       |-- police
|       |       |       |       |       |-- cir
|       |       |       |       |-- mark
|       |       |       |       |       |-- cos
|       |       |       |       |       |-- ip
|       |       |       |       |       |       |-- dscp
|       |       |       |       |       |       |-- precdence
|       |       |       |       |       |-- priority
|       |       |       |       |-- bandwidth
|       |       |       |       |-- shape-peak
|       |       |       |       |-- queue-limit
|       |       |-- ip
|       |       |-- time-profile
|       |       |       |-- day-start
|       |-- if-arbiter
|       |-- 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
|       |       |-- filter
|       |       |       |-- prefix
|       |-- sipalg
|       |       |-- enable
|       |       |-- sip_error_resp
|       |       |-- monitor-port
|       |-- irfm
|       |       |-- enable
|       |       |-- irfmDebugEnable
|       |       |-- dcsDebugEnable
|       |       |-- dpcDebugEnable
|       |       |-- chdcDebugEnable
|       |       |-- 80211a
|       |       |       |-- dpc
|       |       |       |       |-- enable
|       |       |       |       |-- periodic-interval
|       |       |       |       |-- rssi-threshold
|       |       |       |       |-- txPower
|       |       |       |-- dcs
|       |       |       |       |-- enable
|       |       |       |       |-- snr-thrs
|       |       |       |       |-- rssi-sensitvy-thrs
|       |       |       |       |-- periodic-interval
|       |       |       |       |-- anchor-time
|       |       |       |       |-- noise-level
|       |       |       |       |-- interference-level
|       |       |       |       |-- channel-width
|       |       |       |-- covhole
|       |       |       |       |-- enable
|       |       |       |       |-- statsCollectEnable
|       |       |       |       |-- statsCollectInterval
|       |       |       |       |-- rssi-threshold
|       |       |       |       |-- min-failed-client-count
|       |       |       |       |-- percent-failed-client-count
|       |       |-- 80211b
|       |       |       |-- dpc
```

```
|       |       |       |       |-- enable
|       |       |       |       |-- periodic-interval
|       |       |       |       |-- rssi-threshold
|       |       |       |       |-- txPower
|       |       |       |-- dcs
|       |       |       |       |-- enable
|       |       |       |       |-- snr-thrs
|       |       |       |       |-- rssi-sensitvy-thrs
|       |       |       |       |-- periodic-interval
|       |       |       |       |-- anchor-time
|       |       |       |       |-- noise-level
|       |       |       |       |-- interference-level
|       |       |       |-- covhole
|       |       |       |       |-- enable
|       |       |       |       |-- statsCollectEnable
|       |       |       |       |-- statsCollectInterval
|       |       |       |       |-- rssi-threshold
|       |       |       |       |-- min-failed-client-count
|       |       |       |       |-- percent-failed-client-count
|       |-- locationtrack
|       |       |-- enable
|       |       |-- per-client-records-max
|       |       |-- client-record-expiry
|       |       |-- per-system-records-max
|       |       |-- station
|       |       |-- unit-distance
|       |       |-- ltinterval-max
|       |       |-- ltinterval-min
|       |       |-- unit-distance-rssi
|       |-- cluster
|       |       |-- add
|       |       |-- add-apc
|       |       |-- del-apc
|       |       |-- del-apc-all
|       |-- wids
|       |       |-- enable
|       |       |-- monitor-radio
|       |       |-- periodic-interval
|       |       |-- ap-blacklist
|       |       |-- client-blacklist
|       |       |-- client-whitelist
|       |       |-- ssid-whitelist
|       |       |-- oui-whitelist
|       |       |-- friendlylist
```

```
|       |       |-- rogue
|       |       |       |-- expiration-timeout
|       |       |       |-- remove
|       |       |       |-- move
|       |       |       |-- modify-state
|       |       |       |-- adhoc-connection-detection
|       |       |       |-- ap
|       |       |       |       |-- blacklist-mac-add-detection
|       |       |       |       |-- unknownap
|       |       |       |       |       |-- managed-ssid-withauth-client-det
|       |       |       |       |       |-- wired-netwrok-detection
|       |       |       |       |-- fakeap
|       |       |       |       |       |-- managed-ssid-detection
|       |       |       |       |       |-- beacon-without-ssid-detection
|       |       |       |       |       |-- beacon-on-invalid-channel-detection
|       |       |       |       |-- managedap
|       |       |       |       |       |-- incorrect-security-config-detection
|       |       |       |       |       |-- illegal-channel-detection
|       |       |       |       |       |-- invalid-ssid-detection
|       |       |       |-- client
|       |       |       |       |-- not-in-oui-list-detection
|       |       |       |       |-- exceeded-config-80211auth-request-det
|       |       |       |       |-- exceeded-config-80211probe-request-det
|       |       |       |       |-- exceeded-config-80211deauth-request-det
|       |       |       |       |-- allowed-limit
|       |       |       |       |-- exclusionpolicies
|       |       |       |       |       |-- excessive-80211-assoc-fail
|       |       |       |       |       |-- excessive-80211-auth-fail
|       |       |       |       |       |-- excessive-8021x-auth-fail
|       |       |       |       |       |-- excessive-web-auth-fail
|       |       |       |       |       |-- exclusion-list-check
|       |       |       |-- add-friendly-rule
|       |       |       |-- del-friendly-rule
|       |       |       |-- add-malicious-rule
|       |       |       |-- del-malicious-rule
|       |       |-- channel-validation
|       |       |       |-- enable
|       |       |       |-- add
|       |       |       |-- delete
|       |-- wips
|       |       |-- enable
|       |       |-- containment-packet-rate
|       |       |-- contain
|       |       |-- autocontainment
```

```
|       |       |       |-- ap-on-wired-network
|       |       |       |-- ap-with-managed-ssid
|       |       |       |-- adhoc-connection
|       |       |       |-- ap-with-auth-client
|       |       |       |-- rogue-client-enable
|       |-- lacp
|       |       |-- system-priority
|       |-- snmp
|       |       |-- community
|       |       |-- user
|       |       |-- trap
|       |       |-- trap-source-ip
|       |-- pcap
|       |       |-- filter
|       |       |       |-- mac
|       |       |       |-- enable-mac
|       |       |-- rpcap
|       |       |       |-- start-service
|       |-- wlan-radio-service
|       |       |-- sta-idle-timeout
|       |       |-- wmm-mode
```

A.2 show

```
|-- show
|       |-- 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
|       |-- 80211a
|       |       |-- sds
|       |       |       |-- configuration
|       |       |-- cac
|       |       |       |-- configuration
|       |       |       |-- stats
|       |       |-- summary
|       |       |-- qos
|       |       |       |-- policy
|       |       |       |-- ac-profile
|       |       |       |-- edca-parameters
|       |       |       |-- radio-configuration
|       |       |-- radio-config
|       |-- 80211bg
|       |       |-- sds
|       |       |       |-- configuration
|       |       |-- cac
|       |       |       |-- configuration
|       |       |       |-- stats
|       |       |-- summary
|       |       |-- qos
|       |       |       |-- policy
|       |       |       |-- ac-profile
```

```
|       |       |       |-- edca-parameters
|       |       |       |-- radio-configuration
|       |       |-- radio-config
|       |-- 80211h
|       |       |-- configuration
|       |       |-- prohibit-channels
|       |-- qos
|       |       |-- profile
|       |       |-- cac-station
|       |-- wlan-radio-service
|       |-- handover
|       |-- neighbor-ap
|       |-- station
|       |       |-- stats
|       |       |       |-- management_frame
|       |       |       |       |-- all
|       |       |       |-- NCHO
|       |       |       |       |-- all
|       |       |       |-- debug
|       |       |       |       |-- all
|       |       |-- association
|       |       |       |-- history
|       |       |-- summary
|       |       |-- detail
|       |       |-- bssid
|       |-- system
|       |       |-- info
|       |       |-- uptime
|       |       |-- cpu
|       |       |-- memory
|       |       |-- disk
|       |       |-- fan
|       |       |-- temp
|       |       |-- threshold
|       |       |       |-- cpu
|       |       |       |-- memory
|       |       |       |-- disk
|       |       |       |-- fan
|       |       |       |-- temp
|       |       |-- fancontrol
|       |       |-- license-key
|       |-- ap-group
|       |       |-- summary
|       |       |-- detail
```

```
|       |       |-- time-config
|       |-- ap
|       |       |-- summary
|       |       |-- detail
|       |       |-- stats-history
|       |       |-- if-stats
|       |       |-- debug-log
|       |       |-- time-config
|       |       |-- syslog-config
|       |-- apc
|       |       |-- summary
|       |       |-- capwap
|       |       |       |-- summary
|       |       |-- ap-if-stats
|       |-- wlan
|       |       |-- summary
|       |       |-- detail
|       |       |-- security
|       |       |       |-- summary
|       |       |       |-- detail
|       |-- vap
|       |-- if-group
|       |-- ap-upgrade
|       |       |-- summary
|       |       |-- list
|       |-- ap-debug
|       |       |-- summary
|       |       |-- list
|       |-- alarm
|       |       |-- info
|       |       |-- conf
|       |       |-- list
|       |       |       |-- all
|       |       |       |-- level
|       |       |       |-- group
|       |       |-- history
|       |       |       |-- all
|       |       |       |-- level
|       |       |       |-- group
|       |       |-- backup
|       |-- event
|       |-- running-config
|       |       |-- cli-idle-timeout
|       |       |-- alarm
```

```
|       |       |-- network
|       |       |-- snmp
|       |       |-- wifim
|       |       |-- vqm
|       |       |-- apc
|       |       |-- capwap
|       |       |-- if-group
|       |       |-- wlan
|       |       |-- wlan-security
|       |-- ip
|       |       |-- dhcp
|       |       |       |-- pool
|       |       |       |-- lease
|       |       |       |-- proxy-lease
|       |       |       |-- statistics
|       |       |-- 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
|       |-- version
|       |-- syslog
|       |-- debug
|       |       |-- coredump
|       |       |       |-- summary
|       |       |-- crash
|       |       |       |-- info
|       |       |       |-- summary
|       |       |       |-- export
|       |       |-- log
|       |       |       |-- all
|       |       |       |-- level
|       |       |       |-- module
|       |       |       |-- conf
|       |       |       |-- backup
|       |       |-- swm-log
```

```
|       |       |-- processes
|       |-- ssh-server
|       |-- telnet-server
|       |-- ftp-server
|       |-- filter
|       |-- filter-stats
|       |-- policy-map
|       |-- class-map
|       |-- firewall
|       |-- sftp-server
|       |-- ntp
|       |-- timezone
|       |-- clock
|       |-- security
|       |       |-- radius-server
|       |       |       |-- config
|       |       |       |-- summary
|       |       |       |-- detail
|       |       |       |-- stats
|       |       |-- advanced
|       |       |-- hapd-stats
|       |       |-- guestaccess
|       |       |       |-- help
|       |       |       |-- current-config
|       |       |       |-- config-user-detail
|       |       |-- pmk-cache
|       |-- vrrp
|       |-- static-channel-group
|       |-- bridge
|       |-- etherchannel
|       |-- spanning-tree
|       |       |-- mst
|       |       |       |-- config
|       |       |       |-- detail
|       |       |       |       |-- interface
|       |       |       |-- instance
|       |       |       |       |-- interface
|       |       |       |-- interface
|       |       |-- interface
|       |-- vqm
|       |       |-- help
|       |       |-- current-config
|       |       |-- summary-stats
|       |       |-- current-stats
```

```
|       |       |-- history-stats
|       |       |-- alarms
|       |-- sipalg
|       |       |-- help
|       |       |-- config
|       |-- irfm
|       |       |-- config-irfm-status
|       |       |-- config-summary
|       |       |-- help
|       |       |-- current-config
|       |       |-- summary-stats
|       |       |-- current-stats
|       |-- locationtrack
|       |       |-- help
|       |       |-- current-config
|       |       |-- station-location
|       |       |-- location-summary
|       |-- debugging
|       |       |-- lacp
|       |-- lacp-counter
|       |-- port
|       |-- lacp
|       |-- http
|       |-- snmp
|       |       |-- community
|       |       |-- user
|       |       |-- trap
|       |-- pcap
|       |       |-- current-config
|       |-- cluster
|       |       |-- help
|       |       |-- current-config
|       |       |-- list-all-apc
|       |       |-- summary-stats-all
|       |       |-- summary-stats-apc
|       |       |-- current-stats-all
|       |       |-- current-stats-apc
|       |       |-- list-ap
|       |       |-- list-all-stations
|       |-- wids
|       |       |-- help
|       |       |-- statistics
|       |       |-- current-config
|       |       |-- rogue
```

```
|       |       |       |-- ap
|       |       |       |       |-- current-config
|       |       |       |       |-- list
|       |       |       |       |-- detail
|       |       |       |-- client
|       |       |       |       |-- current-config
|       |       |       |       |-- exclusion-policies-details
|       |       |       |       |-- list
|       |       |       |       |-- detail
|       |       |       |-- adhoc-list
|       |-- wips
|       |       |-- help
|       |       |-- current-config
|       |-- stats-report
|       |       |-- conf
|       |       |-- last5min-apc
|       |       |-- last5min-ap
```

A.3 clear

```
|-- clear
|       |-- stats
|       |       |-- station
|       |       |       |-- globally
|       |       |       |-- individually
|       |-- vap
|       |-- ip
|       |       |-- igmp
|       |       |       |-- group
|       |       |       |-- interface
|       |       |-- rip
|       |       |-- pim
|       |       |       |-- sparse-mode
|       |       |-- nat
|       |       |-- ospf
|       |-- mac
|       |       |-- address-table
|       |       |       |-- dynamic
|       |       |       |       |-- address
|       |       |       |       |       |-- bridge
|       |       |       |       |-- bridge
|       |       |       |       |-- interface
|       |       |       |       |       |-- bridge
|       |       |       |       |-- vlan
|       |       |       |       |       |-- bridge
|       |-- spanning-tree
|       |       |-- bridge
|       |       |-- interface
|       |-- lacp
|       |       |-- counters
|       |-- 80211a
|       |       |-- cac
|       |       |       |-- stats
|       |-- 80211bg
|       |       |-- cac
|       |       |       |-- stats
|       |-- cli-session
|       |-- interface
|       |-- arp-cache
|       |-- vqm
|       |       |-- all
|       |       |-- history-stats
```

```
|       |       |-- summary-stats
|       |       |-- current-stats
|       |       |-- history-file
|       |-- pcap-stat
|       |-- security
|       |       |-- radius-server
|       |       |       |-- stats
|       |       |-- guestaccess
|       |       |       |-- guest-user-stats
|       |-- cluster
|       |       |-- clear-all
|       |       |-- clear-apc
|       |-- log
|       |       |-- debug
|       |       |-- alarm
|       |       |-- actalarm
|       |       |-- alarminfo
|       |-- irfm
|       |       |-- all
|       |       |-- stats
|       |-- locationtrack
|       |       |-- all
|       |       |-- history-stats
```

A.4 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
|       |       |-- dot11a
|       |       |-- dot11b
|       |-- locationtrack
|       |       |-- all
|       |-- cluster
|       |       |-- all
|       |-- guestaccess
|       |       |-- all
|       |-- log
|       |       |-- level
|       |       |-- module
|       |       |-- logsize
|       |       |-- logcount
|       |       |-- on
|       |       |-- off
|       |       |-- dump
|       |       |-- mstdout
|       |       |       |-- module
|       |       |       |-- level
|       |       |       |-- on
|       |       |       |-- off
|       |-- dhcp-info
|       |-- capwap
|       |       |-- trace
|       |       |-- log
|       |       |-- status
|       |-- sipalg
|       |       |-- enable
|       |-- pm
|       |       |-- enable
```

A.5 file

|-- file
| |-- download
| |-- upload
| |-- copy
| |-- remove
| |-- move
| |-- ls
| |-- pwd
| |-- cd
| |-- dump
| |-- df
| |-- verify
| |-- version

A.6 Etc

|-- reboot
|-- save
| |-- local
|-- factory-reset
|-- export
|-- import
|-- ping
|-- traceroute
|-- tcpdump
|-- telnet
|-- ssh

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ABBREVIATION

A

ACL	Access Control List
AES	Advanced Encryption Standard
AP	Access Point
APC	Access Point Controller

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
CLI	Command Line Interface
CSMA/CD	Carrier Sense Multiple Access/Collision Detect

D

DDR	Double Date Rate
DDR3	Double Data Rate Type 3
DECT	Digital Enhanced Cordless Telecommunications
DHCP	Dynamic Host Configuration Protocol
DMZ	Demilitarized Zone
DTLS	Datagram Transmission Layer Security
DU	Digital Unit

E

EAP	Extensible Authentication Protocol
EEPROM	Electrically Erasable Programmable Read-Only Memory
EMI	Electro-Magnetic Interference

F

FFT	Fast Fourier Transform
FIFO	First-In-First-Out
FMC	Fixed Mobile Convergence

G

GbE	Giga Bit Ethernet
GI	Guard Interval

H

HO	Handover

I

IGMP	Internet Group Management Protocol
IP	Internet Protocol
IV	Initial Vector

L

LACP	Link Aggregation Control Protocol
LAN	Local Area Network
LED	Light Emitting Diode

M

MAC	Medium Access Control
MCS	Modulation and Coding Scheme
MIB	Management Information Base
MIMO	Multiple Input Multiple Output
MLT-3	Multi Level Transmission-3
MMF	MultiMode Fiber
MSTP	Multiple Spanning-Tree Protocol

N

NAT	Network Address Translation
NMS	Network Management System
NTP	Network Time Protocol

O

OKC	Opportunistic Key Caching
OSPF	Open Shortest Path First

P

PC	Personal Computer
PHY	Physical layer
PIM-SM	Protocol Independent Multicast-Sparse Mode
PoE	Power over Ethernet
POST	Power On Self Test
PPDU	Physical layer protocol data unit
PSDU	Physical layer service data unit
PSE	Power Sourcing Equipment
PSK	Pre-Shared Key

Q

QoS	Quality of Service

R

RADIUS	Remote Authentication Dial-In User Service
RF	Radio Frequency
RPM	Revolution Per Minute
RSSI	Received Signal Strength Indication
RU	Radio Unit

S

SDS	Samsung Downlink Scheduler
SNMP	Simple Network Management Protocol
SNR	Signal to Noise Ratio
STP	Signaling Transfer Point

T

TKIP	Temporal Key Integrity Protocol

U

USB	Universal Serial Bus
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
WIPS	Wireless Intrusion Prevention System
WLAN	Wireless Local Area Network
WPA	Wi-Fi Protected Access
WPA2	Wi-Fi Protected Access Version 2

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Operation Manual